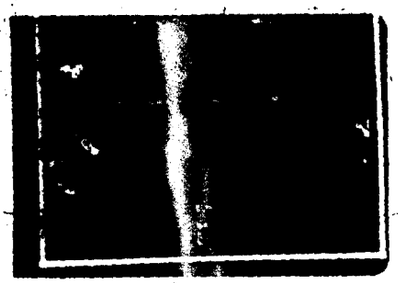
AD-A286 774





This document has been approved
for public release and sale; its
distribution is unlimited.

PROPERTY OF THE UNITED STATES ARMY

Reproduced From
Best Available Copy

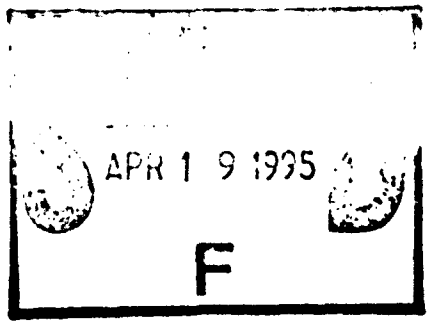
Best
Available
Copy

SGRD-RMS

Mrs. Patricia A. Madigan
SGRD-RMS/USAMRDC
Fort Detrick, Frederick, MD 21701

351
95-01245

MEDICAL DEPARTMENT
UNITED STATES ARMY
IN WORLD WAR II



This document has been approved for public release and sale; its distribution is unlimited

MEDICAL DEPARTMENT, UNITED STATES ARMY

PREVENTIVE MEDICINE IN WORLD WAR II

Volume III

PERSONAL HEALTH MEASURES AND IMMUNIZATIONS

Editor in Chief

Colonel JOHN BOYD COATES, JR., MC

Editor for Preventive Medicine

EBBE CURTIS HOFF, Ph. D., M. D.

Assistant Editor

PHEBE M. HOFF, M. A.

Accession For

NTIS CRA&I
DTIC TAB
Unannounced
Justification

By

Distribution /

Availability Codes

Dist	Avail and / or Special
A-1	

OFFICE OF THE SURGEON GENERAL

DEPARTMENT OF THE ARMY

WASHINGTON, D. C., 1955

[illegible] ASSIGNED 1

PREVENTIVE MEDICINE IN WORLD WAR II

Prepared under the direction of

Major General GEORGE E. ARMSTRONG

The Surgeon General, United States Army

Historical Unit

COLONEL JOHN BOYD COATES, JR., MC, *Director*

MAJOR I. H. AHLFELD, MSC, *Executive Officer*

CAPTAIN J. K. ARIMA, MSC, *Special Projects Officer*

DONALD O. WAGNER, Ph. D., *Chief, Historians Branch*

WILLIA B. DIAL, *Chief, Editorial Branch*

JOSEPHINE P. KYLE, *Chief, Archives and Research Branch*

HAZEL G. HINE, *Chief, Administrative Branch*

GERTRUDE G. JOHNSON, *Publications Editor*

Advisory Editorial Board
on the
History of Preventive Medicine

BRIG. GEN. JAMES STEVENS SIMMONS, USA (Deceased),
Chairman, 1948–54

BRIG. GEN. STANHOPE BAYNE-JONES, USA (Ret.), *Chairman*

JOHN E. GORDON, M. D.
WILLIAM A. HARDENBERGH
ANTHONY J. LANZA, M. D.
ELLIOTT S. A. ROBINSON, M. D.
PAUL F. RUSSELL, M. D.
THOMAS B. TURNER, M. D.
DOUGLASS W. WALKER, M. D.
COL. TOM F. WHAYNE, MC

EBBE CURTIS HOFF, Ph. D., M. D., Editorial Director (Ex Officio)

COLONEL JOHN BOYD COATES, JR., MC (Ex Officio)

Volume III

PERSONAL HEALTH MEASURES AND IMMUNIZATION

Foreword

Health of military personnel is one of the first important matters to be considered in the buildup, development, and active operations of military forces.

Any history of the Medical Department of the United States Army in World War II must present the more important personal health considerations which influenced the sum-total and day-to-day life and experience of officers and men in the Army. Each contributed in its own way to the overall effectiveness of our troops.

While such matters as personal hygiene, immunization, food and nutrition, prevention of injury, and preventive psychiatry—to mention a few—were of broad interest and concern to many within the Army, their detailed program of development and management on a scale of size, scope, and ramifications never before attempted—or fully envisioned—was primarily the responsibility of the Medical Department. In carrying out these responsibilities it should always be remembered that while dealing with the cold realities of war, the Medical Department by expectation and necessity also dealt with the complexities revolving about the physical, mental, and moral constitution of man.

The objectives of military preventive medicine, namely the prevention or control of disease and injury among the members of the military forces, the maintenance and conservation of health, and the physical and mental fitness of the troops, provided the guiding keynote to the personal health program throughout the war.

Principles of personal health maintenance were established and practiced in the Army long before the onset of hostilities of World War II. These were continued on an expanded scale and others were developed as the situation required and as time and circumstances permitted. Valuable assistance and cooperation was extended to the Medical Department by many allied health agencies. In some instances, as might be expected, divergencies of opinion prevailed as to the proper courses of action. As in any comparable situation, there were some errors of omission or commission, despite every effort to avoid them. Many problems were unfolded and revealed for the first time, and, in not all cases were completely satisfactory solutions forthcoming. Many and varied forces and exigencies of war, both at home and overseas, aided as well as militated against the perfect answer to and implementation of the Army's personal health program. Further study and research, coordinated application of practical methods, and full indoctrination of all concerned within the Army are essential for the continued success of this program in the future.

This volume admirably discusses in proper perspective the major problems encountered and the measures taken by the Medical Department to safeguard the personal health of all Army personnel during the period of World War II. The results form a splendid record of which the nation can be proud, and a pattern which should be carefully studied by those who plan the health program of future military forces.

GEORGE E. ARMSTRONG
Major General, United States Army
The Surgeon General

Preface

The complexities of the theory and practice of military preventive medicine were well demonstrated during World War II. It was learned and relearned during that period that effective prevention and control of disease and injury depends upon the judicious, timely, and vigorous application of the basic truths and principles developed in the various disciplines involved. That so much re-learning of this apparently elementary concept was required was unfortunate, if for no other reason than that it was wasteful of time and energy. It is principally this that demands the study, evaluation, and recording of the experiences of that time. These experiences arranged themselves generally and quite naturally into the triad of epidemiology, environmental sanitation, and personal health measures.

It is with the last of the triad that this volume is concerned. Grouped within it are the accounts of the policies and practices concerned with the various direct personal aspects of preventive medicine as it was applied for the United States Army during the war period. It is hoped that this concentration of these highly personalized procedures—ranging from personnel selection through nutrition and clothing to the stimulation of specific individual immunity through immunization—emphasizes that preventive medicine is more than the sanitation of the environment and that the prevention of the disease is more to be desired than the nice description of the epidemic and its control. This volume will serve a useful purpose if those who need to learn will read it and if those who read are willing to benefit from the experiences, mistakes, and repetitive efforts of the past.

The authors of the various chapters were chosen because of their peculiar qualifications to deal with their allotted subjects. They need no introduction here. They alone, however, did not nor could they have accomplished this work unaided. Much credit and appreciation are due to the many others who through their advice, guidance, and reviews helped materially in the preparation of this work. If any of these are not named here, apologies as well as thanks are due. Specifically, the most sincere thanks and appreciation of the authors and editors are due to the following reviewers: Lt. Col. William H. Anderson, MC, USA; Dr. William Ashe; Dr. Stanhope Bayne-Jones; Prof. Georges F. Doriot; Dr. John E. Gordon; Dr. Wendell Griffith; Dr. Anthony J. Lanza; Dr. Karl R. Lundeberg; Col. Clark B. Meador, MC, USA; Dr. Herbert Pollack; Dr. Elliott S. A. Robinson; Dr. Harvey J. Tompkins; Dr. Douglass W. Walker; and Col. Tom F. Whayne, MC, USA.

The editorial office at the Medical College of Virginia was provided with the facilities and staff necessary for carrying out this project through the wholehearted cooperation of Dr. William T. Sanger, President, and Maj. Gen. William F. Tompkins, Comptroller. Their great interest and encouragement have been warmly appreciated. Thanks also are due to Mrs. Jacqueline Pate, Mrs. Geraldine Glick, Mrs. Jeannette Martin, and Mrs. Virginia Wilson for their secretarial work in the editorial office.

All of the statistical data in this volume, except as otherwise indicated, were provided or reviewed by Mr. E. L. Hamilton, Chief, Mr. A. J. McDowell, Assistant Chief, Mr. M. C. Rossoff, and members of the staff of Medical Statistics Division, Office of The Surgeon General. All photographs were obtained from Department of Defense files and were prepared for publication by the Armed Forces Institute of Pathology under the direction of Mr. Herman Van Cott, Chief, Medical Illustration Service.

The advice of members of the Preventive Medicine Division, Office of The Surgeon General, who willingly gave their professional help throughout the many stages of processing these manuscripts has been most valuable. The staff of the Archives and Research Branch, Historical Unit, Army Medical Service, who screened the voluminous wartime records, supplied much of the source material and references to authors. General administrative support and final typing was performed in the Administrative Branch of the Historical Unit under supervision of Mrs. Catherine F. Marshall. Mrs. Hazel G. Hine served as editorial clerk for this volume.

ARTHUR P. LONG
Colonel, MC, USA

26 April 1955

Contents

	Page
FOREWORD	VII
PREFACE	IX
INTRODUCTION	XIII
Chapter	
I. MANPOWER SELECTION AND THE PREVENTIVE MEDICINE PROGRAM	1
II. PERSONAL HYGIENE	13
III. CLOTHING	31
IV. NUTRITION	85
V. MALNUTRITION AND DEFICIENCY DISEASES	159
VI. PREVENTIVE PSYCHIATRY	171
VII. ACCIDENTAL TRAUMA	233
VIII. THE ARMY IMMUNIZATION PROGRAM	271
Appendixes	
A. ADMINISTRATIVE REQUIREMENTS FOR YELLOW FEVER VACCINATION	343
B. ADMINISTRATIVE REQUIREMENTS FOR CHOLERA VACCINATION	347
C. ADMINISTRATIVE REQUIREMENTS FOR TYPHUS VACCINATION	349
D. ADMINISTRATIVE REQUIREMENTS FOR IMMUNIZATION OF OVERSEAS AREAS BY DISEASES	351
INDEX	363

Introduction

Colonel Tom F. Whayne, MC, USA

The development of preventive medicine has been an evolution which progressed rapidly during the first half of the twentieth century. In World War I, major efforts were devoted to sanitary science and to the control of infectious diseases. In World War II, preventive medicine emerged as a special field of the practice of medicine having to do with all of the factors that influence the maintenance of health in the individual and in the military community. These factors may arise from physical or social environment, may be inherent in people as i ividuals or groups, or may be those activities or procedures which directly affect the health and well-being of military personnel as people. It is the latter type of factors with which the authors are concerned in this volume.

The personal health of those coming into the military services is first influenced by the manpower selection process. Viewed as a mass procedure, selection during mobilization has unquestionably established that the study of the physical and mental defects of examinees, whether accepted for the military service or not, greatly aids in determining the most effective health maintenance programs and the most efficient utilization of manpower.

Personal hygiene in the military sense is broad of scope. It includes all of the measures an individual may utilize to maintain or improve his health. Thus it includes personal measures to prevent or control disease and injury, the maintenance of a good nutritional state, mental hygiene, and the proper wearing of clothing to avoid trauma from heat or cold. Because of the personal nature of such practices, they are of necessity difficult to supervise. Health education and training for personal health practices overlap and it is hard to evaluate the effectiveness of each. The results of good or poor individual or group practices cannot be easily measured in disease or injury incidence in a causal relationship, yet may be indirectly responsible for much saving of time or for much noneffectiveness. Moreover, the level of practice of personal health measures is directly related to unit leadership.

Since American forces operated on a global basis in World War II, in vastly different environments, under varying degrees of stress, and often with a minimum of personal supplies and equipment, it is apparent that a sensitive evaluation of personal health practices of the Army as a whole is not feasible. Much was learned and recorded which should serve as a guide for the future.

Hygiene, sanitation, control of the environment, disease and injury prevention and control, immunization, mental hygiene, maintenance of nutritional status, and other practices bearing on health were planned, organized, and supported on a scale never before necessary in United States military efforts. Despite the many variables involved and the difficulty of amassing irrefutable evidence as to the effectiveness of personal health measures, the authors of the chapters of this volume have made a careful effort to sift the experiences of World War II, and to evaluate personal health measures in the light of World War II conditions. The evidence lends added weight in the need for further development of health maintenance practices and the requirement for more effective methods of health education in the armies of the future.

CHAPTER I

Manpower Selection and the Preventative Medicine Program

*Gertrude G. Johnson**

The Surgeon General is responsible for establishing physical standards to prevent induction, enlistment, or commission of the physically and mentally unfit. The Physical Standards Division determines the standards and supervises their administration. The maintenance of these standards was not a function of the Preventive Medicine Service during World War II, but the effectiveness of physical and psychiatric screening had a highly important bearing upon preventive medicine and materially influenced the measures and procedures necessary to plan and carry out the prevention and control of the acute and chronic infections which condition the health of the Army and the loss of manpower and man-days in military operations.

The experience of the Army in World War I made The Surgeon General particularly aware of the necessity for strict screening against tuberculosis. The incidence of tuberculosis during World War I averaged 11 per thousand per year and before World War I was over, about 3,000 soldiers had died of tuberculosis. Throughout that war, tuberculosis had been a leading cause of disability discharges, accounting for 12.7 percent of these.[1] At its end, the newly organized Veterans Administration had inherited a huge and costly program to provide medical care for these casualties.

World War I also pointed up the desirability for adequate psychiatric screening. About 122,000 men were hospitalized as neuropsychiatric patients during that war. It has been estimated that around 34 percent of these men had to be discharged.[2] By 1941 the Federal Government had paid out well over 1 billion dollars for disability, compensation, and hospital treatment of neuropsychiatric patients who were World War I veterans.[3]

The objective of physical screening, therefore, was to eliminate the physically and mentally unfit who would not be capable of performing a useful

---

*Historical Unit, Army Medical Service.

[1] The Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1928, vol. XV, pt. 2, Tables 46, 48, 50, and 82.

[2] Information furnished by Medical Statistics Division, Office of The Surgeon General, 9 Feb 54.

[3] Menninger, William C.: Psychiatry in a Troubled World. New York, The Macmillan Company, 1948, p. 267.

military function, and also those who might reasonably be expected to break down while on active duty. This would provide an Army most likely to withstand the physical strain and other exigencies of service and would also avoid inducting men who might shortly be discharged and thereafter be eligible for disability payments and hospital expenses by the Government.

The Available Manpower Pool

Both the needs of the service and the available manpower pool fluctuated from time to time. The Selective Service System made the initial classification of registrants, complying with current requirements set by Congress as to age, occupation, dependents, and education. The Army determined the number of men needed each month, specified the minimum physical and mental standards required for military service, and conducted the physical examinations.[4]

When mobilization was ordered in the fall of 1940, the basic aim was to get a group of 900,000 highly qualified men who would be trained for 1 year and who would then form part of a reserve pool. This was a relatively small number to take out of the manpower pool of registrants available at that time, which totaled about 17,000,000. It was, therefore, possible to select only those who would be able to enter immediately upon a period of intensive training and who could reasonably be expected to remain fit for a period of years thereafter. Consequently no reparative or therapeutic work was considered; standards were set high; and psychiatric screening was designed so as to exclude anyone who might not respond well to Army life.

After the United States entered the war, the picture changed radically. A large Army was needed immediately. About 3,800,000 men entered the Army during 1942, through inductions and enlistments. Physical standards had to be lowered to get the number of men needed, and limited service personnel were accepted at a fixed percentage of the quota.

Industry and agriculture also expanded to keep pace with the enlarged Army. A great effort was made to increase the available manpower pool. Women formed the greatest labor reserve in the United States and hundreds of thousands became industrial workers. Women's branches were formed, on a volunteer basis, for the Army, including Air Force, and for the Navy, including Marines and Coast Guard. Labor was also drawn from the previously unemployed group and from the older age brackets. There was a decrease in civilian activities and in self-employment. To make the best possible use of the labor available, the work week was lengthened to 48 hours.

The Army and the Navy (including Marine Corps and Coast Guard) competed for manpower through voluntary enlistments. The Army offered a choice

[4] Up to January 1942, the main medical examination was made by the local boards of Selective Service and the Army's function was limited to the final physical examination. After that date, however, the whole medical processing was taken over by the Army, and the function of the local boards was limited to elimination of the obviously disqualifying defects.

of assignment to the Ground, Air, or Service Forces as an inducement; most Army volunteers chose the Air Forces. Since the physical and mental standards for enlistment in the Navy and Army Air Forces were higher than the general requirements for induction, the result was that they were able to obtain men of better physical and mental caliber than were the Ground and Service Forces.[5] Lack of control over the number of available men and the resultant inability to plan accurately laid an undue burden upon Selective Service machinery. President Roosevelt [6] therefore, in December 1942, stopped all voluntary enlistments of men between 18 and 38. Registrants were thereafter processed through Selective Service and allotted to Army and Navy according to established quotas.

The manpower shortage seemed so acute by the end of 1943 that Congress directed the appointment of a commission to study requirements for the Armed Forces.[7] It was hoped that some of the large group rejected for physical reasons (estimated at that time at 3,000,000) could be inducted, especially for limited service. The commission reported that existing physical requirements could not be reduced further without impairment of efficiency. The chief need, the report concluded, was for men for general duty.[8] As a result, it became routine procedure to induct men with dependents; deferments for essential industries were more strictly scrutinized.

By the middle of 1944, the Army had attained the bulk of its procurement objective. With offensives on all fighting fronts, it urgently needed young men as replacements. Exemptions for those under 26 were rigidly screened; deferments in older age groups were liberalized. Men becoming of age for registration were the chief source of replacements for the Armed Forces. Concurrently many were being discharged, primarily for physical reasons, and became available as civilian labor. When once again the Army's mission changed after the defeat of Germany, it was possible to use more limited service personnel, and induction of such men was resumed.

Throughout the period of mobilization and war Selective Service maintained a continuous program of registering, classifying, and reclassifying. Registrants were not considered frozen in one category, but were constantly screened and reevaluated.

Physical Standards for Induction

Basic physical standards for induction were published in August 1940 as Mobilization Regulations (MR) 1-9 in anticipation of the passage of the Selec-

[5] Karpinos, B. D.: Evaluation of the physical fitness of present-day inductees. U. S. Armed Forces Med. J. 4: 415-430, Mar 1953.

[6] Executive Order 9279, 5 Dec 42.

[7] Amendment to Selective Training and Service Act of 1940, Public Law 197, 78th Congress, approved 5 Dec 43.

[8] Selective Service as the Tide of War Turns, The 3rd Report of the Director of Selective Service 1943-1944. Washington, Government Printing Office, 1945, p. 55.

tive Training and Service Act. The President declared them part of Selective Service regulations[9] and they were used both by examining physicians of the local boards and by Army induction examiners.

Mobilization Regulations 1–9 went through several major revisions during the war and were also amended from time to time by War Department directive with respect to specific items. Although for some conditions very sharp lines of demarcation were drawn, the introduction to each of the published regulations stated that they were to constitute a guide to the medical examiner. It was expected that he would exercise his professional judgment. In many instances it was the degree of incapacity which led to classification for general or limited service, or for rejection. An analysis for rejection for cardiovascular disorders showed a particularly wide range of professional difference of opinion upon what would be disqualifying.[10] If the examining physician believed that the general condition of the man would not allow him to perform satisfactorily, he could recommend rejection, even though no specific item was the cause.

The examiner's rigid or liberal interpretation of existing standards, shifting with the need to fill a quota, in effect caused these to fluctuate. The most drastic changes in the regulations themselves were those relating to visual acuity and dental requirements. The first MR 1–9 in August 1940 set the minimum dental requirements at a total of 6 masticating teeth and 6 incisor teeth properly opposed. As soon as the first statistics were available, it was discovered that failure to meet these requirements had resulted in rejection of approximately 9 percent of those examined. If that standard had been maintained, it has been estimated that by the end of 1943 nearly 1,000,000 men who were inducted under the liberalized dental standards would have been lost to the service.[11] Dental requirements were revised downward, and an extensive reparative program by the Dental Corps initiated, until in October 1942 a man completely edentulous could be inducted if his condition was corrected or correctable by dentures.[12]

In 1940 minimum visual acuity for general service was set at 20/100 in each eye without glasses, if correctable to 20/40 bilaterally. This was the second most important cause for rejection, and these requirements were progressively lowered. The lowest visual acuity requirements were reached in April 1944,[13] when 20/200 in each eye, or 20/100 in one eye and 20/400 in the second eye (if correctable to 20/40 in each eye, 20/30 in the right and 20/70 in the left, or 20/20 in the right and 20/400 in the left), was sufficient for general

---

[9] Executive Order 8570, 18 Oct 40.

[10] Levy, R. L., Stroud, W. D., and White, P. D.: Report of reexamination of 4,994 men disqualified for general military service because of the diagnosis of cardiovascular defects. J. A. M. A. 123: 937–944, 11 Dec 43; and 1029–1035, 18 Dec 43.

[11] ASF Monthly Progress Rpt, Sec 7, Health, 31 Jan 44.

[12] MR 1–9, 15 Oct 42.

[13] MR 1–9, 19 Apr 44.

service. The registrant did not have to supply the corrective glasses himself; the Army furnished more than 2 million pairs of glasses.

In general, no registrant with an acute infectious disease, with the exception of venereal diseases which are considered separately, was to be inducted until he had recovered without disqualifying sequelae. Although intestinal parasites were not considered cause for rejection, such findings were to be noted on the record so that medication could be undertaken. Other parasitic infections such as filariasis, trypanosomiasis, amebiasis, and schistosomiasis were cause for rejection.

Tuberculosis. The Subcommittee on Tuberculosis of the National Research Council, at the request of The Surgeon General, made recommendations regarding screening standards for tuberculosis. The aim was to exclude all men with active tuberculosis or tuberculosis of doubtful stability that might break down and lead to active disease during military service. At the same time it was recognized that tuberculous infiltrations of minor extent not infrequently heal completely, and it would be a waste of manpower to reject all persons showing any traces of healed tuberculous lesions.

The 1940 standards included detailed instructions on the physical examination of lungs by palpation, percussion, and auscultation although it was recognized that these methods were of less value than X-rav. The Subcommittee on Tuberculosis pointed out that at least 75 percent of early active tuberculosis can be discovered only by X-ray examination, and that about 1 percent of the male population of military age has active tuberculosis.[14]

Examination by X-ray was carried out wherever facilities permitted and in all doubtful cases. Approximately 1 million men were inducted without X-ray.[15] Many of these however, were X-rayed after acceptance at reception or basic training centers and those found to have active tuberculosis were discharged. In March 1942 chest X-ray on all inductees became mandatory.[16] The criteria for rejection were made arbitrary because induction was rapid and many of the roentgenologists used were inexperienced in the field. The average rejection rate for tuberculosis for the years 1942–45 was approximately 1 percent. The incidence rate of tuberculosis in the Army during those years was 1.24 per thousand, approximately one-ninth that of World War I.

A roentgenogram of the chest was made a routine part of the separation physical examination as well. Cases of active tuberculosis discovered averaged 1 per thousand. All those discovered at induction centers or on discharge were required to be reported to the soldier's State Board of Health, thus advancing the cause of tuberculosis control in the nation as a whole.

---

[14] Minutes of Meeting, NRC Subcommittee on Tuberculosis, 23 Jul 40. HD: 040(TB).

[15] Long, E. R., and Lew, E. A.: Tuberculosis in the Armed Forces. Am. J. Pub. Health 35: 469–479, May 1945.

[16] MR 1-9, 15 Mar 42.

It cannot be claimed that the examination for tuberculosis as conducted was perfect. A considerable number of men with small active tuberculous lesions escaped detection.[17] But the general view of responsible authorities was that the screening process was a highly creditable one, that it eliminated the overwhelming majority of active cases sent to induction stations, and provided a body of troops so nearly free from tuberculosis that further infection from exposure in the Army was negligible.[18]

Venereal Disease. According to the physical standards in effect in 1940,[19] registrants with any form of venereal disease were not acceptable for general service. Registrants with acute or chronic syphilis, including latent syphilis, were classified as limited service. No limited service registrants were called for induction, however, until July 1942. Gonorrhea was considered a remedial defect, and registrants with this disease were temporarily deferred until a cure had been effected.

Several things happened to change this attitude. One was pressure of public opinion which produced a flood of letters of protest against a policy which seemed to penalize good conduct. It was soon obvious, also, that a number of men, otherwise qualified, were being lost to the services.[20] After war was declared, and the limitations of American manpower became evident, regulations were reviewed. Some draft boards, particularly in the South, were hard pressed to meet their quotas because a high percentage of the Negroes in their districts were infected.

The treatment of uncomplicated venereal diseases was very much simplified by new therapeutic discoveries. In the summer of 1942 [21] the Medical Department conducted an experimental program of inducting men with venereal diseases and curing them before they reported for active duty. Since successful results were achieved, induction boards were directed to accept infected men within the limits of facilities for their treatment. By March 1943, about 7,000 venereally infected men were inducted into the Army. About 4,500 of these inductees were infected with syphilis. The induction of men with venereal disease reached its peak in the last quarter of that year, when about 12,000 men with venereal disease were inducted each month. By the end of the first half of 1944, the backlog of all registrants previously rejected for venereal disease was completely rescreened and inducted. It has been estimated that with the liberalization of the standards regarding venereal disease the Army absorbed

[17] Myers, J. A.: Failure to detect all tuberculosis on induction to military service. J. Lancet 64: 111–113, Apr 1944.

[18] Long, E. R., and Hamilton, E. L.: A review of induction and discharge examination for tuberculosis in the Army. Am. J. Pub. Health 37: 412–420, Apr 1947.

[19] WD Cir 117, 18 Oct 40.

[20] Selective Service Med. Statistics Bull. 1, 10 Nov 41. HD: 327.

[21] See footnote 11, p. 4.

during World War II somewhat over 200,000 registrants who had venereal disease.[22]

Psychiatric Screening. During the first 2 years of the war great effort was made to screen out all men with actual mental disorders, also those with psychoneurotic traits which might make it difficult for them to adjust to Army life. But the speed of induction, lack of adequate social histories of the registrants, and shortage of trained psychiatrists made it very difficult to make a definitive appraisal.

The Army emphasized that men with psychoneurotic traits were a detriment to the morale of a unit, were likely to take up needed hospital beds, and would be a great expense to the Government if they had to be discharged as psychiatric patients.[23] Complaints were received from combat officers who had in their commands some of the men who had been misclassified. One War Department directive stated: "There is no classification for duty of military personnel with such mental diagnoses as psychoneurosis. . . ." [24]

As a result of this Army attitude, it became the rule in many induction centers that if there were any doubt at all as to whether a registrant would perform satisfactorily, he should be rejected. If the candidate gave any suggestive evidence of emotional instability, such as nervousness at the time of examination, sweaty hands, or expressed fears, he was usually rejected.[25]

In April 1944, a War Department directive emphasized that accumulating evidence indicated that many individuals with minor personality disorders and mild neurotic trends could be of service to the Armed Forces. It was noted that, on the basis of previous directives, many such men were being rejected at induction stations. The acute need for manpower made it necessary to admit all individuals who had a reasonable chance of adjusting to military service.[26] In order to aid the examiners, who frequently had 3 minutes rather than the planned 15 minutes for the psychiatric interview, a test, known as the Neuropsychiatric Screening Adjunct, was composed which was aimed at selecting those who needed further psychiatric study. This 23-question test was adopted in October 1944 and used in all induction stations.[27]

There was little difficulty in identifying men with serious mental disorders. The borderline cases posed the real problem. The psychiatrist at the induction center had no possible way of evaluating the four most important factors of influence on the adjustment of a soldier: the type of leadership he would receive;

---

[22] Karpinos, B. D.: Venereal disease among inductees. Bull. U. S. Army M. Dept. 13: 806–820, Oct 1948.
[23] SG Cir Ltr 19, 12 Mar 41.
[24] WD AG Memo W600–39–43, 26 Apr 43.
[25] Menninger, op. cit., pp. 266–292.
[26] WD TB MED 33, 21 Apr 44.
[27] WD AG Memo 40–44, 19 Sep 44.

the degree of motivation he would have to do his job; the type of job and unit to which he would be assigned; and the degree of external stress which might confront him.[28]

Functionally effective screening processes may reduce the number of psychiatric casualties during military service. But since a man's personality at time of induction is only one of the factors involved in breakdown, screening cannot be expected to eliminate all such breakdowns. It was also shown that many men at first rejected by psychiatric examiners were able to perform for long periods in a satisfactory manner.[29]

The Physical Profile Serial System

Throughout the major portion of the war there were only two physical classifications used: general and limited service. Classification for job placement was carried out by an extensive program of testing and interviewing. A real attempt was made to match the individual's training, experience, and aptitudes with his military assignment. However there was no simple system of assessing the man's physical stamina and including that as a part of the classification for job assignment.

The Canadian Army had evolved the PULHEMS system which indicated the physical and mental capabilities of the individual. The personnel division graded each job in terms of the minimum PULHEMS requirements necessary to carry it out. The United States observed the Canadian system and, after experimentation in this country, adopted in May 1944 a modified form known as the physical profile serial system.[30]

The initials PULHES represented six factors in an individual which were to be evaluated: P—general physical stamina and strength; U—upper extremities; L—lower extremities; H—hearing; E—eyes; S—psychiatric evaluation. Each of these letters had four potential grades, so that a man's profile might read 121121 for a general service man.[31] The "M" in the Canadian PULHEMS which stood for mentality and intelligence was omitted from the American factors because it was considered adequately covered by the Army General Classification Test. A lettered code to represent certain combinations of grades in the various factors was adopted for statistical, assignment, and reporting purposes.[32]

The profile system proved to be a timesaver in choosing men for particular types of assignment, although the United States Army did not use it as ex-

[28] Menninger, op. cit., pp. 266–292.

[29] Eanes, R. H.: Standards used by Selective Service and a follow-up on neuropsychiatric rejectees in World War II. *In* Selection of Military Manpower: A Symposium. Washington, National Research Council, 1951, pp. 149–156.

[30] WD Memo W40–22, 18 May 44.

[31] Developments in military medicine during the administration of Surgeon General Norman T. Kirk: preventive medicine and professional care. Bull. U. S. Army M. Dept. 7: 594–646, Jul 1947.

[32] Supplement, 12 Jun 45, to MR 1–9, 22 May 44.

tensively as did the Canadian Army. It was particularly helpful when transfers of large numbers of troops were to be made from one type of unit to another since it was possible to check PULHES serial numbers quickly in order to determine who was physically capable of serving in the new assignment.

Physical Standards for Special Categories

The physical standards as given in MR 1–9 applied only to the induction or enlistment of enlisted men. Standards for commission as an officer or as a cadet in the United States Military Academy were embodied in AR 40–105, and were higher than those for enlisted men, particularly with respect to eyesight and physical stamina. The physical standards for all female personnel serving in the Army were adapted from the Army Nurse standards. To admit women of Oriental descent, adjustments were made in measurement requirements.

During World War II the Army did little to devise special testing for specific jobs or climates. More emphasis was placed upon adapting the environment to the man, that is, on developing uniforms and equipment. The Army Air Forces, however, carried out considerable experimentation to arrive at valid tests for determining physical aptitude for aircrew training. To predict success in only three aircrew jobs—pilot, bombardier, and navigator—it was found that a battery of 20 tests was required. Each of these tests contributed significantly to the prediction of success in at least one of these specialties.[33] Followup studies of bomber and fighter pilots in the European theater showed high correlation between aptitude scores and performance in the field.[34]

Special physical standards were devised for officers and enlisted men engaged in training and service in marine and simulated marine diving and in the use of rescue apparatus.[35] In October 1943, physical qualifications for parachute duty for both officers and enlisted men were adopted.[36] Requirements for cardiovascular condition and blood pressure level were higher than under induction standards; many orthopedic conditions were disqualifying for this type of service.

Conclusion

Selection of military manpower during World War II was essentially a negative process; the unfit were to be excluded. It was assumed that all men in the Army should be able to fight, regardless of assignment, should the exigency arise. Screening was set up to eliminate rather than to classify in-

[33] Selection of Military Manpower: A Symposium. Discussion by Dr. John C. Flanagan, pp. 215–224. Washington, National Research Council, 1951.

[34] Grant, D. N. W.: The medical mission in the Army Air Forces. *In* Fishbein, Morris: Doctors at War. New York, E. P. Dutton & Company, Inc., 1945, pp. 275–302.

[35] AR 40–100, C 4, 22 Jul 43.

[36] AR 40–100, C 6, 12 Oct 43.

dividuals and did not take into full consideration the related demands upon the country's total manpower pool.

Physical standards were written so that commanders would have the best manpower available to carry out their missions. The Army wanted to induct only men who would not increase pension or retirement costs to the taxpayer except where disease or injury was incurred in line of duty. It was also considered necessary to select men who would not burden the Medical Department, during critical periods, because of foreseeable physical or mental health breakdowns.[37]

Physical standards were originally set high and were progressively lowered as manpower resources became depleted. Manpower needs of the Army Service Forces, once that element had been organized, were rather stable; the Ground Forces suffered relatively higher casualty rates and required more replacements for combat troops. Thus, when physical standards were lowered, less fit men were assigned to the combat forces. It may be argued that this desire to retain men in jobs for which they have been trained is a reason that, from the outset of mobilization, the less fit should be inducted as well as the best.[38]

The physical selection of personnel was of great importance not only to the Army, but to the health of the whole country. By exposing the physical defects of the large groups of rejected individuals, it provided a unique opportunity to correct many health deficiencies in the civilian population.[39]

The physical standards for selection for Army service established and administered by the Physical Standards Division were effective in screening out those unfit for military service. Psychiatric screening was found to be less effective. Both influenced preventive medicine planning and practice, the former by reducing the reservoir of infectious disease and possibly eliminating a part of the most highly susceptible; the latter by screening out those less well able to understand and absorb health training and to withstand the rigors of military service under conditions of unaccustomed stress. Data on causes for rejection were important indices of the status of health of the United States manpower pool, and formed the basis for further preventive medicine planning for health protection when it became necessary to utilize personnel who could not meet the original high standards. Consideration of these data also greatly influenced the trend of research under the Office of Scientific Research and Development and the National Research Council as to the development of the best practices for full utilization of all segments of the manpower pool.

---

[37] Stone, W. S.: Measuring men for useful assignment. *In* Selection of Military Manpower: A Symposium. Washington, National Research Council, 1951, pp. 79–84.

[38] Bill, R. A.: Medical screening (physical standards) and its relation to service requirements and to retirement. *In* Selection of Military Manpower: A Symposium. Washington, National Research Council, 1951, pp. 84–103.

[39] Simmons, J. S.: Preventive Medicine in the Army. *In* Fishbein, Morris: Doctors At War. New York, E. P. Dutton & Company, Inc., 1945, p. 142.

The administration of the medical aspects of selection was, without question, a proper function of clinical medicine. Evaluation of the World War II experience, however, also leaves no question of the importance of selection to preventive medicine and unequivocably established that clinical and preventive medicine must work in close coordination in establishing standards and studying the physical and mental defects of prospective candidates for military service in order that the most effective health and medical programs can be established and the most economical use be made of a not inexhaustible manpower pool.

CHAPTER II

Personal Hygiene

Colonel Robert L. Callison, MC

In the Army, personal hygiene is defined as the measures each individual must employ to keep in good physical condition and the precautions he must take to protect himself from disease. As such, it includes not only cleanliness of the body, but also proper use of insect repellents, avoidance of unauthorized water and food, and any other measure that the soldier is directed to take to preserve his health. Trenchfoot, which was a major cause of disability in the European theater during World War II and for which care of the feet is a necessary preventive measure, will be fully covered in a separate volume to be published as part of the history of the Medical Department of the United States Army in World War II. Sex hygiene, a part of the educational program for the prevention of venereal diseases, will not be considered in this chapter since it is discussed in detail in the section on venereal diseases in another of the Preventive Medicine volumes.

The basic principle of cleanliness of person and neat appearance of troops is a traditional policy of the Army. Even in the American Revolution, when little was known about transmission of disease, some officers were aware of the hazards from louse infestation. An order of 23 January 1778 issued by Lt. Colonel Marion at Fort Moultrie (S. C.), recommended that each soldier have his hair cut so that it was no longer than the top of the shirt collar in back, and short at the forehead and sides. Otherwise, ". . . those who do not have their hairs in this mode must have them platted and tied up. . . ." Provision was also made to have a certain number of soldiers act as barbers for the regiment.[1]

Personal cleanliness improved in the Army as it improved in the civilian population. As more became known about the transmission of disease, stress was placed upon particular phases of personal hygiene, such as washing hands after using the latrine, and proper use by the individual of sanitary measures for disposal of waste and purification of water.

By World War I the basic rules for personal hygiene and command responsibility for their enforcement were well established. The Medical Department was taken by surprise, therefore, in April 1918 when it received word from the American Expeditionary Forces that 50 percent of the troops arriving in

[1] Medical Men in the American Revolution. The Army M. Bull. No. 25, Medical Field Service School, Carlisle Barracks, Pennsylvania, 1931.

France were louse-infested. Although a certain amount of lousiness among troops in combat had been foreseen, facilities for disinfestation at United States camps had not been considered necessary. A quick survey of training camps in the United States showed that some lousiness existed although the percentage of infested persons was very low. A high degree of louse infestation was discovered at the Newport News, Virginia, embarkation point, however. The overcrowding of transports and their inadequate bathing facilities insured the rapid spread of lice among troops. Disinfestation equipment was immediately set up at all large camps in the United States and troops were carefully examined for lice before leaving the country. Conditions in Europe provided no new hazards for which rules of personal hygiene had to be revised. It was impossible, however, to maintain satisfactory levels of personal hygiene under all combat conditions. When facilities were available, rigid compliance with rules was enforced.[2]

WAR DEPARTMENT POLICY

War Department standards and directives for personal hygiene as contained in Army Regulations (AR) 40–205, 31 December 1942, were in effect throughout World War II. Fundamentally they were the same as in AR 40–205, 15 December 1924, merely rewritten and somewhat expanded. As with all aspects of military sanitation, commanding officers were responsible for enforcement of the provisions concerning personal hygiene. The Medical Department was to conduct inspections and recommend appropriate action to correct deficiencies. It was required that each member of the Army be given a course of instruction in hygiene.

The paragraph of AR 40–205 devoted specifically to personal cleanliness stated:

> Every member of a command will bathe once daily while in garrison, and in the field at least once weekly. The hands will be washed before each meal and immediately after visiting a latrine. Teeth will be cleaned with a brush at least once a day. Fingernails will be cut short and kept clean. The hair will be kept short and the beard neatly trimmed. Clothing and bedding will be kept clean. Soiled clothing will be kept in barrack bags. At prescribed physical inspections particular attention will be given to personal cleanliness.

Unit commanders were instructed to determine that the men of their commands had been properly fitted with socks and shoes and that all foot defects were suitably cared for. An undue amount of foot injury and disability from shoes was to be regarded as evidence of inefficiency on the part of responsible officers.

Precautions for care of feet during marches were specified. Before long or protracted marches, unit commanders were to inspect the bare feet of their

[2] The Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1926, vol. VI, pp. 380–382.

men for defects which might require treatment. While on marches, commanders were to have their men wash their feet each day as soon as practicable after reaching camp, cover blisters or excoriations with a light dressing or zinc oxide plaster, dust the feet with foot powder, and put on clean socks.

Measures that the individual soldier could take for his own protection, as well as measures the Army would take for him, were included in each of the appropriate sections. Under mosquito control were listed the proper wearing of clothing, use of repellents, and use of bed nets. Frequent and thorough bathing was specified as one of the precautions against body lice.

The personal hygiene of men assigned to certain duties was specified in other sections of AR 40–205. Barbers, for instance, were cautioned to wash their hands thoroughly before attending each patron as well as to keep all equipment cleaned or sterilized. All men on duty in kitchens, messhalls, and bakeries were also instructed to bathe frequently, wear clean clothing, and be especially careful to keep their hands and fingernails clean.

TRAINING AND EDUCATION

The policies of AR 40–205 were implemented by a continuing program of training and education. Each soldier was issued Basic Field Manual (FM) 21–100, "Soldier's Handbook," [3] which contained a section entitled "Military Sanitation," consisting of instructions for individual compliance with AR 40–205 and simple explanations of the reasons for each rule. The soldier was instructed to report for sick call at the first signs of illness.

A 1-hour class in personal hygiene was part of basic training for all soldiers. Training Film 8–155, "Personal Hygiene," was used to demonstrate proper application of rules of cleanliness. Because the material included in this instruction contained little that was new to the soldier, the main purpose of the lesson was to provide motivation for careful observance of the rules and to make clear the relationship of individual health to the health and efficiency of the unit.

Field Manual (FM) 21–10, "Military Sanitation and First Aid," [4] a basic field manual, and FM 8–40, "Field Sanitation," [5] a medical field manual, were used as references for the basic training class and were available at company level throughout the Army. Field Manual 21–10 outlined the general groups of diseases and the sanitary measures for their prevention and control. It included a chapter on personal hygiene and also one on the particular problems of march hygiene. Field Manual 8–40 dealt primarily with environmental sanitation, but contained a chapter on factors relative to personal hygiene: care

[3] WD FM 21-100, 11 Dec 40, and subsequent revisions and reprintings.
[4] WD FM 21–10, 1940, and subsequent changes.
[5] WD FM 8–40, 1940, and subsequent changes.

of the feet, especially for the prevention of dermatomycoses; other skin diseases; scabies; and oral hygiene.

A course in personal hygiene, somewhat broader in scope than that for trainees, was given to cadets of the United States Military Academy, candidates in officer candidate schools, reserve officers in training camps, and commissioned officers in refresher courses. Medical Department personnel received further training in personal hygiene at field service schools or medical replacement training centers, with particular emphasis on the individual measures taken to prevent diseases.[6]

The soldier's education in personal hygiene did not end with the 1 hour of classroom instruction included in his basic training, although the effectiveness of further training varied considerably from unit to unit according to the degree of interest of the commanding officer and his appreciation of command responsibility for enforcement of proper standards of hygiene. Regular monthly physical inspections by medical officers, and barracks and dress inspections by commanding officers, served as constant checks and reminders of the fundamental rules of cleanliness. Additional applicatory training was carried out at all times on marches, bivouacs, and training problems.

Maneuvers were an important part of the training program for ground troops, and also served to demonstrate both the difficulties of and the necessity for maintenance of personal hygiene under field conditions. Commanders observed that troops often felt, once they were away from base camps, that sanitary regulations should be relaxed. A report of sanitation during First United States Army maneuvers in 1941 noted: "Rubbish, waste paper, fruit skins, discarded sandwiches and food scraps, and, in certain instances, freshly deposited human feces were noted in and around many of the bivouac areas."[7] As late as 1944 a report on Second United States Army Tennessee maneuvers stated: ". . . defecation on the ground was not uncommon. . . . Enlisted men obtained food and water from unauthorized sources even though this was strictly prohibited." The report concluded that training in basic medical subjects and military sanitation required continuous emphasis and recommended that instruction be realistic and concurrent with other training.[8]

Training directives which included elements of personal hygiene were issued by all command headquarters. The Eastern Defense Command, for instance, provided for a minimum of 1 hour per week to be utilized in instruction pertaining to the health of the individual.[9] Occasionally, directives pertaining to a local hazard, such as ticks in Virginia, were issued to present appropriate preventive measures.

[6] See copies of training courses filed in HD: 353.
[7] History of preventive medicine in World War II, Eastern Defense Command. HD: 314.7-2.
[8] Annual Rpt, Med Sec Hq Second Army, 1944. HD.
[9] Training Memo 13, Hq Eastern Defense Command, 20 Dec 43. HD: 314.7-2.

When units were preparing for overseas, or when replacements were processed through staging areas, further instruction in personal hygiene pertaining to the area of assignment was given. Visual aids supplemented directives and pamphlets which described the environmental conditions to be expected and the diseases prevalent in the overseas theater. For troops destined for the European theater, particular emphasis was placed on louse control for prevention of typhus and care of the feet for prevention of trenchfoot. Troops going to the Southwest Pacific or China-Burma-India theaters were specifically trained in preventive measures against malaria, scrub typhus, and schistosomiasis and warned of the dangers from using unauthorized food and water.

Since the overseas destination was not always known accurately or was sometimes changed, not all personnel leaving for overseas were adequately prepared. In February 1944 a War Department circular [10] established minimum standards of proficiency in sanitation and personal hygiene for enlisted men, noncommissioned officers, and officers. It stated that the probable incidence of disease warranted major consideration in the planning of any operation because reports from all theaters had indicated that malaria, diarrheal diseases, and neuropsychiatric disorders were causing more hospital admissions than all battle casualties. Each major command was ordered to provide such inspections and tests as were necessary to determine and assure the attainment and maintenance of the appropriate minimum standards of proficiency by all individuals and units. At least one inspection and test was to be made within the 6 months preceding a unit's departure for overseas. Refresher courses were to be given in all officer pools, overseas replacement depots, and staging areas. Excessive sick rates from preventable diseases would be investigated and appropriate command action was directed if it was found that reasonable preventive measures had been neglected.

The Training Division, Office of The Surgeon General, had from the beginning of mobilization carried on an extensive program of providing training aids such as posters, films, film strips, and three-dimensional aids. In January 1945 a Health Education Unit was established in the Preventive Medicine Service to produce educational media for a comprehensive continuing program of instruction for the soldier in methods of maintaining his health.[11] The organization of the unit was necessitated by the anticipation of the shift of emphasis in the war to the Pacific where troops would increasingly come into contact for the first time with many diseases against which there was no vaccine or other known specific immunization procedure, and the prevention of which was dependent to a very large degree upon the individual soldier's knowledge and application of proper protective measures.

[10] WD Cir 48, 3 Feb 44.
[11] Annual Rpt, Prev Med Serv SGO, FY 1945. HD.

The general educational program for the soldier in the overseas theaters depended principally on unit training. While preparations for the North African invasion were underway, training in the United Kingdom included indoctrination in methods of protection against louse infestation. Again, as the time of the Normandy invasion approached, troops were specifically briefed on the subject of typhus just prior to embarkation for the Continent. Soldiers were issued individual cans of louse powder in all areas where it was considered advisable.

Special discussion hours were held in the United Kingdom for units moving to France. These talks were based on the assumption that troops were familiar with the principles of good field hygiene and were directed at the specific problems to be encountered, particularly continental customs with regard to disposal of human feces. Later, in 1944, the Preventive Medicine Division, Office of the Chief Surgeon, European Theater of Operations, was able to publish information in the *Stars and Stripes* on individual protection against food-borne infection under combat conditions.

Training in the European theater also emphasized individual measures applicable in the control of respiratory infections. The features of personal hygiene especially stressed by unit commanders and medical officers included the importance of avoiding contact with patients who had common colds or other forms of acute upper respiratory infections; the proper methods for disposal of sputum and nasal secretions, with stress on the dangers of promiscuous spitting; the possibility of contracting infections from common drinking cups, canteens, towels, and other personal items. The importance of personal cleanliness, of thorough hand washing, and of frequent changes to clean fresh clothing were other matters that received attention. (See Fig. 1.)

An intensive theater-wide program to train men in prevention of trenchfoot was begun in November 1944. Replacement depots were instructed to make an entry on the War Department Adjutant General's Office Form 20 of each man who had received instruction in the prevention of trenchfoot, and were not to assign replacements until this instruction had been completed.[12]

In the China-Burma-India theater greater reliance upon individual personal hygiene measures was necessary than in other theaters. Units were scattered over a wide area and troop movements across country usually involved only small groups. An extensive program of environmental sanitation was therefore considered impractical except in fixed installations. Directives and orientation lectures warned soldiers to protect the skin from prolonged exposure to direct rays of the sun. They were told not to work or exercise strenuously in closed spaces. As in all tropical climates, it was important to

[12] Gordon, J. E.: History of preventive medicine in the European Theater of Operations, United States Army, 1941–1945. HD: 314.7–2.



Figure 1. Disregarding the presence of the enemy just across the hill, a member of an anti-tank unit takes time out to brush his teeth behind a shell-torn house in Germany, 1944.

346336 O - 55 - 3

bathe frequently and to drink plenty of cool water.[13] It was a rule never to drink any but boiled or chlorinated water, which the individual usually had to supply for himself during travel.[14]

It was a common experience in India to remain in good health while in a fixed station only to pick up diarrhea or malaria while traveling. Educational literature given to troops prior to train movements outlined specific directions to follow. Troops had to make judicious use of native foods, because quartermaster subsistence was not always available during train travel. Throughout India in the larger stations there were restaurants where clean and reasonably palatable food was served. In small stations a hot curry or vegetable "pilau" could be eaten safely. Soldiers were continuously warned against eating raw fruits and vegetables unless they had been adequately treated.[15]

A constant educational program was carried on by the China-Burma-India theater antimalaria organization to remind individuals of the dangers of malaria and what they could do to protect themselves. Greatest emphasis was placed on the importance of repellents, protective clothing, bed nets, sprays, and atabrine. The troops were reminded repeatedly that they had all the instruments of protection, it was up to them, as individuals, to utilize them.[16]

PERSONAL HYGIENE IN OVERSEAS THEATERS

European Theater of Operations

Standards of personal hygiene varied according both to the facilities available and the type of combat the individual was engaged in. Theater preventive medicine officers at all levels realized the necessity for convincing company officers of the importance of command responsibility for enforcing adequate standards of personal hygiene. Trenchfoot became such a serious problem that disciplinary action was initiated against the soldier when it was discovered that he had failed to observe any of the prescribed measures. (See Fig. 2.)

Bathing and Laundry Facilities. In the early period of the United Kingdom Base, troop accommodations were overcrowded and bathing facilities were correspondingly inadequate, or even absent entirely. Baths and showers were usually installed in separate buildings, often inconveniently far from bar-

[13] Memo 75–31, US Air Forces in India and China, 10th USAF, 28 Sep 42, sub: Health precautions. HD: 314.7–2 (Ref).

[14] Ltr, Div Malariology Lab, 1333d AAF Base Unit, India-China Div ATV, to Div Surg, Hq ICD ATC, 1300th AAF Base Unit, 15 Nov 44, sub: Sanitary survey of a train trip from Calcutta to Chabua. HD: 314.7–2 (Ref).

[15] See footnote 13.

[16] Van Auken, H. A.: A history of preventive medicine in the United States Army Forces of the India-Burma theater 1942 to 1945. HD: 314.7–2.



Figure 3.—A member of the 101st Airborne Division takes care of his feet. Belgium, January 1945.

racks.[17] A survey late in 1942 brought out the fact that men were not bathing with the frequency that they should because the bathhouses were unheated.[18] Gradually adequate facilities were built and stoves were authorized for each bath and ablution house.

After operations were started on the Continent, local bathing facilities in towns were surveyed and inspected by Medical Department officers. In some areas the Quartermaster Corps operated shower points; in others, existing public baths and showers were used.[19] As an example of the assignment of quartermaster fumigation and bath companies in the combat zone, 16 complete companies were allocated to the 12th Army Group. Normally a system of clothing exchange was operated at bath points and sections of the company handled troop laundry for divisions in the vicinity. One platoon operating separately at a bath point could provide baths for 1 division in 4 days if the division was in a temporary noncombat status.[20]

Bathing facilities were variable depending on the unit's location, but that a shortage existed in combat units is indicated by numerous requests made by various headquarters and units for additional bath equipment. It was recommended that bath facilities be provided organically with all types of divisions.[21] The 9th Infantry Division reported, for example, that corps shower units with clothes turn-in privileges provided excellent service, but that the disposition of infantry troops prevented removal of more than 2 to 3 percent of any unit from the front at one time. This allowed only 1 bath per man in a 3- to 4-week period.[22]

The 2d Armored Division reported that during combat a bathing unit was always available to troops. Troops were rotated to get showers frequently.[23] The 35th Infantry Division, on the other hand, reported that during the summer months bathing facilities consisted chiefly of local streams. In October 1944 quartermaster bath units began servicing the division, augmented by unit bath centers generally consisting of heated rooms furnished with GI cans and immersion heaters. Laundry service was erratic, ranging from almost nonexistent to satisfactory.[24]

An example of the experiences of another unit is contained in a report from the 44th Cavalry Reconnaissance Squadron which stated that bathing facilities were always adequate but not always convenient. During the static warfare on the Roer, men had to be transported at intervals to rear areas where

---

[17] Ltr, Chief Surg ETO to CG ETOUSA, 13 Oct 42, sub: Overcrowding of troop accommodations. HD: 024 ETO.

[18] History of medical service, SOS ETOUSA, from inception to 31 December 43. HD: 314.7-2.

[19] See footnote 12, p. 18.

[20] General Board Study 108, "Service Operations of the Quartermaster Corps, ETO." AG: 321.8.

[21] Ibid.

[22] Annual Rpt, Surg 9th Inf Div ETO, 1944. HD.

[23] Annual Rpt, Surg 2d Armored Div ETO, 1944. HD.

[24] Annual Rpt, Surg 35th Inf Div ETO, 1944. HD.

the shower facilities of coal mines were available. After crossing the Roer and Rhine Rivers, bathing facilities in towns and civilian communities were more adequate and available to the troops. Dirty clothing of units was collected and exchanged for an equal amount of clothing from the Quartermaster laundry service. This resulted in some dissatisfaction with regard to sizes but, in general, was very satisfactory.[25]

Water Discipline. Water discipline in combat units improved as soldiers became accustomed to field conditions. (See Fig. 3.) Sporadic outbreaks of diarrhea due to individuals drinking water from local sources, without using halazone tablets or other field purification methods, were reported throughout 1944. More untreated nonpotable water was ordinarily consumed by combat troops in the rear Army and communications zone areas than in the forward zone, primarily due to the natural laxity and letdown associated with rest areas and fixed installations, but also through leave and furlough in municipalities not having approved water supplies.



Figure 3. Drinking water is tested for its chlorine residual, 26th Infantry Division, Luxembourg, January 1945.

[25] Semiannual Rpt, Surg 44th Cav Recon Sq (Mecz), 1945–1. HD.

Many of the units in the communications zone had spent considerable periods in Great Britain or were newly arrived from the United States. The common attitude toward any water coming from a tap was that it was potable and that it was the responsibility of others to see that it was so. Such water supplies were frequently used when not authorized in spite of definitely posted instructions to the contrary.

When the Army occupied Germany, efforts were made to remedy sanitary defects in existing water supplies and bring them to the level of United States Army standards of potability. The general policy was to release troops from the obligation of using field methods of water purification as soon as possible.[26]

Louse Control. A survey of 1,800 units in December 1944 and 1,500 others in January 1954 showed that about 0.5 percent of units gave some evidence of infestation with body lice, but the total number of individual infestations in all units was less than 100. The infestation usually occurred in combat troops who had slept in quarters recently vacated by German soldiers or civilians. The great value of the educational work on louse control was exemplified by the fact that the few infestations which did appear among combat troops were quickly eradicated and only rarely did the same unit have infestation in successive months.[27]

Personal Supplies. Because tonnage was extremely curtailed during the summer and fall of 1942, post exchanges could supply only limited quantities of tobacco products, toilet articles, and candies. Transient troops in embarkation areas were issued ration accessory convenience kits. These kits contained a daily allowance of razor blades, shaving cream, tooth powder, toilet soap, cigarettes, tobacco, matches, hard candy, and gum. Just before embarkation each soldier received a week's free supply. When post exchanges were not available on the Continent, United States troops received exchange supplies on a free and automatic basis.[28]

The barber kit was requested more and more frequently as the campaign progressed. Initial supplies had been inadequate and replacement parts were not available. Many barbers used equipment sent them from home. It was not until the latter part of 1945 that the contents of the kit and Army requirements became standardized and the supply adequate.[29]

North African, Mediterranean, and Middle East Theaters of Operations

Experience in both North Africa and Italy seemed to indicate that prior to arrival in the theater individuals had not been well indoctrinated in the

---

[26] See footnote 12, p. 18.

[27] See footnote 12, p. 18.

[28] Quartermaster Supply in the European Theater of Operations in World War II, vol. V. The Quartermaster School, Camp Lee, Virginia, 1949.

[29] Ibid.

importance of food and water sanitation.[30] Limited fly control supplies and lack of proper toilet facilities made strict enforcement of sanitary measures a necessity. The methods of transmission in the outbreaks of diarrhea in the spring and fall of 1943 in North Africa and in the fall of 1944 in Italy have not been proved, but inadequate protection against flies, improper cleansing of cooking and eating utensils, improper disposal of human wastes, drinking of unchlorinated water, and infected food handlers all seem to have been implicated.[31]

At a meeting of medical representatives of Fifth United States Army, 2d Medical Laboratory, II Corps, and IV Corps in the fall of 1944 to discuss intestinal disease rates it was concluded that the chief problem in sanitation lay in the difficulty of maintaining good personal hygiene by frontline troops under existing conditions. Soldiers were known to eat unauthorized food and to drink unauthorized water without the use of halazone tablets even though they were available. A previous investigation of 18 cases of typhoid fever had indicated poor water discipline of the individuals involved.[32]

Once-a-week laundry service for troops was provided in Oran where clothing salvage operations had been set up. Mobile laundries were in the theater, although they could not be provided in sufficient numbers to meet all the bath and laundry requirements of troops in the field. (See Fig. 4.) Typical of the mobile laundry groups was the 487th Quartermaster Laundry Company which followed the Allied armies through North Africa, the invasion of Sicily, and into Italy. "Always within a stone's throw of the advancing combat soldiers, the 487th nevertheless has continued to break records in laundry production and service to front line troops." [33] Individual enterprises also played a role in providing bathing and laundry facilities. In North Africa an officer, a laundryman in private life, created an overseas "branch" of his civilian business by hiring village women and setting up shop with tubs and irons.[34] Homemade baths were set up in Italy by a quartermaster service company and many units improvised showers. In 1945 the preventive medicine officer for the theater was able to write: "The units of this theater have achieved a high level of personal hygiene." [35]

No particular problems in personal hygiene were encountered in the Middle East theater although the potential hazards were very real. Serious discussion regarding the relationship between desert sores and the lack of bathing facilities led the Preventive Medicine Section, Office of the Surgeon, United States Army Forces Middle East, to recommend an increase in ocean bathing.

[30] Final Rpt, Prev Med Officer, Off of Surg MTOUSA, 1945. HD.
[31] Diarrheal diseases in Fifth Army, cause and prevention. The Medical Bulletin of the North African Theater of Operations, 1944–45. AFML.
[32] Annual Rpt, Surg II Corps, 1944. HD.
[33] Filler, Louis: Laundry and Related Activities of The Quartermaster General. QMC Historical Studies No. 13, OQMG, 1946.
[34] Ibid.
[35] See footnote 30.



Figure 4. An infantryman takes a shower in the new 85th Division shower and clothing exchange unit, close behind the Gustlines. Fifth United States Army, October 1944.

This recommendation was carried out by furnishing more transportation and more time for personnel to bathe in the sea. Personal hygiene was emphazied in health talks to members of the command by preventive medicine personnel.[36]

In the early history of the theater it was not unusual for over 70 percent of personnel among newly arriving units to suffer a gastrointestinal upset within a few weeks of arrival, because they had not been adequately informed of the dangers of consuming uncooked fruits and vegetables from native sources. As preventive medicine procedures became better understood, and were more thoroughly enforced, the rates for dysentery and diarrhea approached a reasonable figure.[37]

The provision of adequate bathing and delousing facilities, the use of anti-louse powder, and the placing of native villages out of bounds helped to

[36] Ward, T. G. History of preventive medicine United States Army Forces in the Middle East from 19 October 42 to 23 June 44. HD: 314.7 .2.

[37] Ibid.

prevent typhus and other diseases prevalent in native quarters from occurring among American Forces.

Southwest Pacific Area

In the Southwest Pacific area the principal efforts were directed toward unit sanitation. Elimination of the insect vectors of diseases such as malaria and scrub typhus with the aim of area control was stressed. Individual protective measures, particularly suppression of symptoms by the use of atabrine, were also important preventive measures.

Reports from Australia and New Guinea show that frequent physical inspections of troops and informal inspections of all units were carried out to determine the status of training and adherence to standards of all phases of medical, sanitary, and personal hygiene matters. Personal hygiene suffered during early months in the theater because only cold water was provided for showers and in many places bathhouses were dark, cold, and offered little protection from the wind.[38] One division surgeon attributed the occurrence of fungus infections to the inadequate laundry facilities.[39] Personal hygiene was raised to a satisfactory level as hot water systems were installed and construction of bathhouses improved.[40] The inadequacy of supplies of some items of clothing, insect sprays and repellents, and screening also presented an early problem for many units.[41]

Disease Control. Instructional periods for all personnel on mosquito control covered organizational and individual protective measures. The latter included sleeping under mosquito nets, using repellents, and proper wearing of clothing. Atabrine discipline was rigidly enforced but was not considered to take the place of preventive measures.

When the Army moved into the Philippines early in 1945 an intensive training program was carried on to give troops an understanding of the various diseases to be encountered. One of the dangers with which there had been little previous experience was schistosomiasis. Newspaper items, posters, roadside signs, and demonstration vans all warned of the dangers of bathing or swimming in fresh water streams and ponds. The educational program was the main weapon against this disease, and as troops recognized the severity of the illness and understood its mode of transmission, the incidence of schistosomiasis decreased.

Consumption of food and water from civilian sources was forbidden as a protective measure against diarrhea, amebiasis, and intestinal parasites. Dis-

[38] Sanitary Rpt, 32d Inf Div SWPA, Jun 1943. HD.
[39] Sanitary Rpt, 32d Inf Div SWPA, Apr 1943. HD.
[40] Sanitary Rpts, 32d Inf Div SWPA, Aug 1943, and succeeding months. HD.
[41] (1) Quarterly Rpt, Hq I Corps, 1943–1. HD. (2) Quarterly Rpt, Base E SWPA, 1944–1. HD. (3) Quarterly Rpt, Hq X Corps, 1945–1. HD. (4) Quarterly Rpt, 6th Army, 1944–2. HD. (5) Sanitary Rpt, Adv Base D SWPA, Jul 1942. HD.

regard of these directives by individual officers and soldiers was a factor in outbreaks of these infections.[42]

Although personal hygiene was generally considered excellent throughout the command, combat conditions necessarily sometimes had an adverse effect. The Sixth United States Army reported that sanitation and individual hygiene suffered during the second quarter of 1945 because of the fatigued condition of the men after several months of fighting and the terrain conditions imposed by the combat situation. The health record became better when troops reached a stable position and began to improve their personal hygiene.[43]

Another extremely common hazard of the Southwest Pacific area was fungus infection. Observance of directives concerning care of the feet was especially important in an area where fungus infections might become disabling. Frequent bathing, with thorough drying of the skin and powdering of the body helped to lower the incidence of fungus infections. (See Fig. 5.) Periodic inspection of troops was necessary to assure early treatment.[44]

Bathing and Laundry Facilities. Bathing facilities were reported as adequate at most times and ranged from mountain streams, ocean, and lakes to improvised showers. Many units improvised hot water systems for showers. In the Philippines, after an immediate problem of water supply, shower rooms were provided for all troops.[45]

Even hospitals reported laundry facilities as inadequate during 1943. In Australia, civilian establishments were utilized, but were working so far beyond capacity that the quality was frequently substandard. Small handwashing machines and many types of makeshift laundry facilities were utilizied in New Guinea. By 1944, quartermaster laundry facilities were being provided, primarily for hospitals. Units, in general, provided facilities for the individual to wash his own clothes.[46]

China-Burma-India

As has been indicated, an educational program in individual protective measures was necessary, particularly for small isolated units and individuals traveling between fixed installations or on leave. Reports as late as 1944 indicate that troops continued to arrive in the theater without proper instructions in malaria prevention and demonstrating poor malaria discipline.[47]

---

[42] Quarterly Rpt, Base K SWPA, 1945-*. HD.

[43] Quarterly Rpt, 6th Army SWPA, 1945-2. HD.

[44] (1) Quarterly Rpt, Base B SWPA, 1943-4. HD. (2) Quarterly Rpt, Base E SWPA, 1944-1. HD. (3) Quarterly Rpt, 6th Army, 1944-2. HD.

[46] Quarterly Rpt, Hq I Corps, 1943-3. HD. (2) Annual Rpt, Chief Surg USASOS SWPA, 1943. HD.

[46] Quarterly Rpt, Base G SWPA, 1944-4. HD.

[47] Memo, Hq US Forces China-Burma-India, 20 Jun 44, sub: Notes on malaria control for reference in conference at SGO. HD: 314.7-2 (Ref).



Figure 5. Men of the 25th Division take time out to dry their clothing, apply foot powder, and re-dig foxholes filled with mud by the night's rain. Okinawa, May 1945.

Bathing facilities were in the majority of cases improvised, but adequate. In 1943, it was reported that some of the smaller stations in the Assam area had only washracks with drains; however, by 1944 each company and detachment had provided itself with showers. At convoy camps along the Ledo Road soldiers were permitted to sponge off at the rivers, but river bathing was forbidden because of resulting skin infections. In China, each group of Americans constructed their own showers, based upon directions in the Army field manual on sanitation. For a time no heating units were available, but when closed buildings were constructed, hot water was provided for washing and shower facilities.[8]

In 1943 the native "Dhobies" did most of the laundry for soldiers and officers in India. Their crude methods of beating out and stamping out the dirt were

[8] (1) Annual Rpt, Hq 478th QM Gp (India), 1943. HD. (2) Ann Rpt, Hq SOS Area Comd, USF in China, 1944. HD. (3) Annual Rpt, Southern Comd, Hq 9th Army Gp, American Liaison Team (China), 1944. HD.

not particularly efficient. Soldiers associated the prevalent skin lesions with these laundry methods and called them all "dhobie itch." Many unit facilities and quartermaster laundries were established during 1944. Individual experimentation also created some novel laundries as the following example of a combination of American ingenuity and Indian tradition indicates:[49]

> Beating blocks were built, on which the Indian help could beat instead of scrub clothes. However, the concession stopped there. Running water was piped to the site; GI cans were installed, in which laundry is soaped and boiled in lye. It is then rinsed, resoaped and beaten upon the blocks and rinsed again. After bleaching it is hung out to dry on clothes lines.

CONCLUSIONS

The relative role of personal hygiene in control of disease varied considerably according to the degree of unit sanitation and area control achieved and according to the degree of specific protection afforded by measures such as immunization. There are few outbreaks of disease in which only one factor can be implicated; it is therefore difficult in most cases to correlate specifically good or bad personal hygiene with disease incidence.

A continuing educational program, combined with frequent inspection by both commanders and medical personnel, was found necessary to keep individual health observance at proper levels. A problem of the Medical Department was to convince line officers of their responsibility in enforcing health precautions, such as water discipline, eating only authorized foods, care of the feet, and proper wearing of the uniform for protection against arthropod vectors of disease. The soldier, too, had to be convinced of the relationship between his actions and his health and the health of his entire unit. Agencies were set up, within the Office of The Surgeon General and at all major command levels, to insure the dissemination of information necessary for the soldier to safeguard his health.

The effectiveness with which personal hygiene measures were applied, both in training situations and in active theaters, varied widely. Experienced observers agree that there were numerous lapses from established minimum standards and that, in future military operations, thorough training in personal hygiene will be necessary. This training must include not only the principles and methods to be applied, but should also serve to motivate personnel of all ranks. In addition, there must be command and medical inspections coupled with provisions for effective corrective actions.

---

[49] (1) Annual Rpt, Hq Med Det 472d AM Gp, 1943. HD. (2) Annual Rpt, Disp 478th QM Gp, 1944. HD. (3) Also see footnote 33, p. 25.

CHAPTER III

Clothing

Colonel Tom F. Whayne, MC, USA

PHYSIOLOGIC MECHANISMS FOR ADAPTATION TO HEAT AND COLD

The study of clothing to meet military needs and protect the health of the American soldier in World War II became a science. The application of this science materially influenced the comfort, efficiency, well-being, and health of the soldier. This was of basic interest to preventive medicine in its mission of the conservation and maintenance of mental and physical health.

Man is a tropical animal. Without the aid of clothing he is physiologically best adapted for the warm climates. Since man must wear clothing, the best types of garments can be developed only by full consideration of his physiologic makeup and his mechanisms for adaptation to heat and cold. For optimum well-being, the human body must maintain a relatively constant internal body heat by a balance between the rate of heat dissipation and heat gain. Fundamentally, the problem is conservation of heat in the cold and the efficient dissipation of heat in the hot climates. In heat regulation and heat exchange, the human body has a remarkable adaptation through a wide range of temperatures. Several mechanisms are involved.

At least two centers, located in the hypothalamus, appear to act as "thermostats," one basically concerned with heat dissipation, the other with the conservation of heat. These centers are closely connected by nerve pathways and, by a mechanism that is not well understood, react reflexly to sensory stimuli from peripheral thermoreceptors and probably to internal body temperature, including that of the brain stem itself. Newburgh [1] and his associates favored the hypothesis that the thermoreceptor mechanism lies in a gradient across the skin between the surface and the blood and that the steepness of the gradient in one direction gives rise to the sensation of cold, while that in the other stimulates the feeling of warmth. It is well understood that heat regulation is intimately related to blood and the flow of the blood stream. Central nervous system control of vasodilatation and vasoconstriction and certain local reflex mechanisms comprise a large part of heat regulation. Thermal adaptation through the nervous system is rapid.

[1] Newburgh, L. H., ed.: Physiology of Heat Regulation and the Science of Clothing. Philadelphia, W. B. Saunders Company, 1949.

Prolonged adjustment to temperature appears to be a function of the endocrine system and is under the master control of the pituitary gland. The mechanism of control through the endocrine system probably is chemical by means of hormones, the products of metabolism, or the metabolic reaction of special chemicoreceptor cells. Metabolism, as the principal process through which body heat is produced, comes under endocrine control through the internal secretions of the thyroid, the medulla of the suprarenal gland, and possibly other internal glands. Adrenalin produced in response to stress undoubtedly increases heat production. The role of the secretion from the cortex of the suprarenal gland and the reaction of the human body to stress has received considerable attention at the hands of Selye [2] and others, but is not completely understood. Lange and co-workers [3] have demonstrated the protective influence of thyroid gland administered to rabbits exposed to extremes of cold, and Leblond and his co-workers,[4] through the use of radioactive iodine, have shown an increased thyroid response in rats exposed to cold after a latent period of approximately 3 days. Return to normal activity occurred after a period of exposure of 40 days and probably indicated that other mechanisms of adaptation had come into play. Schachner and co-workers,[5] working in the Armored Medical Research Laboratory at Fort Knox, Kentucky, after the war, extended the range of observations to shorter and longer intervals, 2 hours to 60 days, and in general confirmed the work of Leblond. The endocrines also exert a definite influence in the control of water balance and the blood level of chlorides. Bazett [6] and others have described blood volume changes characterized by an increase in heat and a reduction in cold.

Bazett stressed the point that body temperature is not constant for all parts of the body, and that variations in surface temperature and even deep muscle temperatures in the extremities occur in the process of heat regulation and the maintenance of thermobalance according to external temperatures. The most constant body temperature is probably represented by that of the liver, the brain, and of the blood as it leaves the heart. Even deep rectal temperatures vary according to heat stress or heat loss.

In response to cold, there is an initial general vasoconstriction involving all types of superficial blood vessels, possibly accompanied by deep splanchnic dilatation. Gooseflesh roughens the skin and the hair rises in an effort to

---

[2] Selye, H.: The general adaptation syndrome and the diseases of adaptation. Practitioner 163: 393–405, Nov 1949.

[3] Lange, K.; Gold, M. A. A.; Weiner, D., and Kramer, M.: Factors influencing resistance to cold environments. Bull. U. S. Army M. Dept. 8: 849–859, Nov 1948.

[4] Leblond, C. P.; Gross, J.; Peacock, W., and Evans, R. D.: Metabolism of radio-iodine in the thyroids of rats exposed to high or low temperatures. Am. J. Physiol. 140: 671–676, Feb 1944.

[5] Schachner, H. E.; Gierlach, C. S., and Krebs, A. T.: The response of the thyroid gland to low environmental temperature as studied with radioiodine. Med Dept Fld Research Lab Project Rpt 6–64–12–02, 1 Jun 49. AFML.

[6] Bazett, H. C.: The regulation of body temperature. *In* Newburgh, L. H., ed., op. cit., pp. 109–192.

decrease airflow over the skin surface and to maintain a layer of air insulation over the body. Bazett points out that the level of deep body temperature, as exemplified in rectal recordings, is influenced by so many factors of adaptation that it is not readily depressed in cold nor increased by moderate warmth. Data collected carefully by Bazett and his group, however, do demonstrate that such an effect is discernible. He states that, "Thus the data . . . indicate differences in average rectal temperature of 0.7° C. (1.3° F.) for the whole range from just endurable cold to sweat-causing heat."

Reflex shivering increases the metabolic rate as part of the physiologic protective response to cold. If exposure to cold is prolonged, the continued vasoconstriction sets up a need for a reduction in blood volume to compensate for splanchnic dilatation. As a result, there is some concentration of plasma protein, which eventually disappears. An increase in cell concentration may occur, but over a long period this also is reduced and the cell composition of the blood is comparable to that seen in subjects in equable temperatures. In vasoconstriction, which affects arteries and veins alike, the blood returns through the venae comites in close apposition to the arteries. Under these circumstances, arterial blood on the way to the surface is cooled and venous blood, coursing centrally, is warmed by an exchange of heat. This results in a gradual cooling of the extremities and eventually allows surface temperatures to fall. This may cause a decrease in evaporation, radiation, and convection from the skin and act as a mechanism for the conservation of heat.

Acclimatization to cold appears to be less specific than adaptation to heat. Increase in thyroid activity in man exposed to cold has not been substantiated. There is some evidence that plasma protein is reduced to accommodate sustained vasoconstriction of the superficial vessels. Roughening and drying of the skin may occur and probably afford better insulation. Individuals exposed to cold develop tolerance and greater comfort within about 1 week. Optimum acclimatization to cold requires long periods of experience in cold climates and appears to involve more of "learning to live with cold" than physiologic adjustment, about which very little fundamental knowledge exists.

Physiologic adjustment of the body to heat is largely a function of the circulatory system insofar as is now known. The basic reactions are the opposite of those described above for cold. A continuous vasodilatation is an early response to heat and apparently depends upon reflex responses to peripheral thermoreceptors acting through thermocenters in the hypothalamus. There is an increased flow of blood, especially at the periphery, and the route of flow of returning blood is in the superficial veins. This allows blood flowing toward the periphery to carry heat outwardly, to lose it near the skin surface through the cooling effects of evaporation and convection, and to return centrally at lowered temperatures to accomplish internal cooling. In the initial adaptation, vasodilatation is accompanied by splanchnic constriction. With further adjust-

ment, however, there is an increase in blood volume. Blood protein increase subsequently parallels the fluid increase, but elevation of hemoglobin levels has not been conclusively substantiated.

The physical mechanisms through which body heat is lost are primarily evaporation of sweat and convection and, to some degree, by conduction of heat through the tissues. The sweating mechanism is largely controlled by the sympathetic nervous system and to a less extent by peripheral heat stimuli acting through a thermocontrol mechanism located in the hypothalamus. Robinson [7] has summarized evidence to the effect that local heat stimuli may also initiate sweating. He further states that the center in the hypothalamus is influenced by afferent impulses from temperature receptors in the skin, direct temperature changes in the center which are determined by the temperature of the arterial blood supply, and possibly by stimuli arising from neuromuscular activity. The initiation of sweating depends largely upon the skin temperature and increases rapidly above a threshold of 34.5° Centigrade.[8] Water output through sweating is therefore in proportion to the heat stress to which the body is exposed. Under heavy stress, dehydration ensues if water is not replaced in adequate quantities. Total water balance in the heat is largely related to sweating, kidney function, and thirst. Robinson [9] has studied the rate of sweating and points out that in addition to the factors noted above, sweating may vary by individual, degree of acclimatization, fatigue, and excessive salt intake. Under stress up to 4 liters of sweat per hour may be lost through the sweating mechanism, although averages are considerably less. High rates of sweating cannot be maintained indefinitely because of fatigue of the sweating apparatus. The ability to sweat and resistance to fatigue of the sweating mechanism vary by individual. Indeed, a few individuals appear to be incapable of sweating to any great degree and therefore are unfit for living in the hot climates.

Acclimatization of men to heat stress is a complex process. Ability to sweat increases, the chloride content of the sweat decreases, and there appears to be some general lowering of the metabolic rate. Robinson points out that in the acclimatized individual, sweating begins earlier upon exposure to heat than in the unacclimatized individual. The heat regulation mechanisms of the body adapt themselves rapidly to increased heat loads and most individuals accomplish a large part of the acclimatization process within a week of having been placed in a hot environment. Robinson notes the great capacity of the circulation to make adjustments to heat stress, and gives as an example observations on well-acclimatized men studied in his laboratory who could maintain thermal equilibrium and water balance while working for 6 hours with a

[7] Robinson, S.: Physiological adjustments to heat. *In* Newburgh, L. H., ed., op. cit., pp. 193–231.

[8] Winslow, C.-E. A.; Herrington, L. P., and Gagge, A. P.: Physiology reactions of the human body to varying environmental temperatures. Am. J. Physiol. 120: 1–22, Sep 1937.

[9] See footnote 7.

metabolic rate of 190 calories per square meter per hour in an air temperature of 50° C. and a relative humidity of 18 percent, or in an air temperature of 33° C. and a relative humidity of 95 percent. Under such circumstances, these men were meeting a threefold demand over and above metabolic requirements as far as the circulatory system was concerned.

The period required for complete acclimatization in hot climates is not known. For practical purposes, however, the war experience demonstrated that the vast majority of men who were transferred from temperate to hot climates had become acclimatized within a period of 1 month to 6 weeks.

This brief summary of the physiologic aspects of the body's adaptation to the extremes of temperature was taken largely from Newburgh [10] and his collaborators and from the reports of the Subcommittee on Clothing of the Aviation Medicine Committee, National Research Council. The purpose has been to emphasize the concept that the development and use of clothing must be predicated upon man's physiologic responses to his environment and not alone to fit, wearability, and adaptation to combat efficiency. This point of view was slow in its evolution. As late as 1940 the development of clothing was largely the responsibility of the Quartermaster Corps School and Depot in Philadelphia, Pennsylvania, aided by field testing for field use and combat adaptation by the Boards of the appropriate Army branches.

In 1940 and early 1941, the Quartermaster Corps Technical Committee was developing the clothing program with the aid of civilian experts in clothing production.[11] Their major interests were fabrics, fit, durability, adaptation to combat and other military requirements, appearance, and supply. It was not until The Surgeon General expressed interest in the development of clothing in relation to the physiologic requirements of the soldier that intensive studies on this subject were begun. Thus, the concepts briefly summarized above were largely an outgrowth of the combined efforts of The Surgeon General and The Quartermaster General during the war, with the assistance of the National Research Council and a number of experimental laboratories.

PROPERTIES OF PROTECTIVE CLOTHING

Forbes [12] has described the properties of clothing as porosity, permeability, flexibility, elasticity, design and fit, thickness, number of layers, color, texture, and weight. Utilization and proper weighting of these properties of clothing promote human comfort and efficiency, and are potent factors in the prevention of injury and disease. They govern the passage or retention of heat and water vapor, and decrease the effect of solar radiation, convection, and wind. Those

[10] See footnote 1, p. 31.

[11] Risch, E., and Pitkin, T. M.: Clothing the Soldier of World War II. QMC Historical Studies No. 16, Washington, Government Printing Office, Sep 1946.

[12] Newburgh, L. H., ed., op. cit., pp. 320–329.

who develop clothing for military purposes cannot ignore the effects of design and appearance upon the morale of the soldier, for what makes up fashion in a uniform is oftentimes neither physiologically sound, nor operationally practical. Fourt and Harris [13] have remarked that "clothing is often chosen on the basis of fashion rather than physiology and physics."

The development of special types of clothing for the protection of the soldier against diverse environmental hazards was a necessity during World War II. The American soldier experienced combat in the dry heat of the desert, the wet moist heat of the tropics, the cold of winter in Italy and Western Europe, and the damp cold at Attu and the Aleutians. (See Fig. 6.) Thus, even with the knowledge of body regulation to heat and the development of fabrics and design of uniforms that existed at the end of the war, uniforms for special requirements could not be avoided.

The characteristics of the uniform for hot climates were lightness, permeability to water vapor, lack of absorbability for water, insectproofness, and firmness of weave sufficient to protect the skin from injury and abrasion. White or other light colors were desirable because of their ability to reflect radiated heat, but were unsuitable for camouflage. Fabrics should be able to conduct heat, dry quickly, reflect radiated heat, interfere as little as possible with the cooling process of evaporation of sweat, and give maximum ventilation during periods of activity while at the same time affording some protection against the wind and lower night temperatures when the soldier is at rest. In hot humid climates, any type of clothing may impede evaporation of sweat to such an extent as to interfere with heat balance. In hot dry areas, a covering of clothing over the body protects from radiation from the sun and prevents heat coming in contact with the body in much the same way that arctic clothing in the cold protects from excessive heat loss.

The effectiveness of clothing for cold climates depends upon thermal insulation properties. Thermal insulation requirements of the human body, however, vary so greatly between hard physical activity and rest in cold climates that great flexibility in design is required. In activity, layers must be shed and neck and cuff openings undone to facilitate ventilation and evaporation of sweat for the maintenance of thermal equilibrium. When sweating is intense, clothing picks up much moisture which later turns to frost or ice and greatly reduces thermal insulation during periods of rest.

Still air is a good insulator. Consequently, the design and construction of clothing for cold climates came to embody those principles which trap air in the interstices of the fabric and between layers of clothing. Moving air on the other hand rapidly dissipates heat so that wind in contact with porous clothing covering the body rapidly causes loss of body heat. It was learned during the

---

[13] Fourt, L., and Harris, M.: Physical properties of clothing fabrics. *In* Newburgh, L. H., ed., op. cit., pp. 291–319.



Figure 6. A. Men of 160th Infantry stalking through Waikia Forest Reserve jungle site, Hawaii, June 1943. B. Armored troops in a frontline position in Holland receive an issue of clothing. October 1944. C. Alcan Highway, 1942. D. Below the snowline, the patrol stops to change back to OD's. Fifth United States Army, Italy, December 1944.

war that a tightly woven, lightweight, windproof outer garment, worn over more porous fabrics as inner layers to give the effect of layers of still air for insulation, gave the best protection. Another characteristic was looseness of fit to encourage the trapping of air and to avoid fatigue by friction or restriction of movements.

Other problems in the development of military clothing have largely to do with special problems, such as protection against fire and chemical warfare agents, and clothing in relation to industrial hazards. At least three hazards required the impregnation of clothing with separate chemical substances. These were fire, vesicant gases, and insects. In all three, toxic effects from the chemicals used provided a difficult problem during the war and necessitated many laboratory man-hours of testing. These chemical substances must be nontoxic, effective for the purpose for which they were designed, and change the characteristics of the fabrics used in the uniform as little as possible. The processes for impregnating them into the fibers of the fabric or in the fabric itself must be simple and preferably susceptible to use in the field or in improvised field installations. These problems became more complex when the type of operation was such that protection against both fire and chemical warfare agents might be anticipated and impregnation with insect repellents or insecticides was a requirement.

Protection of the extremities in both heat and cold gave rise to special problems during the war. In tropical climates fungus infections were prevalent and constant wetness from perspiration or water conditioned the skin to trauma. In the areas of dry cold, frostbite commonly affected hands and feet. Where cold was experienced in association with wetness, the problem of protecting the feet was especially difficult. Footgear alone could not be expected to solve the problem. Conservation of total body heat by efficient protective clothing for other parts of the body had to complement the provision of properly designed, constructed, and fitted socks, and appropriate shoes such as the shoepac and the arctic overshoe in the prevention of trenchfoot. Looseness of fit to avoid constriction of the extremities, layering of socks, wetproofness of the shoe, and ventilation through the uppers of the shoe came to be important considerations in the development of the best type of footgear for protection against cold injury.

CLOTHING IN WORLD WAR I [14]

The development of clothing for the American Expeditionary Forces in Europe in World War I was largely on the basis of expediency. The American Army had had no experience with operations on such a large scale and no basic research had been initiated to develop the best items of clothing and equipment for operations in a temperate climate where winters are relatively severe. Supplies were short, and it was necessary to purchase many items of clothing abroad to meet requirements for United States Forces. Inadequacies in transportation made unit supply difficult.

---

[14] The Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1926, vol. VI, pp. 608–661.

Until late in the war, the preventive medicine aspects of clothing appear to have received little attention, but great emphasis was placed upon the weight of equipment and clothing. It had been determined that the burden of the individual soldier should not exceed one-third of his own weight if he was to have maximum freedom of action on the march and in battle. The mean weight of American soldiers varied between 141 and 144 pounds. The average equipment for the rifleman weighed 61 to 73 pounds. When clothing was added, the weight was 80 to 91 pounds. There are no reports which point out the effect of these loads on the health in the American Expeditionary Forces. It was a common practice, however, for the World War I soldier to discard clothing and equipment. It is recorded that 50 percent of the men discarded extra shoes, 30 percent the extra blanket, and 25 percent the extra suit of underwear.

Operations late in 1917 demonstrated that the 16-ounce Melton cloth for service coats was too light. The Chief Quartermaster, American Expeditionary Forces, recommended an increase to 20-ounce Melton, and a change in construction and lining materials. With the increase of wool consumption and the resulting shortages, the cloths produced were coarse and patchy in appearance. The American soldier appeared poorly dressed in comparison to those of other armies in Europe. Gen. John J. Pershing recommended a new design which, however, was not produced in time for use in Europe.

Great difficulty was experienced in the proper fitting of clothing. Sizes recorded on paper labels were lost and resizing of salvaged clothing was frequently careless in practice.

Special types of clothing were developed for the American Expeditionary Forces in Siberia and northern Russia in late 1918 and 1919. These consisted largely of overcoats with sheepskin lining under an outer shell of moleskin cloth or cotton duck. Parkas came into use, along with heavy fur headgear and fur-lined hoods. Some use of the layering principle was made in winter clothing for Europe as demonstrated by the development of a leather jerkin which was designed to be worn over the uniform coat and under the overcoat. The jerkin was a popular garment and often was worn to the exclusion of the overcoat.

Footgear

The shoe developed by the United States Army before World War I did not stand up in combat use. Changes in design and construction were made in May 1917, but because of the Goodyear-welt construction these shoes were not waterproof and were unsatisfactory. It was not until January 1918 that the Chief Quartermaster, American Expeditionary Forces, investigated the failures of this shoe and recommended improvements, a circumstance reduplicated by the January 1945 conferences on clothing in the European Theater of Operations.

The "Pershing shoe" developed in World War I had such sound military characteristics that its principal features were recommended for inclusion in the military shoe for spring, summer, and fall operations toward the end of World War II.[15]

Shoe Tariffs. Even in World War I, shoe tariffs for United States Forces included 90 sizes: 5 to 12 in half sizes and A through EE in widths. Companies recorded the sizes of the soldiers' shoes. Supply based on these records resulted in a preponderance of the smaller sizes. The problem was further complicated by the recruitment of division personnel by region. Tariffs for the New York City units, made up largely of men of average or small stature, could not be the same as those for units comprised of the men of average to large stature from the Midwest.

Fitting of Shoes. It is recorded that "In the American Expeditionary Forces the fitting of soldiers' shoes was far from being satisfactory practically throughout the existence of these forces." [16] There were no fitting machines, and the selection of shoe sizes was largely a responsibility of the commanding officer of the unit. This personal element and added command responsibility gave rise to much variance in the efficiency with which shoes were fitted. Even when fitted well, due regard was not given to the fact that the foot of the soldier increases in size under the exigencies of marching and combat, and that it was necessary to wear two pairs of socks for comfort during the winter months. Misfitting prior to the winter of 1917–18 was so much in evidence that some divisions reported as much as 90 percent of their men as suffering from foot trouble. Nearly all of the misfits were too small. In the fall of 1917, General Pershing cabled the War Department to stop the shipment of small sizes and established a new tariff in January 1918. In addition, The Quartermaster General caused a study of the problem to be made at Camp Upton, New York, in the spring of 1918. Some divisions called upon division orthopedic surgeons to supervise shoe fittings with improved results.

Reasonably satisfactory dubbins for waterproofing shoes were developed during World War I. Success in their use, however, appears to have depended upon the method of use, which was time consuming and tedious.

The design and construction of rubber boots and arctic-type overshoes were found to be defective. Cloth (cashmerette) uppers for overshoes were failures. They did not wear well and leaked after short periods of wear as was found to be the case with the cloth-type arctic used in World War II.[17]

Socks. Wool socks were worn exclusively. A heavy wool sock worn over a lighter wool sock was the standard procedure. As in the case of shoes, sizing

---

[15] Memo, L. B. Sheppard, Off Chief QM, for Maj Gen R. M. Littlejohn, Chief QM ETOUSA, 18 Mar 45, sub: Footwear and socks for use in the ETO. HD: 332.31 ETO.

[16] The Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1926, vol. VI, p. 630.

[17] ETMD, ETO, Dec 1944. HD: 350.05.

seems to have been the greatest deterrent in the use of these otherwise satisfactory items. Because of the difficulties in the supply and exchange of socks, it was necessary for a general order to be published early in 1918 which directed that all soldiers in forward areas would be provided with three pairs of wool socks so that at least one change per day could be made.[18] The order further established a sock exchange system roughly similar to that found to be so essential in the prevention of trenchfoot in World War II.

Clothing for Hospital Patients

Clothing for hospital patients was not considered satisfactory in the American Expeditionary Forces. A uniform convalescent suit patterned after a similar British item was recommended, but was not adopted. The nightshirt which was recommended as part of this suit was adopted, and the number of blankets issued to each patient was increased from 3 to 4 in the spring of 1918.

Nurses' Uniforms

At the beginning of the war, there was no prescribed outdoor uniform for nurses in the American Expeditionary Forces. The American Red Cross furnished many items for American nurses. It was not until late in the war that the War Department finally approved initial issue of clothing for nurses at Government expense and provided facilities whereby they could keep themselves comfortable and well clad. The nurse's uniform was standardized towards the end of the war and a basis of issue was established. In the period between the two World Wars, little effort was made to develop a satisfactory field uniform for members of the Army Nurse Corps so that at the beginning of World War II the nurses were little better off than they had been when World War I started.

Laundering

Mobile field laundries were not originally part of the American Expeditionary Forces. Late in June 1917, the Chief Quartermaster and the Chief Surgeon, Headquarters American Expeditionary Forces, jointly recommended the establishment of laundries and the Chief Surgeon again on 19 August 1917 reemphasized the need and recommended that laundries be established alongside or in conjunction with delousing stations and the facilities for the sterilization of clothing. Until January 1918, however, the laundering of clothing was left to the individual soldier. Local village women were the laundresses or the soldier did his own, usually using cold water from muddy streams. This did not accomplish efficient cleansing and certainly did not disinfest the clothing. A general order late in January 1918 directed the establishment of free laundries and the first mobile laundry was shipped to Europe on 5 June 1918.

[18] GHQ AEF GO 11, 17 Jan 18.

Three more were in the theater by 18 August and it was only on Armistice Day that 24 additional mobile laundries were shipped from the United States.

The impregnation of clothing for the control of lice was not practiced in World War I. It is interesting, however, that a member of the Medical Research Committee of the American Red Cross in Paris urged a practical trial for the impregnation of underclothing with an emulsion of cresol and soft soap as a louse control measure. While members of the Medical Research Committee wore underclothing thus impregnated for many days without reported cutaneous irritation or allergic manifestations, there is no record of field trial or use by American military personnel.

Control of the ubiquitous "cootie" was largely confined to disinfestation of clothing and the provision of bathing facilities. Methods of disinfestation were by steam sterilization, hot air, and a variety of improvised methods, such as the Serbian barrel or steam boxes which were dependent upon heat or steam. Large delousing plants were established under the control of a bathing and delousing division. The technical director in the division was a medical officer who, in most instances, had had experience as a division medical gas officer. Subsupervisors operated by echelon downward to include regiments and battalions. Successful disinfestation was accomplished at great expense in time and large static facilities. Disinfestation for the individual and for small groups was unsatisfactory. Reinfestation occurred easily because simple heat sterilization of clothing provided no residual insecticidal effect. The bath and delousing units of World War I were the antecedents of the bath and sterilization and the bath and fumigation units of World War II. In contrast to the methods used in World War I, MYL and DDT dusting, together with bathing and laundering and methyl bromide treatment of clothing, kept the American soldier essentially louse-free during World War II. The residual effect of DDT was the factor of greatest importance.

Trenchfoot was not a significant cause of disability in American Forces in Europe in World War I. The role of clothing in the prevention of cold injuries, however, came to be well understood.[19]

In World War I the development of clothing in relation to the function of the soldier and to meet his physiologic requirements received little study and no emphasis. Medically, major interests were directed toward the sanitary aspects of clothing, especially those having to do with laundering and disinfestation. The relation of footgear to trenchfoot was appreciated.

CLOTHING IN WORLD WAR II

Clothing as a preventive medicine interest received little attention in the period between the two World Wars. At the beginning of World War II, the

[19] See footnote 18, p. 41.

American soldier was clothed in a uniform which, with the exception of a moderate trend towards making it suitable for dress and garrison use, was the same as that in use at the end of World War I.[20] The last development in arctic clothing before the war was in 1928. Little attention was given to special types of clothing for unusual military uses. Some observations were made upon the relative desirability of cotton versus wool uniforms for wear in the field in the tropics. The physiologic implications of these observations, however, were on an unsound footing because of the conviction on the part of commanders in general that soldiers fared better on restricted water intake during periods of heavy physical activity. In September of 1936 at Fort Riley, Kansas, field tests were made of clothing impregnated against vesicant gases.[21] The tests, however, were limited to observations on four men and were made by a contract surgeon, rather than under the auspices of trained research personnel.

The need for a field jacket to replace the service coat was established in the middle 1930's. Development began in 1935, ended early in 1937, and after much delay resulted in the adoption of the olive-drab field jacket in November 1939. Lightness of weight, water-repellency, and tightness of weave for wind resistance characterized this garment which might be considered the initial step toward the development of the specialized uniforms required for World War II.[22]

The Chemical Warfare Service laboratories at Edgewood Arsenal, Maryland, maintained a Medical Research Division which stimulated interest in the protection to be derived from clothing or specially treated clothing. A manual, "Prevention and Treatment of Casualties from Chemical Agents," was prepared in 1940 with assistance from the Medical Department and included references to the uses of impregnated clothing.[23] In December 1940, the Training Division of the Surgeon General's Office recommended that the 5th Medical Battalion, assigned to the 5th Division at Camp Custer, Michigan, be used as a unit for winter training and testing. Study was limited to medical care in the cold, and protective clothing suitable for the wounded to wear during evacuation was included.[24]

Isolated medical problems did receive some attention, as is illustrated by the concern over the possibility of pathogenic anaerobic bacteria said to have been found in samples of woolen clothing.[25] Samples of woolen clothing from various sources, including quartermaster stocks, were tested for pathogenic *Clostridia*. The Army Medical School laboratories came to the conclusion

---

[20] See footnote 11, p. 35.

[21] Ltr, J. R. Fuchlow, Contract Surg USA, to SG thru Surg, Ft. Riley, Kans., 10 Sep 36, sub: Medical officer's report on soldiers during a test wearing of impregnated uniforms. SG: 421–1.

[22] See footnote 11, p. 35.

[23] WD TM 8–285, 10 Jul 41.

[24] Memo, Capt T. J. Hartford, SGO, for Gen Love, SGO, 11 Dec 40. HD: 353 (Chron).

[25] Ltr, Dir Army Med School to SG, 13 Sep 41, sub: Anaerobic bacteria in woolen fabrics. SG: 700.2–1 (AMS).

that woolen clothing uncontaminated by soil was not a significant source of gas gangrene or tetanus. Clothing contaminated by the soil of European battlefields or in some training areas in the Midwestern States, might contain enough viable *Clostridia* to cause gas gangrene or tetanus.

In such important items as work clothing, medical opinion was not obtained prior to the adoption of herringbone twill, and there is no record that consideration was given to the use of this cloth in the tropics, either as to its qualities of protection against insect bites or its undesirable characteristics in the dissipation of heat. One- and two-piece herringbone twill fatigue suits were authorized for Army use to the exclusion of denim in February 1941.[26]

A member of the Quartermaster Corps Technical Subcommittee on Combat Winter Clothing tested Army items of winter clothing on an annual hunting trip of a party in the Maine woods in the fall of 1941, and submitted practical recommendations on the defects and good points of the articles tested.[27]

These examples serve to illustrate the uncoordinated approach to the study of combat clothing. As late as the latter part of 1941, an adequate research program had not come into being. Prior to this time, the development of clothing had been largely the responsibility of the Quartermaster Corps Technical Committee on Clothing and of the Quartermaster Corps School in Philadelphia, located in the Quartermaster Depot. Newly developed items of clothing, however, were submitted to the Infantry Board, and to other Service Boards, including the Medical Board, for field trials. The failure to develop better Army clothing in the period between the wars cannot be attributed entirely to lack of foresight or appreciation of the need for versatile combat uniforms. Great emphasis had been placed upon economy by Congress, and funds were not available to establish the research facilities or to train specialized personnel necessary for the required researches.

Medical interest in clothing was largely centered in the Training Division of the Office of The Surgeon General and at the Medical Field Service School at Carlisle Barracks, Pennsylvania. The trend of this interest, however, was focused upon the care of the wounded, and protective clothing for patients during evacuation from combat areas, rather than the prevention of disease and injury through the development of appropriate, flexible, well-designed uniforms based upon the physiologic characteristics of man operating in extremes of climate, and exposed to the hazards of insect vectors of disease. The greatest emphasis had been placed upon the development and testing of field equipment for the Medical Department in the Equipment Laboratory at the Medical Field Service School and in field maneuvers and unit exercises.

---

[26] Memo, TAG to QMG, 5 Apr 41, sub: Adoption of herringbone twill clothing. SG: 421.–1.

[27] Ltr, M. E. Barker, CWS Member QM Subcommittee, 8 Dec 41, sub: A study of the requirements of winter clothing. SG: 421.–1.

Development of Medical Research on Clothing

No agency within the Office of The Surgeon General was by directive assigned the responsibility for the study and development of clothing. Because of the role of clothing in the protection of the health of the soldier, this responsibility quite logically came to rest with the Preventive Medicine Service, and more specifically, the Sanitation Division. Under the direction of its chief, Col. William S. Stone, MC, clothing came to be considered a part of man's environment which might aid materially in the protection of his health or jeopardize his chances of survival.

Sanitary reports from the Panama Canal Department and other tropical areas motivated the chief of the Sanitation Division to call upon The Quartermaster General's Office to review the entire problem of adaptation of clothing to the physiologic requirements of the soldier.[28] Conferences resulting from this action brought the program under review. It was recommended that The Quartermaster General establish a research program fashioned after that of the Harvard Fatigue Laboratory, which had been studying physiology in relation to fatigue and the stresses of heat, cold, and altitude, under the direction of Dr. David Bruce Dill. The Harvard Fatigue Laboratory was requested to begin a series of tests of clothing as it influenced man's ability to function in extremes of climate. Pilot investigations already had been stimulated by The Surgeon General at this laboratory. Early in February 1941, the National Research Council approved support of investigations by this laboratory on "clothing, fatigue, and supplementary substances." [29] The director of the Harvard Fatigue Laboratory addressed a letter to the Chief, Supply Division, Office of The Quartermaster General, outlining the researches approved for the laboratory under Army auspices, and requested certain equipment and soldier personnel as subjects for the experiments. The request was supported by The Quartermaster General and in turn by The Surgeon General, in consequence of which The Adjutant General directed the action and authorized the Commanding General, First Corps Area, to give full cooperation in supplying equipment and subject personnel. This marked the beginning of physiologic researches on clothing, and a coordination of effort on this problem between The Quartermaster General and The Surgeon General.[30]

Simulated cold, hot dry, and hot moist climates were established in the laboratory in which treadmill and other tests were used to study the effects of clothing already adopted, and to determine the physiologic principles on which

---

[28] Gen Sanitary Rpt, Trinidad Base Comd, 31 May 41, with 2d ind, SG to TAG, 30 Jun 41, and 3d ind, TAG to CofEngrs and QMG, 23 Jul 41. SG: 721.1 (Trinidad) F.

[29] Ltrs, Chairman, Div Med Sciences NRC, to Dr. D. B. Dill, Harvard Fatigue Lab, 6 Feb 41 and 11 Feb 41. SG: 421.–1 (Uniforms).

[30] Ltr, Actg Dir, Harvard Fatigue Lab, to Chief Supply Div OQMG, 13 Mar 41, with 1st ind, QMG to TAG thru SG, 28 Mar 41, and 2d ind, SG to TAG, 28 Mar 41. SG: 421.–1 (Uniforms).

to base further development of fabrics and design. The first report upon the relation of clothing to fatigue from the Harvard Fatigue Laboratory was transmitted to The Surgeon General by the Chairman, Division of Medical Sciences, National Research Council, on 8 July 1941.[31] Eventually other laboratories, notably the John B. Pierce Laboratory of Hygiene at New Haven, Connecticut, and the physiology departments of various universities were brought into an extensive program of research and testing.

As an outgrowth of the conferences and researches already noted, it became obvious that sound studies on clothing could not be made without a comprehensive knowledge of climatic conditions in all parts of the world where military operations of American forces might be expected to take place. Knowledge of the climates of cold regions and dry and moist hot regions was limited. The chief of the Sanitation Division, Office of The Surgeon General, suggested these studies and vigorously supported their development. The Quartermaster General obtained the services of Dr. Paul A. Siple, meteorologist and geographer, who had accompanied the Byrd expedition to the Antarctic. Dr. Siple was commissioned in the Quartermaster Corps and made the director of a climatic research unit in the Special Forces Section and took an active part in the program for the study of clothing in relation to climates.[32]

Acting upon the recommendation of the chief of the Sanitation Division, plans were made for establishing a climatic research laboratory in which could be brought together the skills and knowledge of the physician, the physiologist, the textile expert, specialists in the design of clothing, and the meteorologist for the comprehensive and thorough scientific study of clothing. This culminated in the Climatic Research Laboratory at Lawrence, Massachusetts, which was housed in the plant of the Pacific Mills.[33] Three highly qualified medical officers were assigned for duty in this laboratory, one of whom had had experience in testing clothing in the Panama Canal Department, and the other two qualified in physiology or other research skills related to clothing and climatic studies. One of these officers, Lt. Col. (later Col.) John H. Talbott, MC, directed the medical phases of the research work at this laboratory and eventually was designated official representative of The Surgeon General as well as The Quartermaster General in tests conducted on clothing and equipment.[34]

While the National Research Council had been active in establishing research projects on clothing, this organization came to take a very much more active part in the scientific study of this difficult technical problem.

---

[31] Ltr, Dr. L. H. Weed, Div Med Sciences NRC, to SG, 8 Jul 41, with incl, sub: Preliminary report on experiments on soldiers and their clothing under different climatic conditions. SG: 421.–1 (Uniforms).

[32] See footnote 11, p. 35.

[33] Physiological testing. Textile Research 14: 222–227, July 1944.

[34] (1) Ltr, QMG to SG, 28 Aug 42, sub: Physiological and climatological research program of the QMC. SG: 421.–1 (Uniforms). (2) Semimonthly Rpt, Sanitation and Hygiene Div SGO, 16–31 Dec 44. HD.

The Surgeon General of the Navy early in June 1942 called to the attention of Dr. E. F. DuBois, Chairman of the Committee on Aviation Medicine, the unsatisfactory state of aviation clothing. This served as the basis for the creation of a subcommittee under the Committee on Aviation Medicine which had as its terms of reference the study of clothing for the aviator. The Subcommittee on Clothing was organized on 12 June 1942. Members of the subcommittee were Dr. L. H. Newburgh, Chairman, Dr. E. R. Schwartz, Dr. L. P. Herrington, and Dr. W. H. Forbes. The initial interest of the subcommittee was the development of lightweight functional flying uniforms for aviators, so constructed as to protect against cold, flexible enough for wear in the heat, and embodying protective features against fire and drowning. Development of satisfactory headgear, gloves, and shoes was also considered. An electrically heated aviator's suit had been developed by the Canadians, who also had produced a satisfactory helmet. The electrically heated suit, however, was heavy, and required too great a load on the electrical output of the plane to make it practical. A comprehensive research program on physiologic regulation of heat, characteristics of fabrics, design of the uniform, thermal insulation, flash protection from fire, and flotation garments was instituted. The initial meeting of the subcommittee brought together representatives of the Committee on Medical Research of the Office of Scientific Research and Development, the Committee on Aviation Medicine of the National Research Council, the Canadian Research Committee, the British Medical Research Council, the National Bureau of Standards, the National Institutes of Health, and the Textile Research Institute. Armed Forces' members included representatives from the Office of The Quartermaster General; the Materiel Laboratory, the Equipment Laboratory, and the Aero-Medical Center of Wright Field; and the Bureaus of Supplies and Accounts, Aeronautics, and Medicine and Surgery of the United States Navy.[35] Subsequently, there were representatives from the Office of The Surgeon General, the Air Surgeon's Office, and the Armored Force Medical Research Laboratory (later redesignated Armored Medical Research Laboratory) at Fort Knox, Kentucky, as well as liaison personnel from the Royal Air Force, the Rochester Desert Laboratory, the Harvard Fatigue Laboratory, the Textile Foundation, and others. Included in the makeup of the subcommittee and its liaison group were the many skills and sciences having a bearing upon the development of clothing. The subcommittee had been reorganized by the fourth meeting on 17 June 1943, and had brought into its membership Dr. Milton Harris, Dr. Sid Robinson, and Professor C. P. Yaglou. At the same time, its terms of reference were expanded to include consideration of the clothing problems of ship and ground forces, as well as air forces, and researches were initiated on hot weather

[35] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 17 Jun 42. HD: 040.

clothing, comfort at low temperatures, especially as related to electrically heated clothing, cooling characteristics of air, decontamination clothing and footwear, textile materials, and clothing as related to exposure to water.[36]

Because of the urgency of developing satisfactory clothing for operations in the jungle, a series of special meetings was held by the subcommittee to coordinate knowledge and findings on this problem and to push forward the research phases which were not then well developed. The studies initiated and coordinated by the subcommittee, together with the field and combat testing resulting from their findings, were responsible for major advances in adaptation of clothing to the physiologic needs of the soldier and for development of fabrics and design of uniforms which were durable and efficient for combat and, at the same time, contributed to the comfort, efficiency, and well-being of the soldier. Through its efforts, the science of clothing had been launched and was thoroughly established by the end of the war.

The results of the intensive studies guided by the subcommittee have been brought together in one volume by Dr. L. H. Newburgh and his associates under the title of "Physiology of Heat Regulation and the Science of Clothing."[37] Despite the depth and range of these far-reaching investigations, Newburgh and his collaborators repeatedly stressed the point that many phases of clothing in relation to man are not understood, and that there is a need for continued basic and applied research.

The Armored Force Medical Research Laboratory, initiated by the Preventive Medicine Service, the Surgeon General's Office, was established at Fort Knox, Kentucky, in September 1942 with the specific mission of conducting research on physiologic problems of practical significance to the Armored Force. Special attention was directed to the study of the soldier in relation to his duties. The aim of the laboratory was:[38]

> To obtain the basic data on selection and training of personnel and performance of equipment, from which conclusions may be drawn which will enable the individual soldier to perform his duties with maximum obtainable efficiency for the longest possible time, and to determine these limits imposed upon personnel so that they may be used to the best advantage by commanders and tacticians.

With this objective, the study of clothing in relation to the functioning soldier became of necessity an important part of the program.

While the Armored Medical Research Laboratory was not a testing organization, its researches nevertheless were largely applied, rather than basic. Its work, therefore, complemented rather than duplicated the studies of the Subcommittee on Clothing. After June 1942, close liaison was maintained with the laboratory staff of the British Fighting Vehicle Physiological Laboratory. In

---

[36] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 17 Jun 43. HD: 040.

[37] See footnote 1, p. 31.

[38] Historical Rpt, Armored Med Research Lab, 3 Oct 45. HD: 319.1–2.

the summer of 1942 temporary laboratory facilities were established at the Desert Training Center, Camp Young, California, for the study of the effects of dry heat on personnel operating in tanks.[39]

As the program of the Armored Medical Research Laboratory progressed, climatic studies were made which included the protective efficiency of cold weather clothing, the physiologic effects of cold, observations of men in controlled chambers simulating humid jungle heat, ranges of use of clothing for jungle operations, the effects of impregnated and impervious clothing upon the efficiency of personnel, environmental heat and humidity in relation to acclimatization, anthropometric measurements of groups of men in an effort to fit tanks to men and to develop their clothing and equipment for efficient use in tanks, tests of flame-proofed clothing, and the design and fit of army shoes. The findings in this laboratory greatly influenced the fabrics and designs for clothing ultimately developed, especially for hot weather operations.

The impregnation of clothing for protection against vesicant gases, fire, and insects necessitated the use of chemicals which to accomplish their primary purpose also had to be nonirritating and nontoxic to the wearer. Testing for toxicity and allergic manifestations therefore became an important part of the development of special types of protective clothing. In the early phases of the program, much of the testing was done by the Medical Division of the Chemical Warfare Service Laboratory, Edgewood Arsenal, Maryland. Subsequently, the Army Industrial Hygiene Laboratory assumed the responsibility for this phase of the work on clothing.[40] While this laboratory came into operation late in the war, it carried out many thousands of tests on the skin toxicity of various materials treated with waterproofing, fireproofing, and fungicidal agents. Additionally, a safety shoe program and various types of protective clothing used in Army-owned or Army-operated industrial plants were subjects of study at this laboratory.

Both the Armored Medical Research Laboratory and the Army Industrial Hygiene Laboratory were initiated by and came directly under the control and guidance of the Preventive Medicine Service, Office of The Surgeon General. Specifically, their functions were the responsibility of the Division of Occupational Health and Industrial Medicine.

The primary responsibility for the development and production of clothing of all types rested with the Office of The Quartermaster General. Failure to appreciate fully the medical aspects of clothing and the necessity for the adaptation of clothing to the physiologic needs of man under a variety of stress circumstances, before and during the early phases of the war, was responsible for the loose organization and integration of the research and testing agencies previously discussed. Because of the sequence of their establishment, there

[39] Ibid.

[40] Rpt, Army Industrial Hygiene Lab SGO, 17 May 45, sub: Toxicity of tropic-proofed equipment. HD: 422.3 Protective Clothing.

was considerable overlap of function and lack of coordination of purpose. Some duplication of effort was inevitable throughout the program, but by the end of 1942 there was a general understanding of the role each had to play and a mutually accepted division of responsibility. The roster of attendance at meetings of the Subcommittee on Clothing was proof of the interest in integration of effort in the development of military clothing. Further, these combined efforts extended to the research facilities of American Allies, the Canadians and the British.

Field Testing. As the program developed, field testing became an increasingly important practical necessity before adoption of clothing items. Extensive tests were carried on by the Quartermaster Board at Camp Lee, Virginia; representatives of the Medical Department frequently served as observers and participants. Testing of jungle clothing was done in the Panama Canal Department, in Florida, and in the Pacific theaters. Similarly, winter and arctic-type clothing were tested in the Rocky Mountain area by organizations operating in the northern part of the United States, in Alaska, and in Canada. Durability as a military characteristic of clothing was tested on the Quartermaster Board combat course and shoe test track, but combat testing required the concurrence of the Army Ground Forces.

In the early phases of the war, the Office of The Quartermaster General worked on the theory that combat clothing needs could best be met by development of a series of special types of clothing to meet a variety of combat requirements. As the war progressed this point of view changed. The principal objective became the development of the fewest possible items with the greatest possible flexibility to reduce the number of special clothing units to the minimum.[41] Field testing in theaters involved sending teams of qualified Quartermaster Corps clothing experts to observe the use of clothing items by soldiers under as many conditions as possible. These teams went to great lengths to sample soldier opinion as to desirability and utility of individual clothing items and equipment. Further development often was decidedly influenced by the results of these surveys. While this fair and impartial practice produced a wealth of practical information, the results often appeared to have more influence on change of policy and clothing development than they merited. This defect emphasizes the need for greater training of the soldier in what he may expect from clothing and especially the efficient use of clothing assemblies for protection of his health in extremes of climate.

Medical Problems Associated with Clothing in World War II

On that part of the chronicle of clothing which follows, no effort will be made to detail one by one the failures and successes incurred in providing satisfactory military clothing. Neither will detailed theater experiences be

[41] See footnote 11, p. 35.

recorded, but rather examples will be given to illustrate pertinent problems involving principles, major developments, and significant trends. Review of the source material has dictated the advisability of considering the subject on the basis of climatic extreme and special problems. If the reader fails to detect sufficient reference to the tedious negotiations, the slow progress, and the frustrations that often accompany the development of new programs in the military forces, it is not because they may not have existed, but rather that the author feels that they are not apropos to the purpose of this history and would add unnecessary detail to an already over-long story.

CLOTHING FOR HOT CLIMATES

Relation of Clothing to Heat Regulation, Comfort, and Efficiency

Clothing is a thermal barrier. In hot climates, it interferes with efficient dissipation of body heat under most circumstances. The initial impetus in embracing this concept provided by the Office of The Surgeon General was soon reinforced from other sources. A study on protective clothing was begun in the fall of 1941 at the United States Department of Agriculture Laboratory at Orlando, Florida, at the request of The Surgeon General.[42] Tests of several fabrics for bite resistance to mosquitoes were carried out in 1943 as a part of the jungle clothing program of the Subcommittee on Clothing. *Aedes taeniorhynchus*, *A. aegypti*, and *Anopheles quadrimaculatus* mosquitoes were used. It was found that Byrd-cloth offered the best protection, followed by poplin and Army twill. Nylon, British cellular-weave, and herringbone twill were unsatisfactory. Thse findings had a great bearing upon the work which had already been initiated to improve adaptation of the uniform for hot climates.[43] Eventually, field tests of developmental uniforms were established. Field tests in the jungle in Panama under simulated day and night combat conditions demonstrated the protection to be had from the tightly woven fabrics, such as Byrd-cloth.[44] Even more important were the observations in the Everglades of Florida [45] and a provisional test in the Southwest Pacific area which corroborated the effectiveness and utility of the lightweight, tightly woven fabrics and established the criteria for adoption of the World War II jungle uniform.[46]

---

[42] Man and Animal Document No. 5174, Mar 1942. USDA Bureau of Entomology and Plant Quarantine.

[43] Minutes of 7th Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 15 Dec 43. HD: 040.

[44] Rpts, Maj C. H. Kearny, Inf, Mobile Force, Panama Dept, 1944. SG: 426.–1.

[45] Minutes of 4th Meeting on Jungle Clothing, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 6 Oct 43. HD: 040.

[46] (1) ETMD, Caribbean Def Comd, Mar 1944. HD: 350.5. (2) QMG Rpt, Mosquito proofing the jungle soldier. SG: 725.11 (1945).

346336 O—55——5

Great interest in improving the jungle uniform is evidenced by the following radio from General MacArthur:[47]

> For jungle warfare, British grenfell, or material equivalent weight, found best on provisional test because they are lighter, wet or dry, easier to launder in the field, and absorb less water or sweat. Herringbone twill absorbs large quantity of moisture which fatigues wearer, and is very uncomfortable. Advise durability test light material for possible ultimate adoption in the field.

It was determined that the desirable properties of jungle clothing should be:[48]

> (a) Minimum resistance to heat loss,
> (b) Maximum resistance to mosquitoes,
> (c) Maximum resistance to other insects,
> (d) Camouflage,
> (e) Abrasion protection,
> (f) Durability,
> (g) Flexibility (that is, it should be possible to open or remove parts during the day when the mosquitoes are not present), and possibly,
> (h) Minimum weight when wet.

Tightly woven fabrics were found to give the best protection against mosquitoes and on the basis of subjective comment, it was observed that the lightweight fabrics, although tightly woven, were preferred for comfort as well as their light weight when wet.

The Armored Medical Research Laboratory set up projects, in conjunction with programs as directed by Office of Scientific Research and Development, to determine the relative physiologic load imposed by various types of clothing upon acclimatized men working in simulated jungle environment and concluded that:[49]

> a. Acclimatized men work with greatest effectiveness and comfort and least burden upon their heat regulating, cardiovascular and sweat mechanisms and have the lowest water requirements when unclothed (wearing only shorts, socks and shoes).
>
> b. Any garment covering a major portion of the body adds a definite and measurable burden which is manifested by marked increases in heart rate; rectal temperature and sweat loss, and by subjective sensations ranging from moderate to extreme discomfort.
>
> c. In order of magnitude of the added load and the undesirable effects produced, the tested garments or ensembles are as follows: (1) British *fireproof overalls, tank crews, one-piece* manufactured by T. Ravden and Sons, Ltd., 1942. (2) U. S. Army *Suit, one-piece, herringbone twill, protective* modified with overlapping flaps; *union suit, cotton, protective two-piece; socks, wool, light, protective; hood, wool, O. D., protective* and *gloves, cotton, protective*, (Leggings *canvas, M1938, O. D., dismounted, protective*, and *gas mask* not worn). (3) U. S. Army fatigue coveralls, *Suit, one-piece, herringbone twill*, made fire-resistant at M. I. T. by C. W. S. process of impregnation with 22% antimony oxide and 12% Vinylite VYHH resin. (4) U. S. Army *Suit, one-piece, herringbone twill*,

---

[47] Quoted in report cited as footnote 46 (2), p. 51.

[48] See footnote 45, p. 51.

[49] Rpt, Armored Med Research Lab, 1942–46, Project 2, sub: Operation at high temperatures, p. 1. AFML.

unlaundered. (5) U. S. Army *Suit, one-piece, herringbone twill*, worn 2–6 months and laundered repeatedly. (6) U. S. Army *Shorts, Cotton*.

d. When items (3), (4), and (5) above, are wetted with unevaporated sweat the differences between them become insignificant.

Accordingly, the laboratory recommended: [50]

(a) That all clothing to be issued for jungle operations be tested on standardized test subjects before acceptance, to determine the physiological burden which is imposed upon the wearer.

(b) That all jungle clothing (wool excluded) be thoroughly laundered before use in hot humid environments.

(c) When the military situation permits, and when there are no hazards from fauna, flora or solar radiation, men in hot humid climates be permitted to work in minimum amount of clothing.

Further studies in the Physiology Department at Indiana University quantitatively demonstrated that,[51]

Coolness of clothing is directly related to the thinness of the fabric (not to fabric weight); inversely related to weight of suit; inversely to the amount of water required to saturate the suit or to the time required to dry the saturated suit, and directly to the amount of ventilation by openings. The coolness of any design is directly related to the percent of skin surface exposed. The coolness is not related to the permeability of the fabric to air under pressure, for low rates of air movement (¼ mph); for 1 to 2 mph a small effect was seen.

Thus porosity of clothing came to be regarded as of little importance so long as the fabric was permeable to water vapor. It was also determined that impregnation of lightweight, tightly woven fabrics with insect repellents, insecticides, and protective agents against vesicant gases or fire had little or no effect on the comfort and effectiveness of uniforms made from these materials.

The results of these researches and field tests justified the conclusion that thin, tightly woven fabrics were best for the jungle uniform. Nylon and Byrd-cloth appeared to give the best physiologic results which, however, were almost equaled by poplin and Army twill. The insect type of bite resistance of the nylon fabric tested was unsatisfactory. Production of poplin and twill in quantities was practical, whereas Byrd-cloth and nylon would have required additional industrial facilities. For this reason, poplin and twill were adopted for further severe testing under jungle combat conditions.

This recommendation, based almost entirely upon the physiologic and health protective characteristics of clothing, was accepted by The Quartermaster General. The Quartermaster Board conducted severe tests on its combat course and indorsed the feasibility of a jungle combat uniform made as a two-piece suit: jacket of 5-ounce poplin, and trousers of 8.2-ounce cotton uniform twill.

---

[50] Ibid.

[51] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Avalation Medicine, 6 May 44. NRC Med Records Sec.

Combat testing was initiated by The Quartermaster General in the spring of 1944. Extensive tests were carried out in the Southwest Pacific area, the China-Burma-India theater, and the Central Pacific area. The Surgeon General opposed this action on the basis that the uniform was urgently needed for the prevention of malaria and was suitable for this purpose. It was a command decision that combat testing should be carried out, following which The Surgeon General contributed full support.[52] The Commanding General, Army Service Forces, authorized the tests and subsequent reports from the theaters concerned indorsed with few modifications the tropical combat uniform thus developed.[53]

Dr. Sid Robinson, a member of the Subcommittee on Clothing, after an extensive field study in the China-Burma-India theater made the following report on 24 October 1945:[54]

> The design of the U. S. tropical combat uniform in its latest model is probably not perfect, but there are no major modifications necessary. Particularly advantageous design features are the shirt which can be worn with the tail in or outside the pants. . . . Other properties of clothing which are important to the combat soldier are the ease with which it can be kept clean, rapid drying, smoothness on the skin, and warmth at night when he has to sleep without shelter. Experiments and field tests have shown that the lightweight, smooth fabrics (Byrd-cloth, poplin, and Oxford cloth) are all definitely superior in the first three of these properties.

Difficulties in the adaptation of the uniform for use in a combat theater are illustrated by a report of the observations in the South Pacific by Lt. Col. (later Col.) David Bruce Dill, MC:[55]

> In rear areas the 6-oz. khaki shirt and 8.2-oz. trousers are usually worn, with no undershirt by about half of the men. The rest wear the dark herringbone twill, with no jacket, and no undershirt, acquiring a beautiful tan. The trousers are often cut off to make shorts. The fighting Infantry wear HBT—all of it, day and night. It is impregnated with dimethyl phthalate against the mite. The suggested new tropical uniform was tested on Bougainville, Biak, and Leyte, and was approved by the men wearing it. The reasons for approval were not altogether expected. Mosquitoes were not a consideration, for insect bites were not numerous, and the men have insect repellent. The tight woven uniforms were distinctly cooler. The weight was favorable, ¾ that of HBT. Ease of washing and the fact that dirt does not penetrate so readily, were important in the soldiers' minds.

---

[52] Memo, SG for CG ASF, 5 Jun 44, sub: New tropical combat uniform, with 1st ind, CG ASF to SG, 10 Jun 44. HD: 422.3 Protective Clothing.

[53] (1) Ltrs, QMG to CGs SWPA and CBI, 1 Jul 44, and to CG CPA, 17 Jul 44, sub: Tests of jungle combat clothing. SG: 421 Boots. (2) In the Pacific Ocean areas, the uniforms were issued to soldiers functioning in combat and later, by questionnaires and interviews, the combat adaptability and efficiency of the uniform was determined as well as the likes and dislikes of the soldiers and their criticisms concerning this uniform. It was recommended that a uniform of 5-ounce poplin made from the design of the experimental jacket and trousers, combat, tropical, with certain modifications resulting from the tests be standardized immediately and put into quantity production as expeditiously as possible. *In* Ltr, Surg POA to SG, 4 Mar 45, sub: Tests of jungle combat clothing. SG: 421.

[54] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 24 Oct 45. HD: 040.

[55] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 26 Jan 45. HD: 040.

Studies on clothing for hot dry climates did not produce such concrete results. Adolph [56] reported no differences in rates of evaporation of sweat from men in hot dry environment wearing various types of light clothing. Solar radiation was the important factor. Protective clothing, even though it be only a thin white garment, was found to reduce materially the effects of solar radiation, and clothing was advantageous in hot sunshine only when the degree of work was moderate. The principle was established that lightweight uniforms so constructed as to facilitate free ventilation were best adapted for desert use. Color was an important factor and, ideally, white would be desirable. The deeper shades, best for camouflage purposes, absorbed heat, added to the heat load of the soldier, and thus more readily exposed him to the danger of heat exhaustion. Differences of opinion existed as to the advisability of special headgear for desert wear. The consensus was that a loosely fitted helmet which allowed free circulation of air provided the best protection.[57] Likewise, footgear with porous uppers facilitated heat loss. Traumatism from thorns of cacti and other desert plants was an important factor. It was necessary that clothing be sturdy enough to reduce injury from these sources to a minimum. Adolph,[58] towards the end of the war, summarized the status of clothing and the understanding of acclimatization of men to hot dry climates by noting that knowledge of these subjects was limited and that further long-continued studies of climate, physiologic reactions of men to heat, and fabrics and design of clothing would be necessary.

In summary, men are more comfortable when wearing uniforms made of thin, tightly woven fabrics, so designed as to facilitate ventilation in the moist tropics. During activity, work, or combat, the greatest working efficiency goes with the fewest clothes. In hot dry climates, working efficiency at moderate degrees of activity is highest when lightweight clothing, preferably light in color, is worn. Clothing appears to have little relation to acclimatization. Heat exhaustion is the end point of stress to heat. Susceptibility to heat exhaustion in general is greater when clothing is worn; design, color, and weight of fabrics are important factors in its prevention.

Clothing and Vectors of Disease

Clothing remained the first line of defense against the biting of adult mosquitoes during World War II despite the development of efficient repellents and powerful insecticides. The Office of The Surgeon General and malariologists in the field consistently stressed the importance of developing mosquito-proof uniform fabrics. Following studies in the China-Burma-India theater,

[56] Adolph, E. F.: Desert. *In* Newburgh, L. H., ed., op. cit., pp. 330–338.
[57] Ltr, SG to QMG, 6 Mar 43, sub: Sun helmets. HD: 422.3 Protective Clothing.
[58] See footnote 56.

a representative of the Subcommittee on Clothing of the National Research Council reported: [59]

> Protection against mosquitoes is a property of clothing which all malariologists with whom I talked in military establishments and civilian laboratories and other medical authorities in Delhi, Calcutta, Rangoon, Colombo, Kandy and Bombay, agreed should be provided for military personnel in malaria zones.

Before the war, considerable study had been given to the development of efficient head nets, mosquito gloves, and bed nets. Because the bed nets and head nets were of small mesh, interfered with air movement, and therefore were uncomfortable, it was difficult to obtain the cooperation of the soldier in using them.[60] The development of repellents greatly reduced the need for head nets and even for bed nets and netted hammocks for field use, also mosquito gloves. Repellents functioned satisfactorily in tests on head nets up to ¼-inch mesh construction, which would have resulted in greater visibility, improved ventilation, and marked savings in materials and production costs. The ¼-inch mesh head net was never issued, however, since its effectiveness depended upon re-treatment every few days. With the development of satisfactory repellents, an effort was made to improve the insectproofness of the uniform by impregnation. Experimentally, it was possible to provide effective repellency for periods up to 1 week.[61] Impregnation produced no significant difference in heat exchange through the fabric.[62] The method, however, was never used on a large scale against mosquitoes in the field. Reliance was placed upon use of repellents on the skin of exposed parts of the body and at clothing openings. In practice the duration of effectiveness of repellents was found to be short, 4 to 6 hours, and was materially reduced by exposure to wet during rains and stream crossings.

Research on insect repellents and insecticides carried out during the first months of the war came to have a significant bearing on the role of clothing in the protection of the health of the American soldier. In training areas in the United States, mites, or common "chiggers," caused much discomfort and disability secondary to infections at the site of bites. In the summer of 1941 The Surgeon General requested the Orlando laboratory of the United States Department of Agriculture to study means and methods for controlling mites by repellents or insecticides, or a combination of both. This work led to the consideration of other insects and resulted in the development of dimethyl phthalate, Indalone, Rutgers 612, and later dibutylphthalate. Madden, Lindquist, and Knipling of the Orlando laboratory successfully demonstrated the protective value of dimethylphthalate and Indalone for troops in the Louisiana

---

[59] See footnot 54, p. 54.

[60] Annual Rpt, Surg Panama Canal Dept, 1942. HD.

[61] See footnote 43, p. 51.

[62] (1) Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 10 Mar 44. HD: 040. (2) See footnote 51, p. 53.

maneuvers in 1942. In 1943 these results were corroborated by an Australian medical officer, Capt. R. N. McCulloch, MC, who used dimethylphthalate and Indalone against New Guinea species of mites. McCulloch demonstrated that dimethylphthalate and dibutylphthalate also were actually effective miticides.[63]

Extensive tests in New Guinea and in the Far East showed that clothing impregnated with dimethylphthalate or dibutylphthalate was a potent weapon in the control of scrub typhus.[64] The urgent need for the protection of troops against this disease hastened the development of practical improvised field methods of impregnation, but not without opposition.[65] It was claimed that the GI soap used as an emulsifying agent in the process was conducive to fungus infections.[66] One precaution was noted; nonimpregnated shorts were to be worn to prevent irritation of the scrotum.[67] No primary irritation of the skin was found to result from wearing impregnated clothing and the impregnates did not aggravate fungus infections of the skin.[68] Later, a concentrate embodying an emulsifying agent (Triton–X–100, Tween 20, Span 20) simplified the field impregnation of clothing with miticides. Subsequently, benzyl benzoate was used as a miticide because of its easy availability and the short supply of some of the chemicals required to produce dimethylphthalate.[69]

The impregnates were lost from the clothing through successive launderings. Dibutylphthalate and benzyl benzoate appeared to withstand the greatest number of launderings and were favored for that reason. Field tests on benzyl benzoate showed that it could be carried through five launderings, but dibutylphthalate gave longer sustained protection. For practical purposes, however, it was recommended that reimpregnation be carried out after each laundering.[70]

In the early phases of the war, there was neither vaccine nor an effective lousicide for the prevention of epidemic typhus fever. In view of the historic wartime havoc from this disease, The Surgeon General instituted a search for improved methods of destroying lice. Tests of fumigation gases, such as chloropicrin, eventually resulted in the adoption of methyl bromide for both individual and mass delousing of clothing. Considerable question arose as to the

---

[63] (1) Bushland, R. C: Tests against chiggers in New Guinea to develop a practical field method for impregnating uniforms with dimethylphthalate for scrub typhus prevention. Am. J. Hyg. 43: 218–229, May 1946. (2) Rpt, Capt R. N. McCulloch, 3d Australian Mob Ent Sec, 10 Oct 43, sub: Trombiculid mite control. HD: 710 Typhus (Rpts).

[64] Ltr, Dr. F. G. Blake, Dir USA Typhus Commission, to CG USASOS, 11 Dec 43, sub: Scrub typhus in New Guinea—preliminary report and recommendations. HD: 710 Typhus (Rpts).

[65] Rpt, Brig Gen G. B. Denit, Chief Surg USASOS, sub: Mite protection of military personnel by simple clothing treatment. HD: 710 Typhus (Rpts).

[66] Ltr, Lt Col C. B. Philip, SnC, to Surg USAFFE, 5 Aug 44, sub: Scrub typhus on Owi and Biak Islands. HD: 710 Typhus (Rpts).

[67] Ltr, Maj R. R. Kierland, MC, to Surg Base F SWPA, 31 Jul 44, sub: Investigation of clothing impregnated with dimethylphthalate in an emulsion of G. I. soap. HD: 710 Typhus (Rpts).

[68] Ltr, SG to Chief Surg USASOS, 6 Sep 44, sub: The effect on the skin of clothing impregnated with soap—dimethylphthalate. HD: 710 Typhus (Rpts).

[69] Semimonthly Rpt, Prev Med Serv SGO, 16–31 Mar 45. HD.

[70] Ltr, Capt R. C. Bushland, SnC, USA Typhus Commission, to Brig Gen S. Bayne-Jones, USA Typhus Commission, 22 Mar 45, sub: Field tests on clothing treatment. HD: 710 Typhus Reports.

possibility of toxic effects from clothing treated by methyl bromide, but were not substantiated.

Concurrently, the search for a more practical individual method produced MYL powder. The Orlando laboratory conducted tests with MYL powder on Negro volunteers. Underwear impregnated with this powder remained lousicidal for periods up to 150 days.[71] Prior to the development of DDT, MYL dusted into the clothing and on the underwear was widely used by United States Forces in North Africa.

The researches on DDT began in the fall of 1942. It was soon apparent that an insecticide of wide range and multiple usages had been discovered. Tests at the Orlando laboratory demonstrated its effectiveness against lice when dusted into clothing. Its role in mass delousing was conclusively proved in the Naples typhus epidemic. Clothing thus dusted was shown to be lousicidal for periods of a month or longer provided it was not laundered. So effective was the method for mass delousing that Quartermaster Corps fumigation and bath companies were reequipped with hand and power dusters for use with American troops if necessary, but pointed primarily at the prevention of typhus fever by delousing prisoners of war, refugees, displaced persons, and populations of liberated or occupied territories.[72]

Efforts were made to impregnate clothing with DDT. It was found that the impregnation of underwear was sufficient. A practical field test was attempted in December 1943 when DDT-impregnated underwear was forwarded to the North African theater where it was issued to selected companies of French Goums. The test could not be followed to its ultimate conclusion because of movement of personnel and loss in supply channels of some of the underwear, but it was noted that the troops observed were still free from lice at the onset of warm weather. It was concluded that the DDT-impregnated underwear had been responsible for drastically reducing the louse infestation of persons who normally are constantly infested with lice.[73]

Experimental work continued under the auspices of the Preventive Medicine Service, Office of The Surgeon General. It was announced on 31 May 1944 that impregnation of underwear was a practical procedure and that an emulsion had been found which retained its effectiveness against lice after the clothing had been laundered 8 times over a period of 2 months.[74] The DDT emulsion concentrate for impregnation consisted of DDT, 25 percent; Triton X–100, 10 percent; and Xylene, 65 percent.[75] By dilution with water, any strength of

---

[71] Knipling, E. F.: Insect control investigation of the Orlando, Fla., laboratory during World War II. *In* Annual Report of the Smithsonian Institute, Washington, Government Printing Office, 1948, pp. 331–348.

[72] ETMD, ETO, Jun 1944. HD: 350.05.

[73] Ltr, Surg NATO to SG, 1 Jul 44, sub: Testing of DDT impregnated underwear. SG: 421 Boots.

[74] Speech by Lt Col A. L. Ahnfeldt, SGO, at press luncheon, Hotel Pennsylvania, New York, under auspices of Geigy Company, Inc., 31 May 44. HD: 700.7.

[75] Semimonthly Rpt, Sanitation and Hygiene Div SGO, 16–30 Sep 44. HD.

DDT desired could be prepared. In practice, 1 part of concentrate to 11 parts of water was found desirable and gave a DDT-dosage of slightly over 2 percent of the dry weight of the garment. Underwear impregnated with this material was worn in field tests and found to retain its lousicidal effect for periods of 1 to 4 months without toxic effects or skin irritation. There was some danger to personnel handling fuel or lubricating oils while wearing clothing impregnated with DDT. The practical hazard was incurred when oil which was spilled on the clothing would dissolve the DDT and might be absorbed through the skin.[76] The critical supply situation for Triton X–100 necessitated the use of other emulsifiers. Span 20 and Tween 20 proved to be the equal of Triton in fresh water, and better as an emulsifying agent in salt water.

Appropriate clothing acted as a barrier against the cercariae causing schistosomiasis. The summary of a report of the 5th Malaria Survey Detachment and Medical Research Unit is representative of the experimental work done.[77]

(a) Cercariae of *Schistosoma japonicum* did not penetrate O. D. woolen trouser material within 2 hours in any of a large series of experiments both when the cloth was tested untreated and impregnated with either emulsified dimethyl phthalate, dibutyl phthalate, or benzyl benzoate. No cercariae passed through untreated Byrd-cloth. Uniformly, untreated old suntan and fatigue trouser material allowed more cercariae to penetrate.

(b) In rigorous washing tests clothing impregnated with dibutyl phthalate was most resistant to penetration by cercariae.

(c) In continuous water immersion tests, benzyl benzoate impregnation prevented penetration one day longer than dimethyl or dibutyl phthalate.

(d) Woolen sock material did not prevent the passage of cercariae even when impregnated.

Practical considerations dictated that schistosomiasis control was best obtained by remaining away from infested water. For engineers, signalmen, and others required to work in water at times, waterproofed clothing and boots were desirable but not always practical. By the end of the war no effective impregnating agent for clothing had been discovered and attention had been turned to research on cercariacidal agents and snail control.[78]

Leeches were prevalent in the jungles of the Pacific and Far Eastern areas. It was necessary to wear trousers inside combat boots to prevent ingress of leeches through upper shoelace eyelets or around tops of the boots.

---

[76] TB MED 194, 17 Aug 45.

[77] Ltr, 5th Malaria Surv Det and Med Research Unit AFWESPAC to SG, 16 Jul 45, sub: In vitro experiments on the penetration of cercariae through untreated and impregnated cloths. SG: 421.

[78] (1) McMullen, D. B., and Graham, O. H.: The control of schistosomiasis japonica II. Studies on the control of *Oncomelania quadrasi*, the molluscan intermediate host of *Schistosoma japonicum* in the Philippine Islands. Am. J. Hyg. 45: 274–293, May 1947. (2) McMullen, D. B., and Ingalls, J. W.: The control of schistosomiasis japonica IV. The effect of various chemicals on cercariae of *Schistosoma japonicum*. Am. J. Hyg. 45: 294–298. (3) Army Epidemiological Board: Collected Reprints. Washington, Government Printing Office, vol. IV, 1946; vol. V, 1947.

The Quartermaster General was placed under considerable pressure to develop a tropical uniform consisting of shorts and shirts with short sleeves. A precedent had been set by the British who had used uniforms of this type in their tropical stations for a number of years. The Army Air Forces were foremost in pressing for the adoption of such a uniform as "special items over and above minimum issue of long sleeved and long trousered cotton uniforms." [79] In response to a request for the procurement of 800,000 of these uniforms, the Air Corps was required to substantiate the need. The Surgeon General considered that such a uniform was not necessary; it exposed the soldier to the hazard of mosquito bites and, for the infantrymen, materially increased the incidence of skin trauma and infections. An indorsement to this correspondence quite clearly states his position: [80]

1. The policy of this office on the issue of short sleeved shirts and short pants as items of equipment for troops has been there is no objection to the issue of this type of equipment provided it is in addition to the standard clothing issued to troops in the field. However, it must be pointed out that the short pants and short sleeved shirts if issued should be authorized only for wear in daylight hours because of the danger of contracting malaria in most tropical stations when protective clothing is not worn after dark. In addition, there will be a great increase in the number of skin infections, and traumatic skin lesions, as well as lesions due to leeches and other noxious parasites.

2. The British Army is abandoning the use of short pants and short sleeved shirts for most theaters of operation. In those theaters where this clothing is authorized there are strict orders that it must not be worn after sunset or before sunrise in the morning. . . .

3. In the Malayan and Burma campaigns from 50%-90% of the English troops engaged contracted malaria. The type of clothing and equipment possessed by a large proportion of these troops consisted of short pants and short sleeved shirts. Due to the high incidence of malaria, orders were issued during the campaign to discontinue the wearing of this type of equipment, but due to the shortage of supplies it was impossible to comply. Medical authorities assigned to these forces considered the high incidence of malaria to be blameable to a large extent upon the nonprotective type of clothing possessed by the troops.

4. The only advantage that can be claimed for the short sleeved shirts and short pants is the coolness of this type of equipment and the ability of the wearer to withstand high temperatures as compared with wearing the conventional long sleeved shirts and long-legged trousers. That there is considerable erroneous information in this respect is evidenced by investigations recently completed under the auspices of the Committee on Medical Research of the Office of Scientific Research and Development by the Harvard Fatigue Laboratory. . . . "Results of these experiments indicate that the standard summer outfit of 8.2-ounce cotton shirt and ankle length trousers does not limit to any important degree the capacity for elimination of body heat. Such an outfit is well adapted for use of troops since it is durable and affords necessary protection from sun, wind, insects and possible chilly nights. Small but measurable increases in coolness may be obtained by omitting the undershirt, opening the neck of the shirt, and rolling sleeves and pants legs."

---

[79] Memo, CG AAF for CG SOS, 6 Oct 42, sub: Uniform for wear in tropic and semi-tropic climate. HD: 421.–1 (Uniforms).

[80] Ltr, CG AAF to QMG, 17 Oct 42, sub: Procurement of tropical clothing. SG: 421.–1 (Uniforms)

5. It is therefore recommended that the short pants and short sleeved shirts not be issued to troops unless they are issued as additional items of equipment, and restrictions are placed on their use so that these items of clothing are not worn after sunset or before sunrise in any malarious area.

Shorts were never an item of issue by the quartermaster. Several theaters permitted local purchase of shorts and shirts with short sleeves. In these theaters, the wearing of shorts was permitted between sunrise and sunset. An additional problem of discipline, training, and inspection was thus created and undoubtedly was a factor in the prevalence of malaria.

A consensus of theater reaction to the question of shorts is expressed in the report of the Air Surgeon after an extended tour of forces located in malarious areas: [81]

Standing orders in malarious areas prescribe long-sleeved shirts and long trousers for all American military personnel. The same is true in the Australian Army. The reasons are summarized in the following statement of the Combined Advisory Committee on Tropical Medicine, Hygiene and Sanitation: "In the opinion of the Committee, it is essential, not only for malaria protection, but also for protection against other diseases, such as dengue fever and scrub typhus, and against skin injuries, insect bites, septic sores, tropical ulcers and blast burns that long-sleeved shirts and slacks be worn on all occasions." There have been complaints of heat rash ascribed to the wearing of such garments.

As a result of their experiences in New Guinea, the Australian Army authorities prohibited the wearing of shorts, day or night.[82]

Clothing and Skin Diseases

Clothing in relation to skin diseases was an unsolved problem. It was the experience in all theaters located in hot climates that skin diseases were an important cause of disability and loss of time. Dr. Sid Robinson, after spending 5 weeks in India, Burma, and Ceylon, reported that: [83]

The most difficult and most prevalent problem confronting the ground forces in Burma and India is skin trouble. Beginning with prickly heat as the most universal disturbance, a long list of troubles could be listed including tropical sores, ringworm, blisters, toe rot, athlete's foot, scabies, dhobie itch, etc. Infections of the feet and legs, jungle or tropical sores being quite common, were the most disabling skin infections of the front line troops in Burma. . . . All medical and operational personnel in the theater recognize skin trouble to be a major problem.

This was borne out by the experience in other theaters in the tropics, notably the Southwest Pacific area.[84] Skin diseases as influenced by clothing appeared

---

[81] Rpt, Inspection Trip SWPA, [Mar 1943] Brig Gen D. Grant, Air Surg. HD: 333.

[83] Tidy, Henry L., and Kutschbach, J. M. Browne: Inter-Allied Conferences on War Medicine. London, Staples Press Limited, 1945, p. 88–100.

[82] See footnote 54, p. 54.

[84] (1) Skin diseases in the tropics. Bull. U. S. Army M. Dept., No. 80: Sep 1944. (2) Clark, T. W.: Treatment of skin diseases in the tropics. Bull. U. S. Army M. Dept., No. 87: 70–76, Apr 1945. (3) Dermatological problems in tropical theaters. Bull. U. S. Army M. Dept. 4: 299–300, Sep 1945. (4) Epstein, E.: The lichen planus - eczematoid dermatitis complex of the Southwest Pacific, a study of 65 cases. Bull. U. S. Army M. Dept. 4: 687–694, Dec. 1945.

under three main considerations: footgear and trichophytosis; the wearing of the uniform to prevent insect bites, scratches, abrasions, and cuts which, when they occurred, often became secondarily infected; and miliaria, or prickly heat, which may have been made worse by clothing covering the major portions of the body. So many variables influenced the prevalence of dermatophytosis that it was impossible to define the precise role of clothing. The experience of the war established that type of footgear was an important consideration, and especially incriminated the combat boot.[85] The protection afforded by clothing against skin trauma is a part of many records. In the Middle East, annual admission rates per 1,000 for miliaria for the months July, August, and September 1944, were 4.88, 5.39, and 9.05 respectively, and in the China-Burma-India theater, 2.47, 3.16, and 2.09 during the same months. Rates for cases severe enough to affect efficiency but not made of record will never be known, but undoubtedly were high. Dr. Robinson noted the prevalence of prickly heat in the Pacific theater and pointed out that the University of Queensland, Australia, had sponsored the organization of a research team for work on the fundamental aspects of skin physiology. He recommended the initiation of research on the same problem by American scientists.

Footgear

The leather combat boot of World War II was not satisfactory for jungle operations. In addition to its probable role in trichophytosis, it did not stand up well under use in the wet jungles. The Surgeon General encouraged development of special footwear for the tropics which would combine protection against biting insects, ventilation of the feet, and comfort. The Quartermaster General developed a rubber-soled boot with permeable duck-fabric upper and stitched tongue that was impermeable to mud, insect bites, and leeches, but at the same time provided ventilation. A removable fabric insole was a feature of the boot, and when worn with a cushion-soled sock, sweat from the feet was dissipated by evaporation.[86] The feet dried more rapidly whether wet by perspiration or water. The leather service shoe, on the other hand, was found by the Armored Medical Research Laboratory to permit dissipation of only a relatively small amount of foot moisture to the exterior.[87]

The advisability of developing a mosquito boot for the protection of the American soldier against malaria was considered by The Surgeon General and discarded as impractical and unnecessary, a decision that proved to be sound as the tropical uniform and insect repellents came into use. The need for this

---

[85] (1) Quarterly Rpt, 144th Sta Hosp SWPA, 1945–3. HD. (2) Quarterly Rpt, Med Det 839th Engr Avn Bn SWPA, 1945–3. HD.

[86] Pitkin, T.: Quartermaster equipment for special forces. QMC Historical Studies No. 5, OQMG, Feb 1944.

[87] Rpt, Armored Med Research Lab, 4 Dec 45, sub: Study of sweating of the feet of marching troops. HD: 421 Shoes.

item for use by officers, nurses, and troops, however, was insisted upon by Air Force personnel stationed in Africa. British practice had set the precedent, and Pan-American Airways had used a similar item with satisfactory results. Extra length boots were recommended for members of the Army Nurse Corps. The Surgeon General's policy and opinion on the development of this boot is expressed as follows:[88]

> 1. This office does not consider the issue of mosquito boots to troops and/or nurses as satisfactory or desirable for the protection of the health of the individuals concerned, provided all troops are furnished standard long trousers and canvas leggings, and nurses are provided with uniform, one-piece, coverall type with canvas leggings. The canvas leggings and long trousers afford adequate protection against mosquito bites and greater protection than mosquito boots against the bites of crawling insects such as chiggers, fleas, and ticks. They also prevent the ingress of leeches which abound in most tropical jungle areas in Africa and Asia. For the same reasons, the one-piece uniform, coverall type, with canvas leggings, affords much greater protection for nurses than mosquito boots. The mosquito boot affords no protection for nurses against crawling insects and leeches. It is extremely uncomfortable to wear, fatiguing, and practically impossible to keep in place during operations in jungle territory.
>
> 2. The use of mosquito boots at fixed camps and stations may have some value, but for all-around military purposes, it is felt that this type of equipment is undesirable as an item of issue to troops in tropical regions.
>
> 3. It is strongly recommended that mosquito boots not be standardized for issue to troops and nurses.

Development of the item was subsequently discontinued by The Quartermaster General.[89]

CLOTHING FOR COLD CLIMATES AND FOR WINTER OPERATIONS IN TEMPERATE CLIMATES

Development of Research and Field Tests

Provisional data recorded approximately 90,535 cases of cold injury for United States Forces operating in all theaters during World War II.[90] This experience has been summarized in a study at the Harvard University School of Public Health in which the role of clothing as one of a number of environmental factors was demonstrated.[91] The history of the development of cold weather clothing has been carefully prepared by the Office of The Quartermaster General,[92] the physiologic adaptation of man to cold has been briefly

---

[88] 4th ind, SG to Dir Regmts Div SOS, 15 Aug 42, on Ltr, CO SOS USAF Central Africa to CG SOS, 22 Jul 42, sub: Mosquito boots. SG: 421.–11 Shoes.

[89] 13th ind, CG SOS to QMG, 2 Jan 43, on Ltr, QMG to CO SOS USAF Central Africa, 11 Aug 42, sub: Mosquito boots. SG: 421 Boots.

[90] Information supplied by Medical Statistics Division, Office of The Surgeon General, 22 Mar 55.

[91] Whayne, Tom F.: Cold Injury in World War II, A Study in the Epidemiology of Trauma. Thesis, Harvard School of Public Health, 1950.

[92] See footnote 86, p. 62.

summarized above, and Newburgh and his associates[93] have made a thorough review of the literature and of the results of research during World War II.

Cold injury in World War I was minimal, and affected American troops only in the last weeks of the war. Training maneuvers in the cold climates between the wars and early in World War II did not provide sufficient exposure to alert those responsible for preventive medicine to the casualty-producing potentiality of cold and wet. The history of wars fought in winter cold, however, were a continuing story of crippling losses from cold injury.

The Surgeon General was not active in the development of cold weather clothing during the early phases of the war. The chief of the Sanitation Division, Preventive Medicine Service, in his recommendations that led to the study of the physiology of man in relation to clothing, had included adaptation to cold. In 1941 The Surgeon General advised The Quartermaster General that semi-impervious ski clothing was satisfactory for arctic wear provided provision for adequate ventilation was made during periods of physical exertion. Isolated activities were initiated, but were not included in the preventive medicine program. An opportunity to take part in special projects in a cold climate that involved the use of clothing was declined in the fall of 1942.[94]

Consideration of plans for cold weather operations emphasized the lack of knowledge of arctic clothing, medical equipment, and supplies. The Surgeon, Headquarters Alaskan Department was ordered to the Office of The Surgeon General for consultations on clothing, hospitalization and evacuation, medical equipment and supplies, housing, and arctic sanitation in 1942. Upon his return to Alaska, field studies were begun which included observations upon clothing.[95] The Surgeon General initiated action for the procurement of arctic clothing for nurses early in September 1942.[96] Changes in the basic list of items and standardization with men's arctic clothing where possible delayed procurement beyond the period of the Attu operation.

Investigations on protection for the extremities by footgear and gloves of improved design were carried out by the Armored Medical Research Laboratory, in the summer of 1943, and were expanded to include tests of the adequacy and ranges of use of winter combat clothing in subsequent research.[97] The Surgeon, Headquarters, United States Air Forces, Central Canada, reported upon the inadequacies of winter clothing in August 1943 and continued cloth-

---

[93] See footnote 1, p. 31.

[94] 1st ind, SG to CG SOS, 30 Oct 42, on Memo, CG SOS to SG, 19 Oct 42, sub: Arctic clothing. SG: 422.–1.

[95] Memo for record, Col T. F. Whayne, MC, 17 Oct 50, sub: Conference with Col W. S. Stone on the development of cold weather clothing. HD: 422.3 Protective and Special Clothing.

[96] Ltr, SG to CG SOS, 5 Sep 42, sub: Arctic clothing and equipment for nurses. HD: 421 Uniforms (Nurses).

[97] Annual Rpt, Armored Med Research Lab, 1945. HD.

ing observations into 1945.[98] A study of the effect of climate on protective clothing for personnel was made a joint project between the United States Army, the Canadian Army, and British Army in 1944.[99] Two expeditions to Alaska, one in 1943, and one in 1944, tested mosquito repellents, mosquito head nets, mosquito gloves, mosquito socks, and certain fabrics to determine clothing and procedures best adapted for protection against pest insects in the North.[100]

Surgical consultants of the Professional Service, Surgeon General's Office, shared the interest in prevention of cold injury with the Preventive Medicine Service, while at the same time placing much emphasis upon treatment, rehabilitation, and reconditioning. It was not until after the losses of the first winter in Italy that an energetic effort was brought to bear upon the prevention of trenchfoot and other cold injuries.[101]

Representatives of the Office of The Surgeon General participated actively in the proceedings of the Subcommittee on Clothing, National Research Council, the studies of which embraced cold weather clothing. Research by Newburgh and his associates was far reaching in its approach to the problem of man and his clothing in relation to cold. Physical responses, physiologic adjustment, and emotional reactions of man to the stress of cold were studied. Regional heat loss, the range of physiologic response to climatic cold, indices of comfort and the physical properties of clothing fabrics, clothing in relation to climate, and protection from clothing against the extremes of climate in the field were investigated.

Textile research and development produced no synthetic fibers and fabrics which were superior thermal insulators to wool and alpaca pile materials or to the fur of northern animals such as the caribou. The development of pile fabrics as clothing insulation for arctic climates made possible for the first time in history the fabrication of washable combat garments which approached, in the protection they afforded, the fur parkas used by the Alaskan scouts before World War II. A tightly woven, wind-resistant 9-ounce Oxford cloth was developed as the best of the wind-protective fabrics which were practical from the standpoint of mass production and combat-wear life. The combination of pile insulators and wind-resistant outer covers was one of the major advances in cold weather clothing development. Several types of arctic footgear were developed. Fur, wool, and other fibers were used in various ways, including felts, without producing an entirely satisfactory item. For winter operations in temperate climates, the shoepac, as finally designed was considered satis-

---

[98] ETMDs, USAF Central Canada, 2 Aug 43, 19 Mar 45. HD: 350.05.

[99] See Minutes of Meetings, NRC Subcommittee on Clothing, 1944, 1945. HD: 040.

[100] Rpt, 2d Arctic mosquito test expedition, 1944. SG: 725.11.

[101] Rpt, Lt Col M. Ladd, JAGD, to SG, 9 Jun 45, sub: Study of records and of investigation relative to trench foot. . . . HD: 710 Trench Foot.

factory when fitted loosely over two pairs of wool ski socks in graduated sizes and worn with a felt insole in the bottom of the boot.

Experiments with impervious latex rubber socks gave promise of much improvement in protection of the feet. A wool sock next to the foot, covered in turn by a rubber sock, a second wool sock, and finally a second rubber sock, experimentally gave greatly improved protection, but in field tests was not readily accepted by the soldier.

The end of the war brought promise of the development of better protective fabrics with the studies on silica aerogel. First studied as a water-repellent agent of great buoyancy for use in flotation suits, it was also discovered that aerogel had great thermal resistance. In the form of a powder, it was first used as insulation in sleeping bags, certain types of experimental jackets, and blankets. Later, through a bonding process with latex, it was incorporated into certain types of fabrics by laminating techniques and designated under the name "Aerobond." Experimental use in antiexposure suits, ponchos, parkas, and trousers for wet weather wear, waders for the prevention of schistosomiasis, arctic clothing, gloves, and liners for combat boots, gave considerable promise.[102] However, while silica aerogel in its pure unbonded form has a superior thermal insulation value to that of still air, serious problems arose due to the difficulties of anchoring the powder in place without destroying its desirable properties. In addition, no successful, practical methods were found for containing the aerogel in vapor permeable materials, so this project was abandoned.

These researches and developments in clothing were carried out during the war period. Consequently, preparations for combat in the cold lagged despite the great efforts that were made to translate the results of these studies into practical protection for the soldier in the field.

Clothing and Cold Injury

Many American soldiers suffered unnecessary cold injury on Attu, in the Mediterranean theater, and in Western Europe for lack of adequate types and supplies of clothing or because their training in the use of clothing had been incomplete.

On Attu, troops were largely equipped with high-topped, laced leather boots. Among those so equipped, trenchfoot developed in large numbers, whereas those with the shoepac were much better protected.[103] When the Attu task force was getting ready to depart, in May 1943, Quartermaster Corps cold-climate specialists had recommended shoepacs to the commanding general.

---

[102] (1) Minutes of Conference on Hydrophobic Silica Aerogel, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 30 Sep 44. HD: 040. (2) See footnotes 54 and 55, p. 54.

[103] Annual Rpt, 183d Sta Hosp Alaska, 1943. HD.

Instead of the shoepac, he had chosen a 12-inch leather Blucher boot, which was perhaps a more comfortable item but not so well insulated nor so efficient as the rubber-footed shoepac would have been in the slush of Attu.[104] In an after-action report dated 10 June 1943, the surgeon of the forces on Attu stated:[105]

> The large number of casualties due to foot trouble were the result of damp feet, added to cold and the inability of men pinned down in foxholes or other cover to keep up proper circulation by exercise. A waterproof type of footgear would probably have prevented the occurrence of disability in many of these cases.

For the Attu action, the annual rate for total cold injury for the 22-day period was 1,301.2 per thousand per year. This figure reflects the task force's unpreparedness for winter combat and their deficiencies in training and clothing. The principal problems of protective clothing in relation to cold injury in the Mediterranean Theater of Operations were summed up by the Fifth United States Army Surgeon in his annual report for 1944:[106]

> The Winter Campaign of 1943–44 found Fifth Army troops poorly equipped to meet the dangers of trench foot. Troops were provided only with the Standard Army shoe or combat boot and a light wool sock. These shoes and boots became water-soaked and the light wool sock offered no protection against either wet or cold. The shoe or combat boot fit so snugly that a heavy wool sock could be worn only by issuing a larger size shoe. Supplies were not adequate for such a readjustment, nor were heavy wool socks available for issue early in the winter. Apart from these deficiencies, neither officers nor enlisted men were alert to the dangers of trench foot, or adequately indoctrinated in preventive measures. Trench foot was a new experience to Fifth Army troops and the preventive measures urged by the Surgeon were difficult to put into effect.
>
> Recommendations were made for a daily change in socks, but at first there were not sufficient socks on hand to enable their being "issued with the rations." . . .
>
> In the winter of 1944–45, Fifth Army troops were better equipped and trained to prevent the occurrence of trench foot. All combat troops were issued shoe pacs to be worn with two pairs of heavy wool ski-socks and a pair of felt innersoles. All divisions made provisions to supply front-line troops with an exchange of socks and to provide warming and drying stations near the front lines. . . .
>
> When, despite the issuance of shoe pacs, a flood of trench foot cases occurred in Fifth Army troops in the month of October 1944, the Office of the Surgeon prepared a questionnaire for every trench foot admission to a Fifth Army Hospital to determine the cause for this influx of cases. It was discovered that a number of the troops had not been properly instructed in the use of the shoe pac, nor had they been issued proper sizes.

The shoepacs as originally issued in the Mediterranean theater in the fall of 1943 were unsatisfactory. They had neither heel nor arch support, traction was poor, and the combat soldier felt they were a hindrance in combat.[107] Studies

[104] U. S. Army in World War II. The Quartermaster Corps: Organization, Supply, and Services, vol. I, p. 106. Washington, Government Printing Office, 1953.

[105] After-Action Rpt, Surg Attu Force, 10 Jun 43. HD: 319.1–2.

[106] Annual Rpt, 5th Army Med Serv MTO, 1944. HD.

[107] Memo, Dir Sanitation and Hygiene Div SGO to Chief Prev Med Serv SGO, 20 Jun 44, sub: Immersion (trench) foot problem. HD:350.05 (NATOUSA, Mar 1944).

of footgear conjointly made by the Surgeon, Mediterranean Theater of Operations, United States Army, and Chief Quartermaster prior to and during the Anzio beachhead operation were forwarded to the War Department through Quartermaster Corps channels and recommended heels, arch supports, and sole traction for the shoepac, and an adequate supply of the heavy wool ski sock. The necessity for a heavier sock was further supported by a comparison of the American and British experiences. By 20 December 1943, the Fifth United States Army had had over 900 cases of trenchfoot, whereas a like number of British troops experienced only 50 cases. The principal difference was that American troops were issued 20-percent wool smooth-ribbed, lightweight socks, whereas the British wore a heavy-ribbed, pure wool sock. French troops wearing the American issue likewise had high rates for trenchfoot.[108] Adequate supplies of heavy wool socks did not begin to reach the theater until late in the winter. The essential technical medical data report for March 1944 reported tests of heavy socks in the 3d Infantry Division and supported their use as a "definite step in the right direction in the prevention of trench foot." [109] The supply of socks was greatly improved before winter operations late in 1944. The entire Fifth Army had shoepacs by the middle of October, but it was not until December that the desirable ski sock was available for general issue.[110] The essential technical medical data report for the month of January 1945 stated that: [111]

> Shoepacs when properly worn, appear to be a real protection against trench foot since only 11 percent of cases in December were wearing shoepacs with the two pair of ski socks as recommended. A total of 38 percent were wearing shoepacs but 27 percent were wearing the wrong socks. Fitting of shoepacs is now better, but there is still a shortage of smaller sizes. The most frequent complaint against shoepacs as noted on trench foot questionnaires is that feet perspire in them and then get cold. The solution is to change socks frequently allowing the damp socks to dry against the body. There is also some difficulty in maintaining stocks of ski socks so that men can always wear two pair and carry two pair.

The German troops were reported not to have suffered severely from cold injury in the Mediterranean theater. They attributed this to excellent foot hygiene and discipline, easily removable high leather German field boots, and the four pairs of thick, but loosely woven, all-wool high stockings provided to German troops in forward areas in the winter.[112]

Some shortages of other items of the uniform existed in the Mediterranean theater in the winter of 1943–44, but footgear was cause for the greatest concern. At the end of December 1943 only 50 percent of nurses in the North African

---

[108] ETMD, NATOUSA, Dec 1943. HD: 350.05.
[109] ETMD, NATOUSA, Mar 1944. HD: 350.05.
[110] ETMD, MTO, Dec 1944. HD: 350.05.
[111] ETMD, MTO, Jan 1945. HD: 350.05.
[112] ETMD, MTO, May 1945. HD: 350.05.

theater were equipped with woolen uniforms.[113] In the fall of 1944 many troops were issued standard War Department uniforms including the jacket, field, M–1943; trousers, field, cotton; shoepacs; ski socks; and the high-necked sweater. Initially, this uniform was not well accepted by troops. Investigations revealed that these uniform items had not been well fitted and were not being worn in the manner for which they were designed. Training classes and a refitting program indoctrinated troops with the proper use of the uniform and resulted in a general acceptance. Training programs stressed that any constriction of clothing should be avoided, that perspiration was dangerous in the cold, that tight closures at neck, wrist, waist, and ankles were essential for maximum warmth, and that damp socks should be changed regularly.

In the European theater, planning, training, and stockpiling of clothing and footgear failed to take full cognizance of the clothing lessons learned in Italy. Confidence born of the rapid sweep across Europe in the summer of 1944 and the conviction on the part of many that the successes of Allied arms would be rewarded by victory before the onset of winter contributed to the unpreparedness for winter combat. Under these circumstances, command, training, and technical directives initiated by the Preventive Medicine Division of the Office of the Chief Surgeon, European Theater of Operations, produced few results. The onset of trenchfoot early in November 1944 could be likened to the situation in the Mediterranean theater in the fall of 1943. The greatest defects as to clothing were insufficient supplies, inadequate footgear, improper sizing and fitting, and failure to train the soldier in the proper use of clothing.[114]

Only the Seventh United States Army, which had previously served in Italy, was supplied with shoepacs by the middle of November 1944.[115] The Annual Report, Division of Preventive Medicine, Office of the Chief Surgeon, for 1944 reported:[116]

> Clothing and Equipment: The most outstanding deficiency in respect to clothing has been that related to overshoes and shoepacs. Shortage of these items has contributed to the incidence of trench foot. The following were apparent reasons for insufficient supplies: (a) Troops embarking to this theater equipped with overshoes were required to turn them in prior to departure, the understanding being that they would be similarly equipped upon arrival overseas. (b) There was a critical shortage of these items which was alleviated in part by air shipment from the United Kingdom. (c) There was an overage of smaller sizes of overshoes which further complicated the overall basis of allowance and issue. (d) Priority in issue was justly given to combat troops at the expense of service units. The latter troops were many times working continuously in the rain and mud without suitable foot cover.

---

[113] See footnote 108, p. 68.

[114] (1) Rpt, 3d Army Trench Foot Control Team, 10 Apr 45. HD: 710 Cold Injuries (ETO). (2) Rpt, 1st Army Trench Foot Control Team, 7 Apr 45. HD: 710 Cold Injuries (ETO).

[115] Ltr, Lt Col R. P. Mason, MC, to Chief Surg ETOUSA, 11 Jan 45, sub: Report on study of trench foot in Seventh Army. HD: 710 Cold Injuries (ETO).

[116] Annual Rpt, Chief Surg ETO, 1944. HD.

Many reports of medical officers stated that the soldiers were inadequately clothed to withstand the severity of the European winter. It is felt that the M-39 field jacket normally issued is not practicable and cannot be compared with the British woolen battle jacket as regards warmth. The garrison cap, OD, worn by many troops in the rear, is worthless as headwear in that it neither keeps the rain from the face, the sun from the eyes, nor affords protection to the ears. Many units such an anti-aircraft gun crews who have to stand watch in fixed positions should be issued subarctic clothing for comfort since they have little opportunity for movement and the wearing of such apparel will not interfere with their work.

Blankets were in short supply during the early autumn, many units having but two per individual. The authorized issue of 4 per man still cannot be provided in many instances. Sleeping bags are heartily received by the troops, and no adverse comments relative to their use have been heard.

The shoepac was not considered entirely satisfactory for western European winter operations.[117] A variety of expedients in footgear were tried, some of which were deemed satisfactory. Blanket-strip wrapping and socks, made from blankets and worn inside the arctic overshoe, were among the most effective of these.[118]

Unit shortages in the supply of footgear, especially the arctic-type overshoe, form a part of too many of the official records of units to be detailed. A study made by the Preventive Medicine Division, Office of the Chief Surgeon, showed that in November 1944, only 3 divisions were completely equipped with overshoes; in December, 9 divisions were still incompletely equipped; and in January 1945, 7 still lacked overshoes for their entire commands. When rates for cold injury were related to supply of overshoes, it was found that divisions fully equipped in November had an average rate of 4.3 per thousand per annum; those not fully equipped until December, a rate of 10.5; and those not fully equipped until January 1945, a rate of 11.7.[119] Soldiers often declined to wear overshoes into combat because of weight and poor traction and some divisions ordered overshoes left behind when combat activities took place.[120] By January 1945 both shoepacs and overshoes were in much more generous supply. Woolen socks were never in critical shortage, but difficulty was experienced by many units in getting them forward for daily exchange.[121]

Tariffs for shoes and overshoes were predominantly in the small sizes because they had not been established with the view to the extra sizes required to fit footwear over two pairs of wool socks. Correspondingly, overshoes were not available in the required large sizes. Many men had not been resized since passing through reception centers.[122]

---

[117] See footnotes 17, p. 40 and 114, p. 69.

[118] (1) Semiannual Rpt, Surg 3d Armored Div ETO, 1945–1. HD. (2) Semiannual Rpt, Surg 44th Cav Recon Sq (Mecz) ETO, 1945–1. HD.

[119] See footnote 91, p. 63.

[120] Rpt, Maj. P. A. Siple, QMG Tech Observer, 12 Apr 45, sub: Report on adequacy of winter clothing in ETO, winter 1944–45. HD: 710 Cold Injuries (ETO).

[121] See footnote 114, p. 69.

[122] See footnote 114 (2), p. 69.

In addition to the difficulties with fitting, the M–3 and the field combat boot were poorly constructed for the prevention of trenchfoot. The welt-type sole leaked, there was too little room in the vamp, and the uppers were so scantily cut around the ankles and above, that properly fitted shoes could rarely be laced together without causing some constriction. With the bulk of extra socks, these defects were particularly objectionable and some constriction from lacing the shoe was the rule. These basic defects were recognized by The Quartermaster General. Based on a special report by Mr. Lawrence B. Sheppard,[123] Assistant Director of the Leather and Shoe Division, War Production Board, after a survey of footgear requirements in the theater, the Chief Quartermaster, European Theater of Operations, United States Army, made several recommendations. He suggested that a combat boot similar to the one used throughout the war be maintained but that a change be made from a welt construction to a more waterproof type; that the last fits too closely and therefore requires further development; that better fitting devices and procedures be executed, especially at reception centers.[124]

In February 1945, a representative of the Quartermaster General's Office was sent to the European theater to observe the adequacy and use of winter clothing. He reported that the complete clothing assembly as developed by The Quartermaster General was adequate for frontline troops, but was provided in insufficient quantities and in many cases so late in the season that it was not available for winter combat. The winter campaign in Europe was fought by most combat personnel in a uniform that did not give proper protection. The principal weaknesses described were insufficient insulation, poor balance of insulation, lack of windproofness, lack of water repellency, and faulty closures. The report further pointed out that the clothing initially provided for the European theater could not afford sufficient insulation because of poor balance, insufficient overall thickness, and the inefficiency with which it was worn.[125]

Clothing conferences were held by the Chief Quartermaster, European Theater of Operations, and attended by Quartermaster Corps representatives from major forces and units on the Continent in January and March 1945. The purpose was to determine which articles of clothing were best adapted for preservation of the health of the combat soldier, for combat adaptability, and for durability. They also considered the service uniform for service troops and for all troops after the cessation of hostilities. The keynote of the conference was the provision of a simple and practical uniform and the reduction of the number of different uniform items. The winter combat jacket was unanimously favored and the wool and combat trousers met acceptance. Little

[123] See footnote 15, p. 40.

[124] Memo, Chief QM ETO to QMG, 23 Mar 45, sub: Footwear and socks for use in the European Theater of Operations. HD: 332.31 (ETO) (Winter Clothing).

[125] See footnote 120, p. 70.

change in underwear, shirts, hand gear, and headgear was thought necessary, but modifications of the combat boot, service shoe, overshoe, and shoepac were recommended. It was thought that socks should undergo some modification; sweaters should be unchanged; and the overcoat be limited to the poncho, lightweight, nylon type and the overcoat, field, trenchcoat type. The Chief Surgeon, European Theater of Operations, favorably indorsed these recommendations to the War Department.[126]

The role of protective clothing was emphasized in a period report for 1 January to 30 June 1945 by the Surgeon, Third United States Army:[127]

> It was self-evident that cold type injuries were preventable in seventy-five to ninety percent of the cases. Prevention depends upon a combination of factors:
>
> 1. Adequate, properly fitting winter clothing.
> 2. Adequate, properly fitting footgear or combination footgear (shoepacs, regulation shoes, combat boots, and overshoes).
> 3. Adequate, properly sized socks.
> 4. Continuous, daily sock exchange to combat troops during the winter months.
> 5. Rotation of small and large units of combat troops out of the line at frequent regular intervals to enable warming, drying and changing of individual soldier's wet shoes and socks. Providing tents, huts, etc., wherein these things may be done.
> 6. Instruction and training of troops in the early recognition of signs and symptoms preceding injury of tissue due to cold and dampness and the individual precautions necessary to prevent frostbite.
> 7. Continued emphasis of the command responsibility for the above items.
> 8. Frequent inspections (at least once weekly) of feet and footgear of the command. Necessary corrective action, insofar as possible, must be taken on the spot.

So many factors combined to produce the approximately 64,008 American casualties[128] from cold injury in Western Europe that it is impossible to estimate accurately what proportions could have been prevented, or the relative weight of one factor such as clothing.

Several important principles, however, did evolve from the wartime research and theater experiences on clothing for the cold regions.

1. Clothing is one factor among several which influenced noneffectiveness from cold injury. In a conference of trenchfoot control officers, held in Paris, 21 April 1945, these experienced officers placed the following factors in the prevention of trenchfoot in the order of their importance as follows:[129]

---

[126] Memo, Chief QM ETO to QMG, 9 May 45, sub: Winter uniform, with 1st ind, Chief Surg ETO to CG ComZ ETO, 12 May 45. HD: 332.31. The chief surgeon's indorsement contained the following statement: "Subsequent to the above meeting, a general conference of all trench foot control teams of armies was held in Paris. The line was principally represented, together with medical officers responsible for preventive medicine. It is significant that this group came to essentially the same conclusion in respect to clothing as did the Quartermaster conference."

[127] Semiannual Rpt, Med Sec 3d Army, 1945–1. HD.

[128] This constitutes more than four 15,000-men divisions. Approximately 90 percent of cold casualties involved riflemen and there were about 4,000 riflemen per infantry division. Thus closer to 13 divisions were critically disabled for combat. For further details see volume on Cold Injury, History of Medical Department, United States Army, World War II, to be published.

[129] See footnote 100, p. 65.

a. Individual foot care.

b. Clothing and equipment.

c. Rotation.

d. Weather.

2. No clothing developed during the period could be considered as complete protection against cold.

3. Properly designed and effective clothing covering the torso is just as important as protective clothing items for the feet in the prevention of trenchfoot. Loss of heat from any part of the body predisposes the cold injury of another part. This concept was dramatized by the Chief of the Preventive Medicine Service, Office of the Chief Surgeon, European Theater of Operations, when he said: "When a soldier takes off his hat, his feet begin to get cold." [130]

4. The most effective clothing for cold climates embodied layering of wool clothing underneath an outer garment of tightly woven windproof, water-repellent, durable fabric. This principle made the maximum use of the insulating properties of still air.[131]

5. For maximum protection against the cold, the various items of clothing must be worn for the purposes for which they were designed. The Quartermaster General developed groups of clothing items appropriately called "clothing assemblies." Unless utilized as a total assembly, the degree of protection was materially reduced. This could be accomplished only by adequate supplies to forward elements of all components of the assembly, and by careful training of all personnel in the utilization of the winter clothing assembly to provide maximum protection.

6. Prevention of trenchfoot required waterproofed footgear worn over sufficient insulation by air and wool as provided by at least two pair of heavy woolen socks. Since wetness destroyed the insulation thus provided, opportunities for a change to dry socks must be provided daily and certainly within the average incubation period (3 days) of trenchfoot.[132]

7. Loose fit of clothing and footgear to avoid constriction of the parts and unnecessary friction, and to provide freedom of action is essential for full clothing protection against cold.

SPECIAL CLOTHING PROBLEMS

A number of special problems arose in connection with clothing, some principally medical in character, others obliquely so because specialized protective techniques introduced health hazards in themselves.

---

[130] See footnote 100, p. 65.
[131] See footnote 120, p. 70.
[132] See footnote 91, p. 63.

Impregnation of Clothing

Impregnation of clothing is patently a responsibility of the Chemical Corps. Toxicity, skin irritation, and added physiologic heat loads produced by the impregnates in clothing were of pertinent medical interest. Clothing impregnation with insecticides has been discussed in the section on clothing in the hot climates. Although plans for testing wool impregnated with these agents were made in the summer of 1945,[133] no evidence that they were carried out has been found.

The medical aspects of fireproofing and water repellency techniques came under the surveillance of the Subcommittee on Clothing, National Research Council, as early as 1 September 1942.[134] Pursuing the concept of developing clothing in accord with physiologic demands, The Surgeon General in the fall of 1942, called to the attention of the Chief of Staff the probable hazards from clothing impregnated against vesicant gases to soldiers operating in the tropics. In January 1943 a directive from the Chief of Staff to the Chief, Chemical Warfare Service, set up the requirement that all overseas troops were to be equipped for chemical warfare by that spring, and pointed to the doubts that had arisen over the suitability of impregnated clothing for the tropics. By direction, a committee to study this problem was established, participation by The Surgeon General directed, and arrangements made for studies in the John B. Pierce Laboratory of Hygiene, New Haven, Connecticut, and for tests to be conducted in a tropical region (Panama and, if practical, in Liberia or the Southwest Pacific as well).[135] The National Institutes of Health investigated the effects of chemical warfare protective clothing upon the efficiency of soldiers in tropical climates. Early tests at the Pierce Laboratory concluded that the impregnating agent CC–2 imposed no unusual physiologic load nor impairment of efficiency, and recommended additional field testing.[136] Interim reports from the Panama tests confirmed these observations, and the final report on 15 June 1943 recommended that clothing impregnated with CC–2 was satisfactory for use by troop personnel under combat conditions in tropical climates. The water-suspension process of impregnation was favored. It was found that clothing should be reimpregnated or replaced after 14 days' wear and that laundering of impregnated clothing in the tropics should be kept to the minimum compatible with reasonable standards of cleanliness. Skin-patch testing had not been completed and further studies were required as to abrasiveness, porosity, flexi-

[133] Semimonthly Rpt, Prev Med Serv SGO, 16–30 Jun 45. HD: 024.

[134] Minutes of Meeting, NRC Subcommittee on Clothing, Committee on Aviation Medicine, 1 Sep 42. HD: 040.

[135] (1) Memo for Record, 25 Jan 43, sub: Expedited tests of permeable protective clothing. SG: 421.–1. (2) Ltr, CG SOS to SG, QMG, and Chief CWS, 13 Feb 43, sub: Committee for controlling tests for permeable protective clothing. SG: 334.8–1.

[136] Ltr, SG to Dir Reqmts Div SOS, 27 Feb 43, sub: Expedited tests on permeable protective clothing. SG: 421.1.

bility, weight, comfort, fatigue, wear, and functional restrictions.[137] Further testing showed that impregnation of the underwear worn under the herringbone twill one-piece suit was almost as effective as when both outer and under garments were impregnated.[138]

The impregnation of women's clothing was made the subject of a separate study. It was concluded that protective clothing impregnated with CC–2, either by the solution or the water-suspension method, is physiologically satisfactory for constant wear over a period of at least 4 weeks by women engaged in moderately strenuous activity in temperate climates. Occasional dermatitis resulted, but it was concluded that the skin of women is no more sensitive to clothing than the skin of men.[139]

In December 1943 the Armored Medical Research Laboratory was requested by The Quartermaster General to test a group of flameproof treatments for clothing, notably fire-retardant, CM, manufactured by the DuPont Company, an ammonium sulfomate type, and "Flame-Out," manufactured by Treesdale Laboratories, a borax-boric acid type.[140] The DuPont product was recommended and approved for limited use. Coveralls treated with the CM fire retardant were to be issued to tank and other vehicle crews, gasoline and ammunition handlers (first echelon), personnel handling or using incendiary agents, including flamethrowers, and other personnel designated by unit commanders because of exposure to fire hazards. Some skin irritation was seen, but the protection afforded the personnel noted was considered to outweigh disability likely to arise from skin irritation.[141]

Studies on protective clothing against chemical agents and fire continued into 1945. In November 1944, the Chemical Warfare Service requested the services of the director of the Armored Medical Research Laboratory for cooperative special studies on protective clothing.[142] These studies resulted in tests on "Banflame" and the initiation of field tests of garments impregnated with this agent by the Army Ground Force Boards.

The Subcommittee on Clothing in March of 1944 recorded that, "Mosquito-repellant impregnation of clothing seems to produce no difference in heat exchange. This is also true of water-repellency treatments, and Chemical Warfare Service impregnations, which are themselves water-repellent." [143]

---

[137] Rpts, Lt Col T. H. Marshall, CWS, Lt Col W. S. Stone, SGO, Mr. H. A. Secrist, QMGO, to CG ASF, 29 Apr 43, and 15 Jun 43, sub: Protective value, life span and physiological effects of impregnated cotton clothing in tropic zone. SG: 421.1.

[138] CWS Rpt, M. Sullivan and C. M. Hunt, 28 Mar 44, sub: A comparison of the penetration of measured droplets of H through CC-2 impregnated and unimpregnated clothing worn by men. Filed at Army Chem Ctr, Md.

[139] Memo, 1st Lt M. Hayes, MC, for SG, 10 Nov 43, sub: Test of clothing, women's, protective, QMBT-1305. SG: 421.1.

[140] Ltr, QMG to SG, 28 Dec 43, sub: Test of flameproofing for clothing. SG: 421.1.

[141] (1) Rpt, Project 27, 13 Mar 44, sub: Fire resisting compounds for clothing, in Annual Rpt, Armored Med Research Lab, 1945. HD. (2) See footnote 120, p. 70.

[142] Ltr, Chief CWS to SG, 21 Nov 44, sub: Investigation on protective clothing. SG: 421 Boots.

[143] See footnote 62 (1), p. 56.

The development of the foam-impregnation technique for clothing improved the heat dissipation characteristics of impregnated clothing, simplified the problem of laundry,[144] and made possible the impregnation and reimpregnation of clothing during the laundry process in both fixed and mobile laundries. The multiple impregnation of clothing with insecticides and flame and chemical protective agents, while comprising technical difficulties, did not materially affect clothing in relation to the physiology of man.

Dubbin

The use of dubbin for shoes is a form of impregnation. The procedure was important medically only in that the dubbin allegedly waterproofed shoes and improved their wearing qualities and comfort, and aided in protection against cold injury. Dubbins containing antivesicant impregnates were used for protection against chemical warfare agents. Based on complaints from the field that dubbin makes shoes colder in the cold and hotter in the heat, a series of laboratory tests were made in which it was shown that dubbin did not significantly affect the thermal insulation of leather, but did reduce porosity. Dubbin was ineffective in improving the performance of shoes in protection against cold injury.[145] Dubbins containing impregnates were overrated and a series of tests by the National Bureau of Standards revealed that there was little difference between the impregnated and unimpregnated dubbins in their ability to protect against vesicant agents.[146]

Since there was considerable demand for dubbin, a decision was made late in 1943 to issue both types indiscriminately for normal use. Development of a new and improved dubbin impregnate against chemical warfare agents was initiated.[147]

Special Gas Masks

The development of the gas mask for World War II has been recorded in reports of activities of the Chemical Warfare Service. In the European theater, certain hospitals were considered to be vulnerable to gas attack from the air. A head wound gas mask appeared desirable. Upon receipt of the recommendation from the European Theater of Operations, the War Department canvassed other theaters to determine the desirability of the item. All advised development. The Surgeon General had such an item under study, but even-

---

[144] (1) Ltr, Chief CWS to CO Armored Med Research Lab thru SG, 14 Apr 45, sub: Heat load studies on clothing flameproofed by foam impregnation method. SG: 421. (2) Ltr, Chief CWS to CO Armored Med Research Lab thru SG, 20 Jul 45, sub: Laboratory tests on worn flameproof protective clothing. SG: 421. (3) Filler, L.: Laundry and Related Activities of The Quartermaster General. QMC Historical Studies No. 13, Washington, Government Printing Office, 1946.

[145] See footnote 114 (2), p. 69.

[146] Rpt, QM Climatic Research Lab, 17 Apr 46, sub: Dubbin on footgear, heat and cold effect of. SG: 400.112.

[147] Ltr, QMG to CG ASF thru Chief CWS, 2 Mar 44, sub: Study of dubbing and shoe impregnate. SG: 400.112.

tually the Chemical Warfare Service took over this responsibility, together with that for requirements, storage, and issue.[148]

Allergy to Clothing

Allergic manifestations and skin irritation resulting from fabrics, dyes, and impregnating agents were not a significant medical problem. Tests of the standard uniform in producing allergic dermatitis were negative. Some reaction to the cushion-soled sock was reported by the Armored Medical Research Laboratory.[149] In March 1943, the senior consultant in dermatology in the European theater noted an increasing number of men with sensitivity of the skin to dye, wool, and other materials in uniforms, severe enough at times to be disabling. Issue of long cotton underwear upon the recommendation of the Office of the Chief Surgeon was authorized for these patients. Likewise, he reported that patients with skin disease apparently had been made worse by contact with the general issue, blue-gray woolen pajamas used in Army hospitals.[150] In the China-Burma-India theater, a dermatitis venanata, or "Dhobie-mark dermatitis," resulted from the use of "bichi" nut ink used for laundry marking.[151]

Tropic-Proofed Clothing and Equipment

Mildew formed by fungi affected many types of fabrics, leather, and equipment. Tentage, bed clothing, canvas linings of the combat shoe and shoe leathers were the items of clothing, or related to clothing, that were affected. In the early phases of the war, toxicity of the mildew-proofing agents under study was tested by the Chemical Warfare Service Laboratory and by the Armored Medical Research Laboratory. With the establishment of the Army Industrial Hygiene Laboratory in Baltimore, Maryland, this function became a part of its responsibilities. Many fungicides and mildew-proofing agents were patch-tested on human volunteers without reference to ultimate adoption by the developing agency. These chemicals were classified according to the degree of exposure or contact of the soldier with the agent.[152]

Footwear

Dyes and Finishing Material. With the cessation of European hostilities, improvement in the appearance of the flesh-side out shoe became a matter of some importance. Toxicity from unauthorized shoe dyes was cause for the

[148] (1) Ltr, Chief Surg ETO to SG, 16 Feb 44, sub: Development projects. SG: 470.7. (2) Ltr, SG to CG ASF, 7 Aug 44, sub: Standardization of mask, gas, head wound, M7-11-9. SG: 470.7.

[149] Appendix B to Annual Report cited as footnote 96, p. 64.

[150] Ltr, Lt Col D. M. Pillsbury, Senior Consultant in Dermatology ETO, to Chief QM ETO, 4 Mar 43, sub: Long cotton underwear for use on patients with sensitivity to wool uniform. HD: 422 (ETO).

[151] CBI Field Med Bulls, vol. 2, No. 6, Jun 1943; vol. 3, No. 6, Jun 1944.

[152] See footnote 40, p. 49.

testing of a number of products by the Army Industrial Hygiene Laboratory. A War Department circular in May 1945 directed use of dubbin or shoe impregnate, and prohibited the application of dyes, coloring, or finishing material on combat boots and service shoes without specific authorization or approval by the War Department.[153]

Plastic Insoles (Saran). A variety of materials were used as insoles for shoes. Felt eventually was adopted and was further improved after the war for use with shoepacs. Plastic-mesh net soles were given trials both by the Quartermaster Board and in the Mediterranean Theater of Operations. Being impervious to water and because the mesh construction provided airspace and a bellows action, it was hoped that these insoles would prove of benefit for both cold weather and tropical wear.[154] Troop trial in the Mediterranean theater both supported and criticized the device. Medical officers indicated that they added to marching comfort when fitted with the proper size shoes, kept the foot warmer in moderately cold weather, and aided in drying of socks. The consensus of opinion was that Saran insoles were a comfort in cold wet weather, but would not greatly influence the incidence of trenchfoot.[155] A supply of shoes big enough to fit over the necessary socks and the insole was a practical consideration. Tests at Camp Lee, Virginia, early in 1944 caused the Quartermaster Board to recommend "that the Saran insoles be considered as not possessing sufficiently outstanding or clearly evidenced value to warrant their issue for general use of troops in temperate climates with the service shoe or combat boot." [156]

Sizing and Fitting of Footgear. In March 1945, the Chief Surgeon, European Theater of Operations, in commenting upon improvements in the uniform recommended by the Chief Quartermaster, European Theater of Operations, stated, "In almost thirty years of service, I have rarely seen shoes fitted with the care and expertness that this function deserves." [157] "Improper Fitting of Shoes" was the subject of a War Department memorandum published on 17 September 1942, which called attention to the fact that enlisted men were being issued shoes at reception centers and elsewhere in the sizes they requested, a practice which resulted in many improper fits. Commanding generals of all service commands were directed to see to the fitting of shoes in compliance with the provisions of Army Regulations (AR) 850–125.[158] Fitting of shoes for Wacs was unsatisfactory for the same reason. Women preferred fits over thin hose and resisted sizing by fitting machines. Eventually correct sizes were prescribed and issued without consideration of the Wac's choice. Inspection

[153] WD Cir 137, 8 May 45.

[154] Ltr, SG to QMG, 5 May 43, sub: Insole, ventilating, experimental. SG: 421.11 (Shoes).

[155] Ltr, SG for QMG, 15 May 44, sub: Insoles, ventilating, lab test No. AMRL3. SG: 421.-1.

[156] Rpt, The QM Board, 30 Jul 44, sub: Report of test of insole, ventilating, Saran: fused edge type and fused and bound edge type. SG: 400.112.

[157] 1st ind, Chief Surg ETO to CG ComZ ETO, 26 Mar 45, on basic ltr cited in footnote 124, p. 71.

[158] AG Memo S850-2-42, 17 Sep 42, sub: Improper fitting of shoes. AG: 333.1.

to insure the fitting of clothing and directing that woolen and other winter clothing issued during warm weather was to be tried on and inspected for proper fit in compliance with AR 850–126 was the subject of another War Department memorandum in December 1942.[159]

The medical implications of the misfitting of shoes were recognized in the research project carried out at the Armored Medical Research Laboratory in the spring of 1943. The report of the findings recommended:

> a. That a thorough study of foot disabilities resulting from misfitted shoes be undertaken.
>
> b. That anthropometric measurements of soldiers' feet be secured to provide a basis for the design and fitting of Army shoes.
>
> c. That certain recommended changes in the structural characteristics of Army shoes be given consideration.

Further action on these recommendations approved anthropometric studies of measurements by this laboratory. Results of these preliminary studies showed that the design of the army shoe was not altogether in accord with shape and size of feet, and that procedures for fitting soldiers' feet were not satisfactory. The laboratory believed that this situation contributed in no small measure to foot disabilities and that further study of the problem could result in marked improvement.[160]

Improper fitting and the sizing of combat boots and shoepacs in Italy in the winter of 1943–44 contributed to trenchfoot prevalence and complicated the problem of control. There was much improvement by the winter of 1944–45.[161]

In the European theater, the long wait in England before the assault on the Continent saw little emphasis upon the fitting of clothing and footgear, especially as it related to combat activities in the cold. The importance of fit, however, was stressed in a headquarters circular prepared in the Office of the Chief Surgeon in October of 1944.[162]

Numerous essential technical medical data reports and sanitary reports from the European theater pointed out deficiences in the fit of shoes, shoepacs, and overshoes, and their relation to cold injury.[163] The importance of proper fitting of shoes was stressed in War Department Circular 312, 22 July 1944. The headquarters of the Ground Forces Replacement System in the European theater drew attention to the urgency of the proper fitting of shoes in their Circular 55, dated 13 December 1944.[164]

Investigation of clothing problems in the spring of 1945 led the Chief Quartermaster, European Theater of Operations, to the conclusion that shoe lasts fit too closely, that better fitting devices and procedures must be found,

---

[159] AG Memo W30-15-42, 26 Dec 42, sub: Improper fitting of clothing. SG: 421.–1 (Uniforms).
[160] Appendix B to Annual Report cited as footnote 96, p.
[161] Simeone, F. A.: Trench foot in the Italian campaign. HD: 314.7–2.
[162] Hq ETOUSA Cir 108, 26 Oct 44, sub: Care of the feet. HD.
[163] (1) For example see footnote 17, p. 40. (2) ETMD, MTO, Oct 1944. HD: 350.05.
[164] See footnote 90, p. 63.

that shoe tariffs included far too many sizes, and that the tariff must be expanded upward to include larger sizes.[165] The medical implications of improper sizing and fitting were summarized by the Chief Surgeon, European Theater of Operations, in an indorsement to the report of the above investigations:[166]

* * * * * * *

2. Insofar as cold injury (trench foot, frostbite, immersion foot) is concerned, the generalization may be made that it is the direct result of lack of adequate circulation of the blood. With sufficient blood circulating at a temperature of 98 degrees Fahrenheit, little or no damage can be done to tissue by cold.

3. It follows, then, that prevention of cold injury lies entirely in the maintenance of adequate circulation. The factors of decreased circulation, particularly in the extremities, are:

a. *Loss of surface heat.* As a defense mechanism against lowering the body temperature as a whole, surface blood vessels are constricted reflexly when surface temperatures are lowered by exposure to cold. Surface temperature is lowered faster through a wet medium than through a dry medium. For this reason, extremities are injured at higher temperatures when wet than when dry; and trench foot occurs in higher temperatures than frostbite.

Consequently, warmth and waterproofness in a shoe or garment is to be sought. If it be impossible to waterproof an item, the skin should be further protected by a heavy layer of material which retains a large part of its insulating quality when wet—such as wool.

b. *Constriction of circulation.* It is of the greatest importance that circulation be not constricted by tight shoes or clothing. A large proportion of patients with trench foot showed the marks of shoe laces over their insteps. Shoes that fitted too tightly were solely responsible for many cases of trench foot.

It is impossible to fit shoes properly unless socks be of uniform thickness.

Furthermore, the construction of both the Type III shoe and the combat boot—with quarters that are wide apart over the instep, invites tight lacing.

c. *Stagnation of circulation.* Hours of inactivity promote stagnation of circulation, particularly in the extremities. One way to combat stagnation is to have the footwear fit loosely enough to permit of active movement of the foot within the shoes.

Sizing of socks offered some difficulty, and some units requisitioned socks only in size 12 in order to have enough large sizes. Shrinkage of socks occurred as a result of the quartermaster laundry procedures, which complicated the satisfactory reissue of properly sized socks. This failing was critical enough to justify The Quartermaster General in instituting research to determine laundry procedures and treatments of wool to reduce shrinkage to a minimum.[167]

Tariffs

Complaints about the uniform, field investigations, and practical experience in the Zone of Interior and in the several theaters of operations, thoroughly

[165] See footnote 124, p. 71.
[166] See footnote 157, p. 78.
[167] See footnote 124, p. 71.

demonstrated that a scientific basis for design, sizing, and establishment of clothing tariffs had not been available to guide the provision of clothing stocks during the war. With a realization of this defect, The Quartermaster General in October 1945, authorized the Climatic Research Laboratory to conduct a series of anthropometric studies on a sufficiently large number of male and female Army personnel to establish authentic guides for design, sizing, and tariff determinations. Between May and November 1946, 105,062 men selected in accord with the population distributions prepared by the Bureau of the Census were subjected to detailed anthropometric measurements.[168] Additionally, over 8,000 women were measured. The data on males and females were subjected to statistical analysis. The distribution of body types was found to fall into distinct groupings that arranged themselves roughly into the form of a normal curve. These data, establishing type groups and distribution of body types within the military population, should materially improve fit, appearance, tariffs, and stockpiling of the uniform. These studies have been continued into the postwar period.[169]

Reconditioning and Reissue

The reissue of salvaged clothing and textile items was not a matter of great medical concern. The Office of The Surgeon General adhered to the policy that ordinary laundering or dry cleaning offered sufficient sterilization and disinfestation. Exceptions were noted for the clothing of soldiers known to have been ill of communicable diseases or where the degree of louse infestation might require the use of methyl bromide disinfestation.[170] Spread of fungus infections through reissued shoes came under consideration in 1941. Until the middle of 1943, the methods recommended or concurred in by The Surgeon General involved the use of chlorine as a fungicidal agent.[171] Some question arose as to the necessity for sterilizing shoes under any circumstances. The Division of Medical Sciences, National Research Council, on 27 June 1944 made the following recommendations to The Surgeon General:

1. Foot baths for the prevention of "athlete's foot" are not prophylactic, not necessary, and their use should be discontinued by the Army.

2. Shoe sterilization:

a. For factory rebuilt shoes: Sterilization is desirable, at least until further information is available.

---

[168] QMC Climatic Research Lab, Rpt No. 122, 2 Jul 47, sub: Survey of body size of Army personnel, male and female. QM: 420 Anthropometric Survey.

[169] QMC Research Lab, Proposed Studies, 5 Oct 48, sub: Body size measurements of inductees and body size measurement and clothing fitting tests on inductees. QM: 420 Anthropometric Survey.

[170] (1) Ltr, QMG to SG, 6 Oct 44, sub: Sterilization of clothing for reissue, with 1st ind, SG to QMG, 26 Oct 44. SG: 720.5. (2) Ltr, Dir Sanitation and Hygiene Div SGO to Mr. M. E. Kent, UNRRA, 4 Feb 44. SG: 720.5.

[171] Ltr, QMG to SG, 18 Apr 42, sub: Sterilization of class B shoes. SG: 421.–11.

b. For shoes turned in for exchange, but not requiring repair: There is not sufficient evidence that such shoes transmit fungus infection of the feet to warrant sterilization.[172]

Subsequently, a method of sterilization, using formaldehyde in 1-percent solution, followed by a soap solution, and finally immersion of the shoes in an oil emulsion with 5-percent pentachlorphenol [173] came into limited use.

Some soldier resistance to wearing rebuilt and reissued shoes because of foot complaints was observed. The large-scale program for the rebuilding of service shoes was so important that the adverse comments of the 326th Glider Infantry, Army Air Base, Alliance, Nebraska, was cause for thorough investigation by Quartermaster Corps and Medical Department consultants.[174] The investigation substantiated the wisdom of the rebuilt shoe program and further emphasized the need for fungicidal treatment. Formaldehyde fumigation according to the method developed by Dr. Fred O'Flaherty, at the University of Cincinnati, was the basic sterilizing procedure used in the army shoe reconstruction factories.

Transmission of trichophytosis through gymnasium shoes used in reconditioning facilities was cause for concern. The Preventive Medicine Service, Office of The Surgeon General, recommended a pair of shoes for each individual during hospitalization with fumigation before reissue by the O'Flaherty procedure.[175]

Industrial Medical Aspects of Clothing

Protective clothing in industrial operations in Army-owned or Army-operated industrial plants conformed largely to commercial practice. Among the most significant health problems was trinitrotoluene poisoning. Personnel handling toxic explosives were provided with powder uniforms, socks, suitable underwear, head coverings, powder shoes, and sweat shirts or sweaters as necessary. These articles of clothing remained in the plant. Freshly laundered uniforms were furnished each day. Each worker was required to have a bath and a complete change of clothing after the work shift. These were requirements that could be met only by careful supervision and maintenance in the bath and change rooms. Special types of protective clothing were developed for workers involved in the application of radioactive luminous paint to instrument dials.[176]

Appropriate protective clothing for service personnel engaged in handling heavy shipping on docks, in railway yards, and in similar operations received

---

[172] Ltr, NRC Div of Med Science to SG, 27 Jun 44. SG: 421.–11 (Boots).

[173] Ltr, QMG to SG, 2 Sep 43, sub: Disinfecting worn shoes for athlete's foot. SG: 421.–11 (Boots).

[174] Memo, CG ASF for SG, 9 Jul 43, sub: Rebuilt shoes. SG: 421.–11 (Boots).

[175] Semimonthly Rpt, Prev Med Serv SGO, 1–15 Jul 45. HD.

[176] Rpt, Army Industrial Hygiene Lab SGO, 9 Oct 50, sub: Relationship of clothing to industrial hazards including the use of protective clothing during World War II. HD: 422.3 Protective Clothing.

ittle medical attention, but was largely within the province of safety officers nd safety engineers. The Surgeon General's concern for the problem was xpressed in an indorsement reporting standardization of safety working shoes, n which he noted that, while civilian employees were used whenever possible n storage, transportation, and repair of materials for war in the Zone of nterior, military personnel accomplished such work in the theaters. This ersonel should be protected by safety shoes wherever needed.[177]

Miscellaneous

Anti-Louse Suit. In 1942 an anti-louse suit was designed in the European 'heater of Operations and submitted to the War Department for develop- ıent.[178] DDT modified the requirement. In October 1943, 2,000 suits were equested. Their use was to be limited to heavily exposed personnel and to terilization and bath units.[179] Subsequently, protection from DDT and vac- ination were considered adequate and the anti-louse suit was discarded.

---

[177] 1st ind, SG to QMG, 8 Jan 44, on Ltr, QMG to SG, 27 Dec 43, sub: Shoes, safety, working, ›mposition sole. SG: 421.–11 (Boots).

[178] Ltr, Chief Surg ETO to Chief QM ETO, 8 Dec 42, sub: Anti-louse protective clothing. HD: 22 ETO.

[179] Memo, Chief Surg ETO to Chief QM ETO, 17 Nov 43, sub: Anti-louse suits. HD: 422 ETO.

346336 O—55——7

CHAPTER IV

Nutrition

*John B. Youmans, M. D.**

The Medical Department of the Army has always been concerned with ıe feeding of the soldier as it affects health and effectiveness. This responsiility was given statutory status in 1863 (Act of March 3, 1863, 12 Stat. 744: '. S. Code (10: 104). As revised in 1877 (Rev. Stat. 1174, February 27, 1877, ec. 1174), it holds today as follows:

> The officers of the Medical Department of the Army shall unite with the officers of the line (under such rules and regulations as shall be prescribed by the Secretary of War) in superintending the cooking done by the enlisted men; and the Surgeon General shall promulgate to the officers of the said Corps such regulations and instructions as may tend to insure the proper preparation of the ration of the soldier.

The application of the science of nutrition in the Army, both as a part of reventive medicine and as a therapeutic procedure for the sick and wounded, egun in World War I, was expanded in World War II. The developments in utrition in relation to vitamins A and C, thiamine, minerals (especially calium and iron), and the acid-base balance to the health of the soldier were ppreciated during World War I. In addition, the loss of vitamin C and ıiamine by heat, including considerable destruction of the latter in cooking, nd the loss of nutrients in milling was known. On the other hand, the requireıents of the body for these vitamins, in fact the exact nature and identity of ıese vitamins, were unknown. Knowledge of the vitamin content of foods 'as in terms of the relative value of different foods for the various vitamins ı general terms. The development in nutrition had increased the number of itamins identified. It resulted in their isolation and synthesis so that the ɔecificity of their action and the curative effects of some of them had begun to ɐ determined before World War II. A greater appreciation of the effects of lack or diminished intake of vitamins was more general.

Every war brings many new and unsolved problems, particularly to a ɔuntry which does not maintain a large preparedness program. Such was ıe case in nutrition in this country at the beginning of the war. Two avenues ! approach were used to solve problems as they arose. The first was to define ·oblems and submit them through the Office of Scientific Research and Develɔment to various university and industrial laboratories for solution. The cond was to tackle them in military research organizations.

*Dean, School of Medicine, Vanderbilt University. Formerly Colonel, MC, AUS, Chief, Nutrition vision, Preventive Medicine Service, Office of The Surgeon General.

By precedence since the Spanish-American War and by Army regulations after World War I, one of the duties of The Surgeon General has been to prescribe the basic standards of diet for the Army. By informal agreement between The Surgeon General and The Quartermaster General, the recommended dietary allowances submitted by the Committee on Medicine, National Research Council, and later confirmed in the "Recommended Daily Dietary Allowances" of the National Research Council were accepted as the dietary standards of the Army at the beginning of this war. Although the standards selected were not designed for Army use, they had such a large margin of safety that they were deemed suitable and satisfactory. Later, at the request of The Surgeon General, the Subcommittee on Medical Nutrition, National Research Council, submitted minimum dietary allowances, prepared by the Food and Nutrition Board, for use under emergencies and in times of short supplies.

Upon request by the Office of The Surgeon General the nutrition requirements of troops were studied in detail. The nutritional value of food items being supplied to the Army was studied by the United States Food and Drug Administration and by many university laboratories. Nutrient cooking loss data were accumulated from a large variety of sources among which were the Bureau of Human Nutrition and Home Economics of the United States Department of Agriculture, and the Nutrition Laboratory of the Pentagon Restaurant Association. In addition, much technological work on food in relation to nutrition was done by the Quartermaster Subsistence Research Laboratory. The relation of nutrition to prevention and cure of disease was studied by medical officers in the field.

Many studies of the relationship of protein metabolism to wound healing were done by both civilian and military hospitals in this country. One well-organized group was the Committee of the Josiah Macy Foundation, studying the relationship of metabolism to convalescence. There was also a subcommittee of the National Research Council which studied metabolism in relation to wound healing. The individual projects studied are too numerous to list in this history. Special diets made from Army rations were studied in the Army's Medical Nutrition Laboratory at Chicago, as was the relationship of atabrine and vitamin A deficiency to the development of atypical lichen planus, a serious skin affliction of the Southwest Pacific theater. Nutrition in relation to the healing of acute decubitus ulcers was studied at the Wakeman General Hospital, Camp Atterbury, Indiana, under the direction of the Chief Nutrition Consultant, Fifth Service Command.

Throughout the war, at a large number of military installations, the energy expenditure of troops in a wide variety of activities was studied. The method used was usually that of oxygen consumption. At Wright Field, Ohio, and at many of the subsidiary Air Force physiologic investigation centers, the

oxygen requirements of pilots and other crew members were determined for all types of aircraft at all altitudes. The Army Signal Corps determined energy expenditure in a variety of field tests at Fort Monmouth, New Jersey. Infantry troop and tank personnel energy expenditure was studied to some extent by the Medical Department in conjunction with the Quartermaster Board at Camp Lee, Virginia, and by the Armored Medical Research Laboratory at Fort Knox, Kentucky. Much work was done by the United States Navy at the Submarine Center in New London, Connecticut, also on board many training ships, and at the Naval Medical Research Institute at Bethesda, Maryland.

To carry out an appraisal of the nutritional state of troops, in relation to the rations which they consumed, a controlled experiment was conducted on 1,000 infantrymen in the mountains of Colorado in the summer of 1944.[1] Here the technique for determining the nutritional state were standardized and critically studied. Subsequent to the standardization of these methods, a survey team was sent to the Pacific theater to appraise the nutritional state of carefully selected samples of men from all arms and services in the major Army areas.[2] This was done in an effort to determine whether or not the troops who had lived on the B ration, C ration, K ration, and ten-in-one ration for periods of time up to 3 years were, in fact, properly nourished. The findings of this survey indicated that the nutritional state of a vast majority of the troops in this theater, whether they were fresh from the United States or had been there for long periods of time, was satisfactory. The same approach was used in China in the winter of 1944 as a basis for determining the supply requirements of Chinese troops under American supervision.[3]

THE RATION

Training Camp and Garrison

Formal improvements in the ration have been slow. The training camp and garrison ration was based on the quantities of standard foods consumed by 400 messes, obtained by nutritional surveys between 1917 and 1918. A proposed training ration was presented by the Chief, Food and Nutrition Division, Office of The Surgeon General,[4] at the close of World War I, with suggestions for a revision, but no immediate action was taken. As the result of the inability to purchase a satisfactory dietary with the money provided by the garrison

[1] Rpt, Armored Med Research Lab, Proj. 30, 22 Nov 44. HD: 430 (Rations).

[2] Rpt, Nutrition Div SGO, 22 Aug 45, sub: Nutrition survey in the Pacific Theatre of Operations. HD: 720.1.

[3] Memo, Col J. B. Youmans, MC, to CG China Theater, 20 Jan 45, sub: Report on the nutritional status and requirements of Chinese troops, the adequacy and availability of food supplies, and their procurement, distribution, storage, and issue. Filed in Nutrition Div, OTSG.

[4] (1) Murlin, J. R., and Miller, C. W.: Preliminary results of nutritional surveys in United States Army camps. Am. J. Pub. Health 9: 401–411, Jun 1919. (2) Chamberlain, W. P., and Dunham, G. C.: The well balanced ration. The Quartermaster Review 1: 16–17, 52–58, Jan-Feb 1922.

ration, the Quartermaster Corps, with the advice of the Medical Department,[5] accomplished a revision in 1927 to increase the money value of the ration. The intent of the changes was to permit the purchase of supplementary food to provide variety. While the nutritive value of the ration was considered by the Office of The Surgeon General, the higher money value of the ration received by the Navy at the time was an important factor in the decisions. A large proportion of the changes in food were in animal products, some of which, particularly meats, were expensive and also beyond the normal consumption by the Army. The normal use of these foods allowed ration savings for the purchase of fresh vegetables, fruits, and milk. The result of this abnormal distribution of foods in calculating the money value of the ration was evident in the depression of the 1930's when the cost of meat decreased out of proportion to vegetables, and the Army was again faced with an unsatisfactory dietary. As the result of nutritional surveys, a proposal was made to the Quartermaster Corps that a ration be set up that would represent fairly satisfactorily the food needs and nutritive requirements of a hard working man. It was also desired to develop some method of determining the money value of the rations from such a ration rather than to obtain additional money by introducing quantities of food out of proportion to those which a suitable dietary should contain. It was indicated that a ration to be successful must have the following characteristics:[6]

1. A ration must be defensible from a nutritional standpoint.

2. When issued in kind, it must afford sufficient quantities of each item of the various classes of foods to allow the preparation of adequate, varied, and balanced menus. From the standpoint of supply agencies, it must be capable of issue in kind.

3. The relation of the various groups to each other should be such that it can be used to determine the adequacy of the rations actually consumed.

4. When commuted into money, it should furnish sufficient money to buy the various kinds of food necessary to provide nutritionally adequate meals sufficient in quantity and of suitable variety and balance. Providing sufficient money for food purchases does not assure suitable variety, caloric content, vitamin sufficiency, et cetera; only competent personnel can insure this.

The ration approved in 1932, while showing much improvement in the variety, quantities, and distribution of food, still required slight adjustment especially in meat (reduction) and milk (increase) and sources of vitamin C, for adequacy and normal distribution of food. Furthermore, the primary

[5] (1) Ltr, Lt Col H. L. Cooper, Inf, to Chief of Infantry, 26 Jun 23, sub: Difference in the value of the ration between the Army and Marine Corps, with inds. SG: 246.4–1. (2) Memo, Brig Gen B. H. Wells, ACofS, for SG, 23 Dec 26, sub: Increase in the ration allowance—Regular Army and Philippine Scouts, with inds. SG: 430.2–1. (3) Ltr, Lt Col P. E. Howe, SnC, to Col J. F. Siler, SGO, 11 Jan 27. SG: 430.2–1.

[6] Ltr, Lt Col Paul E. Howe, SnC, to SG, 27 Oct 32. HD: 720.1.

consideration was still the money value in spite of the recommendation of the Office of The Surgeon General.

During the mobilization of troops for defense in 1940, a "menu" plan of prescribing rations was introduced for trial in 1941 and adopted with changes from time to time.[7] The basis of this field ration was a monthly menu to be prescribed for all stations operating on a field ration system within a corps or service command area (the hospital phases of this plan will be discussed later). The menus were required "to indicate the components of each of the three daily meals, and a daily recapitulation of the total quantity of units of purchase of each item required to feed the prescribed menu to 100 men." Provision was made that "care will be exercised to see that the menu is nutritionally balanced," and by implication, adequate, "ample variety provided, and full utilization made of seasonal fresh fruits and vegetables."

The latter statement is the first formal statement in War Department directives that required that the dietary to be fed to the soldier be nutritionally balanced. In the final adoption and revision of War Department circulars relating to the menu plan of field rations, the following was included as the result of suggestion of The Surgeon General:[8] ". . . that consideration be given to evaluation of vitamins and minerals. . . . In its preparation, consideration should be given to the quantities of food necessary to meet nutritional requirements consistent with the prescribed training program."

The concept of the menu plan of prescribing and issuing rations was excellent and generally successful. The chief difficulties arose from the problems of any ration that is prescribed for troops with units having variable degrees of activity and a variety of food habits and operating in areas with different supplies of perishable foods such as meats and vegetables. There are three possibilities that might meet the problem of variable activity—to prescribe food for (1) the maximum activity contemplated; (2) the minimum activity with regard to caloric content and protein, vitamin, and mineral requirements, and additional food for more active units to meet the increased caloric requirements and to carry the additional vitamins associated with the use of carbohydrate or fat; and (3) the average activity of a camp or corps area and provide for adjustment of the distribution of food between organizations with high and low degrees of activity, or extra food for organizations with activity greater than the average. No definite policy was expressed, however, in the various directives relating to field rationing. The tendency was to provide for average activities. War Department Circular 208, 13 September 1943, at the insistence of the Surgeon General's Office, provided for more active troops as follows:

> In instances where the field ration is insufficient in certain components to provide adequate sustenance for certain organizations, station commanders may, on request of the

[7] (1) WD Cir 28, 17 Feb 41. (2) WD Cir 16, 11 Jan 43. (3) WD Cir 208, 13 Sep 43.

[8] Ltr, SG to TAG, 1 Jul 41, sub: Comments and recommendations on the field ration system in effect since May 1, 1941. SG: 430.2.

commanders thereof and with the approval of local medical authorities, authorize the issue of additional quantities of grain products (including bread and flour), legumes, potatoes, etc., and such additional fats, spreads and seasoning as may be required to make the additional foods palatable and to insure their consumption, provided the cost of such increases will not cause the value of the rations for the station to be greater than the value of the garrison ration for the same month.

Measures were taken to correct problems that resulted from too much food (because prescribed in greater amounts than some organizations could consume, kinds of food that were not generally eaten, or due to variable attendance at the mess), and that created new problems. A plan introduced to correct variations in attendance was to issue rations in accordance with a count of the number of individuals who actually ate meals, combined with a percentage reduction in the number of rations drawn with increase in the size of the mess. This plan produced a situation in which some organizations would not have received sufficient food had the requirements of the directive been followed explicitly.[9]

With suitable adjustment at the camp or station level and the resourcefulness of the Army mess sergeants, the menu plan of field rationing in the United States generally supplied adequate and acceptable rations. Master menus were ultimately prepared in the Office of The Quartermaster General, with adjustments made at the corps area, camp, or station level. Medical Department officers, particularly food and nutrition officers at the various levels of command, especially corps area and camp or station, reviewed the adequacy of the quantities of food prescribed to prepare the menus and offered valuable suggestions with regard to changes and adjustment to particular conditions. Nutritional surveys were conducted from time to time to determine whether the soldiers were actually consuming an adequate dietary.

No special provision was made to assure an adequate dietary for troops subsisting on the garrison ration as suggested by The Surgeon General. One step in such a direction was the classification of foods into groups having roughly similar nutritive value and the suggestion that garrison ration accounts provide for nutritional as well as financial accounting of the food purchased with the garrison ration. All foods in nutritional accounts used were listed according to groups instead of only the more perishable foods. Such information reduced to a pound per man per day basis provided an excellent first approximation as to the adequacy of the food used. The foods prescribed in master menus were then classified and properly arranged and offered future possibilities for practical evaluation of the food provided for troops living on garrison rations.

At the end of the war the Army had a variety of rations, all of which met the nutritional requirements of the published basic dietary standards. They were the A ration, which was used in the Zone of Interior and which was made

[9] ASF Monthly Progress Rpt, Sec. 7, Health, 31 Aug 43.

up of the best fresh and canned food that it was possible for The Quartermaster General to procure. The quantity of food required was so enormous that it was necessary to limit the variety of choices of any given post in terms of the national supply. Hence, the War Department master menu was prescribed, the component parts of which were determined by food availability in the nation. The B ration was essentially the same as the A ration except that nearly all of its components were canned. It was used in communications zones and, as far as practical, in combat zones.

The C ration, K ration, and ten-in-one ration were designed for the various phases of an assault and were intended to be used only for short periods before adequate cooking facilities could be brought forward. It was thought that the K ration should be used in the early days of an assault where no facilities or time for preparation were available. In the next few days, the C ration, which required only heating, and could even be used cold, was indicated. In the next phase, where small groups could eat together, the ten-in-one ration was to be used and finally, when kitchens could be set up, the B ration was indicated.

In practice, however, because of the ease of issue, the lack of necessity for bringing up troop kitchens and other complicated requirements of more normal messing, commanders used these battle rations for much longer periods than that for which they were designed. In many instances the problems of supply necessitated such use. For that reason there was much discontent and often failure to consume the rations because of their monotony and lack of acceptability. The rations themselves were wholly adequate to maintain health and a high degree of combat efficiency when issued and consumed in sufficient amounts to cover the caloric requirements. The rations failed, however, in some campaigns. Most of the defects described were results of improper use rather than defects in the ration itself. From one point of view, these rations were too good because they did permit commanders to use them for too long periods of time.

Troops in training were fed the A ration. Commanders were urged to teach their men the value of eating properly and there is every evidence that this program was generally very effective. Careful nutrition surveys indicate that the American Army was, in fact, the best fed Army in the world and that the nutritional state of troops was far superior to that of American soldiers in previous wars. Also, surveys indicate that it was as optimal as it is possible to measure in our present state of nutritional knowledge.

As indicated above, the packaged rations were often used for excessive periods of time and the men frequently ate too little and lost considerable quantities of weight. Satisfactory procedure for supplying at least one hot meal per day to troops in actual combat in cold theaters were never well or generally developed. Some units were successful and others were not. It is apparent, from discussing this matter with infantry commanders, that success

was a result of the interest of the command. Many tests were devised to study this problem but none of them were satisfactorily carried out. Furthermore, it appeared to be the attitude of the Office of The Quartermaster General at times that combat feeding was one problem with one solution. It is apparent from study of the actual procedures used by units in the various theaters that there were many problems, depending upon the area in which the troops operated. In some cases, it was necessary to supply troops by night (Europe), and in others food could be supplied only by day (New Guinea). For security reasons some units were not permitted to make fires and in others the commanders stated that fire made no difference. There was general agreement among commanders that the morale value of at least one hot meal a day was of real importance in all theaters and that it is imperative in cold theaters.[10] This is one of the problems of the future which should not be overlooked.

Because of the emotional stress of battle, troops fail to consume the available food even when other factors, such as acceptability of the food, are satisfactory and lose weight during the very active stages of combat regardless of the ration they are fed. For that reason, the concept of rehabilitation feeding at the end of each active combat period developed in all theaters. Commanders gradually became aware that men could go for days or weeks on slightly inadequate rations provided that they were very well fed during their rest periods. This concept is of real importance and needs additional study.

At the beginning of the war, feeding on troop trains and troopships was very haphazard and men frequently received unsatisfactory meals. By the end of the war, largely as a result of the efforts of the Food Service Program in the Office of The Quartermaster General, troop train and troopship feeding was almost as satisfactory as garrison feeding. In general, the A ration was used for such activities.

There was much interest during the war in the matter of feeding Air Force personnel in flight, particularly at very high altitudes. Investigative work in high altitude chambers indicated that men could not eat at 30,000 feet because unconsciousness occurred as soon as the oxygen mask was removed. However, in practice, it was found that men did eat at such altitudes and that, almost invariably, they carried some kind of lunch in their pockets. The first real study of the problem was made by the nutrition officer of the Eighth Air Force in England. He found that men on bomber missions were happier, remained more alert, and came home less exhausted if they had something to eat while in flight. The first flight lunch which he designed consisted almost exclusively of small bits of candies and it was very well accepted.

This problem was also studied by a medical officer from the headquarters of the Second Air Force at an experimental laboratory, Smoky Hill Airbase,

[10] Wardlow, Chester: The Transportation Corps: Responsibilities, Organization, and Operations. *In* United States Army in World War II. Washington, Government Printing Office, 1951, p. 16.

Salina, Kansas. Here he studied not only the ability of men to eat at high altitudes on long flights but the effectiveness of food on their normal activities under such conditions. His work, also, indicated that food was desirable in flight, particularly for flights which exceeded 5 hours. His work bore out the contention of investigators of the Nutrition Foundation in New York that high carbohydrate diets were better for flight crews than high protein diets, but the differences were of small magnitude. In general, the nutrition requirements of men in flight are identical to those of ground troops and sea troops.

With the beginning of the bombing of Japan by B–29's, in which the duration of flight missions ranged from 8 to 20 hours, feeding of Air Force personnel in flight became imperative. Also, proper management of preflight and postflight feeding became more important. The men going out on long missions were under severe emotional strain and frequently did not eat well before the takeoff. After such missions men were frequently too tired to eat satisfactorily and the frequency with which such missions were flown sometimes resulted in a gradual decline in the nutritional state of personnel. For the above reasons, preflight and postflight feedings were carefully studied and adequate procedures worked out for them, particularly by the Twentieth Air Force. Records of their experiences and requirements will be found in the Office of the Air Surgeon. In general, in-flight feeding became satisfactory when properly made sandwiches, containing highly acceptable foods, plus hot drinks, were made available. Schedules were altered to permit proper feeding before takeoffs and the frequency of missions was altered to allow adequate rehabilitation after long flights. Feeding of relatively long-mission fighter pilots while in flight was not adequately solved.

OVERSEAS HOSPITAL RATION

In 1942, in connection with the development of expeditionary menus for temperate, tropical, and frigid climates, the medical staff at Headquarters Army Ground Forces suggested that provision should be made for the patients in hospitals. As a result, 10-day rations were planned for regular, light, soft, liquid, and special diets for overseas hospitals. Maximum use was made of foods in the Expeditionary Menu No. 1 (revised 1 June 1942) and No. 2 (revised 27 August 1942). With suitable changes in quantity or the addition of supplementary foods it was possible to provide a reasonably satisfactory diet for patients. It was assumed that hospitals would have the first chance at satisfactory perishable foods whenever available. There were basic menus related to the food supplied. It was assumed and suggested that there could or should be changes in the use of foods in different hospitals.

Data with regard to the preparation of the different types of diets to be expected were not available. There were no records of hospital diets used or methods of providing for hospitals in the history of World War I. As the

result of suggestions from Walter Reed General Hospital, Washington, D. C., a percentage distribution of diets was made for purpose of procurement and issue, as follows:[11] regular diets, 85 percent; light diets, 3 percent; soft diets, 6 percent; liquid diets, 4 percent; and special diets, 2 percent.

Copies of the overseas hospital menu were prepared and distributed by The Quartermaster General to port commanders for reproduction and issue to all outgoing task force shipments. This method of distribution was not entirely satisfactory because there was insufficient indoctrination of personnel in the subsistence offices and hospital personnel in the field. Until indoctrination was accomplished and special items reached the hospitals, results were rather unsuccessful. In some instances, especially where some local foods were available, special plans had been developed previously and there was difficulty in obtaining sufficient interest to give the plan a trial.

The emergency combat rations, C, K, and ten-in-one, proved to be inadequate for sick and wounded soldiers at clearing stations and evacuation hospitals. They were dehydrated rations, in part, and it was difficult to make acceptable liquid and soft diets from them. For that reason two ration supplements were standardized. The first was an aid station beverage pack and consisted of soluble coffee, tea, soup, and fruit juices to make hot drinks for men wounded or in shock. The requirement for it developed in the theaters of operations and many supplements of this sort were used before the official standardization of the pack in 1944. The second pack, the hospital ration supplement, consisted of components for making liquid and soft diets from the C ration and the ten-in-one ration. It contained soups, fruit juices, additional beverages, and some cereal components. To supplement this pack, some investigative work was done in the Medical Nutrition Laboratory in Chicago by the dietetics branch which developed a wide variety of acceptable diets that could be made from the packaged rations plus the hospital supplement. These diets may be found in the records of the Medical Nutrition Laboratory.[12]

There were several other types of Army food, sometimes erroneously called "rations," which were to be used for special purposes and in the event of severe emergencies. They were not rations in the true sense because they did not contain adequate nutrients for a soldier for 1 day. Examples of these are the D bar which was a type of chocolate bar, the Air Corps flight lunch which was a box of mixed candies, the parachute ration which was a small packaged ration equal to approximately one-third of the K ration, the life raft

---

[11] Ltr, QMG to Port Comdrs, 25 Nov 42, sub: Overseas hospital ration menu, with incl. SG: 430.1 Boston.

[12] Rpt, Med Nutrition Lab, 1 Sep 45, sub: Project MNL-3, Hospital special diet modified from expeditionary forces ration. AFML.

ration which appeared in at least five forms, made up mostly of candies and raisins, and a number of others. None of these emergency type, lifesaving rations was satisfactory but their use for the purposes for which they were designed turned out to be infinitesimally small, so the deficiencies in them were of little importance.

At the end of the war representatives of the Office of The Surgeon General, Office of The Quartermaster General, Army Air Forces, and Army Ground Forces met in Chicago on 17 August 1945 to determine the direction which research should take in the future with regard to pure emergency, survival type rations. It was generally agreed that a survival ration should be a part of the equipment of each soldier, just as a first aid pack is a part of his basic equipment. It was agreed that this ration should contain not less than 25 percent of the probable emergency requirements of a soldier for 1 day and that it should be packaged in a watertight container which would fit into a pocket of the soldier's uniform. No consideration need be given to vitamin content because vitamin deficiencies are not a consideration in an acute, lifesaving type of ration. Since most of the use of such a ration is by Army, Navy, and Air Force troops lost at sea, arrangements were made to include apparatus which would supply 800 cc. of water daily with the ration. Careful analysis of all available data indicated that less than 0.05 percent of the troops would ever be required to use such a ration for a period in excess of 48 hours. It was agreed that food was not essential for the maintenance of life in such a short period of time but that its morale value was worthwhile.[13]

NUTRITION SURVEYS

Throughout World War I, the interval of peace, and up until the middle of 1944 there was a strong feeling on the part of the Subsistence Division, Office of The Quartermaster General, that if a nutritionally adequate diet was supplied it naturally followed that men consumed an adequate diet. The Food Division, Office of The Surgeon General, in World War I and the Nutrition Division, Office of The Surgeon General, in World War II have correctly insisted that an appraisal of the dietary of the Army must be on an "as consumed" basis if nutritional adequacy is to be determined. The nutrition officers began early to conduct nutrition surveys of the adequacy of the diet as consumed and indoctrinated troops and commanders in the importance of this concept. This is a proper function of The Surgeon General and supplies essential data to Subsistence Division, Office of The Quartermaster General, upon which to base food procurement.

[13] Interim Rpt, QMC Subsistence Research and Development Lab, Aug 1945, sub: Survival rations: a critical review. HD: 720.1.

The nutritional state of troops is an important part of the general responsibility of The Surgeon General for the preservation of health and the prevention of disease. It is also of paramount importance to commanders because it determines much of the fighting efficiency of combat troops. One of the reasons for the reorganization of the Nutrition Division in the spring of 1944, placing at its head a medical officer, was to implement The Surgeon General's responsibility in the maintenance of an optimal nutritional state in all troops. This is a medical officer's job because it requires a physical examination and in some instances a laboratory study of certain body tissues.

Nutrition surveys of messes, lasting from 7 to 10 days, were conducted in various camps and stations for periods usually of 30 days, to supply information on the nutritional adequacy of the food consumed by the soldier as compared with that planned or issued. The factual data obtained gave confidence in the rationing procedures or brought out difficulties and served as a sound basis for recommendation. Particular attention was given to the selection and handling of food because the maltreatment of food in storage, cooking, and serving or the failure on the part of the soldier to consume food because of dislike or poor preparation could render an originally adequate dietary inadequate. Lacking actual data on losses of vitamins in such procedures, such data were obtained through the Office of Scientific Research and Development for the losses under good, poor, and very poor conditions of storage and preparation characteristic of the Army. Corrections were then applied to the calculation of nutritional content of the dietary in accordance with the methods used in a kitchen or with the average of Army methods.

Nutritional surveys had a secondary and often very useful purpose under conditions where the causes of apparent difficulties were hard to detect or where there was some uncertainty as to the success of messing operations. This was true because, in the course of collecting data, food and nutrition officers were in constant contact with the personnel of a mess and were usually able to gain their confidence and thus obtain a background to the problems confronting the mess that was not possible on inspection with its usual formality.

Surveys were made by food and nutrition officers before and upon completion of their training and before assignment and afterwards when required in the course of their duties. A simultaneous survey of 99 Ground Force organizations was made in June 1943,[14] when it appeared that the plan of determining the number of rations to be drawn might result in an inadequate dietary for some organizations if followed as prescribed. A second simultaneous survey was conducted in 1945.

---

[14] (1) Howe, P. E., and Berryman, G. H.: Average food consumption in the training camps of the United States Army, 1941–1943. Am. J. Physiol. 144: 588–594, Sep 1945. (2) See footnote 9, p. 96.

The early surveys in 1941 [15] represented roughly the concept of Army personnel with regard to the kinds and quantities found required for a satisfactory dietary based on experience with the garrison ration and information in technical manuals at that time. Subsequently the use of the master menu prepared by the Quartermaster General's Office tended to modify slightly the choice of foods. The chief differences in the quantities of food consumed in 1941 and subsequently were that in the later period there were less meats and citrus fruit and greater quantities of all other classes of food, particularly sugar, cereal grains, and potatoes.

The various types of organizations or units surveyed had a wide range of duties and levels of activity. They included infantry, artillery, cavalry, quartermaster, military police, ordnance, engineering, medical, air, chemical warfare, tank, induction center troops, and others. The number of each type of unit differed widely (from 1 chemical warfare unit to 77 infantry units), and the caloric value of food consumed likewise differed over a wide range (from 3,132 for 5 induction centers to 4,135 for 3 demolition units). The average caloric value of the food consumed in the average mess, when properly weighted, was almost 3,700 calories (3,694) by calculation. This agrees closely with the estimate reported by Murlin and his associates [16] during the last war (3,633). As was also observed in World War I reports, the calculated caloric value of food consumed in the ordinary mess rarely lies outside the range of 3,000 to 4,000 calories.

The data examined in terms of seasons gave results that are again similar to those reported in 1919. The caloric intake was highest during the fall (September-November, 3,960 calories), dropping in the spring (March-May, 3,570 calories) and rising slightly during the summer (June-August, 3,790 calories). The observation by Murlin that seasonal variation caused no more than a 400 calorie deviation (in food consumed in the mess only) is corroborated by these data.

The simultaneous surveys carried out in 99 messes at 38 Ground Force stations during the first week of June 1943, represented approximately 130,000 rations consumed. They included a study of: the food planned and consumed; the number of men present for rations (rations due); rations drawn; average number of men eating (the basis on which rations were drawn according to War Department Circular 16, 1943); table waste, i. e., food left on plates and total edible waste; the cooking and standing time for classes of food that might be seriously affected in nutritional value by long cooking and standing.

---

[15] (1) Howe, P. E.: Nutritional problems of the Army. Mil. Surgeon 90: 253–266, Mar 1942. (2) Howe, P. E.: The dietaries of our military forces. Ann. Am. Acad. Polit. & Social Sc., Jan 1943, pp. 72–79. (3) Howe, P. E.: Effect of recent developments in nutrition on the rationing of the Army. Connecticut M. J. 6: 157–161, Mar 1942.

[16] Murlin, J. R., and Hildebrandt, F. M.: Average food consumption in the training camps of the United States Army. Am. J. Physiol. 49: 531–556, Sep 1919.

Table 1 presents composite data on the quantities of food consumed, and wasted, by classes of food having similar nutritive value.[17] "Food consumed" represents the average amounts of food eaten in the mess. It does not include waste. The data on waste refer to the quantities of edible food fit for human consumption but not eaten by the soldier, or prepared or discarded in the kitchen. The food waste has been corrected to the equivalent original form, i. e., as purchases, for the purpose of comparison. (The data on waste of individual classes of food represent averages of averages. Such data might be open to serious question because of irregular weighting. It is justified here due to the fact that the kinds and amounts of food and the size of organizations were similar.) Edible table waste is the waste of food, corrected to its purchased form, taken on the soldier's plate and not consumed. Total edible waste, including this waste and all other edible food prepared or discarded, was 0.39 pounds per man per day.

Table 2 is based upon the June 1943 survey of 99 messes and relates to the extent of overcooking or preparation or standing before serving the foods that

TABLE 1. AVERAGE QUANTITIES OF FOOD CONSUMED IN ARMY MESSES (AS DETERMINED IN 455 MESSES DURING 1941–43)

Food groups	Consumed (pounds per man per day)	Percent edible waste*
Meat, fish, and poultry	0. 909	7. 5
Eggs	. 149	6. 2
Milk and milk products (fluid milk equivalents)	1. 016	1. 6
Fats, butter, and spreads	. 083	. 7
Fats, other	. 069	4. 5
Sugar and syrups	. 262	1. 0
Cereals and grain products	. 567	11. 1
Beans; other legumes, dry; nuts, dry	. 055	10. 5
Vegetables, leafy green or yellow	. 359	16. 4
Tomatoes	. 155	3. 5
Citrus fruits	. 248	1. 3
Potatoes	. 561	12. 9
Vegetables, other than leafy green or yellow	. 252	10. 8
Fruits, other than citrus	. 358	2. 0
Fruits, dried	. 026	4. 7

*$\frac{\text{Average edible food wasted in messhall and kitchen}}{\text{Average total edible food issued to organization}} \times 100$.

Source: Howe, P. E., and Berryman, G. N.: Average food consumption in the training camps of the United States Army, 1941–1943. Am. J. Physiol. 144: 588–594, Sep 1945.

[17] See footnote 14 (1), p. 96.

TABLE 2. OBSERVATIONS ON LENGTH OF TIME TAKEN IN PREPARING OR COOKING FOOD AND ON STANDING TIME

Type of food	Preparation or cooking time				Standing time (percent standing more than half hour)
	Nominal allowance in hours	Percentage requiring			
		Less than 1 hour	1 to 2 hours	2 or 3 hours	
Meats	2	60	0	40	62
Vegetables, leafy green or yellow	1	31	43	26	76
Salads	1	8	17	75	100
Potatoes	1	24	61	15	27
Vegetables, other	1	52	15	33	61

Source: Howe, P. E., and Berryman, G. H.: Average food consumption in the training camps of the United States Army, 1941-1943. Am. J. Physiol. 144: 588-594, Sep 1945.

result in serious destruction of vitamins. The period of "ample cooking or preparing time" is an arbitrary value which may be longer than desirable.

The data on rations drawn were studied in relation to the caloric content of the food planned and consumed. They were divided into two groups as follows:

1. Messes that consumed less calories than were planned. In this group 63 messes consumed an average of 3,440 calories against 3,710 calories planned. They had an average attendance of 161 men and drew 171 rations (10 extra rations per day). The latter represents 106 percent of the attendance. The attendance was 86 percent of the morning strength report. There was 0.15 pound edible table waste and 0.36 pound total edible waste. In addition to the above there were 19 messes that drew fewer rations than indicated by the attendance. These messes consumed 2,780 calories against 3,620 calories planned. They had an average attendance of 176 men and drew 169 rations representing 96 percent of the morning strength report. There was 0.13 pound edible table waste, 0.24 pound total edible waste.

2. Messes that consumed more calories than were planned. In this group 15 messes consumed 3,940 calories against 3,690 calories planned. They had an average attendance of 158 and drew 180 rations (22 extra rations per day), representing 120 percent of the attendance. The average attendance was 77 percent of the morning strength report. There was 0.17 pound edible table waste, 0.30 pound total edible waste. Two organizations in this group drew less rations than the number of men eating.

The general conclusions to be drawn from these data are as follows:

1. Organizations drew more rations than they were entitled to according

to War Department Circular 16, 1943, when followed exactly. In 17 percent of the cases extra food was needed if the caloric intake can be taken as an index of the requirements of the messes. On the average, the organizations were receiving barely enough food for their needs if the rations were drawn according to regulations. In no case were more rations drawn than represented by the number of rations to which the organizations would have been entitled according to the number of men present for rations without the deductions made for strength according to Army Regulations (AR) 30–2210.

2. The total edible waste was fairly high, 0.32, approximating the waste in 1917–18, 0.38 pound per man per day. It is possible under very close supervision to reduce edible waste as it is prepared to 0.1 pound per man per day or even less. Table waste was approximately 50 percent of the total edible waste, indicating that the soldier in his eating habits is not more wasteful than the kitchen personnel. That is, waste that occurs to a considerable extent occurs in the administration and preparation phases of mess operation. Waste did not bear a marked relation either to caloric intake or the excess number of rations drawn. It is obvious, however, that if more perishable food is issued or excessive quantities prepared than can be consumed there will be more waste. Excess issue of staple foods should not have as great effect on waste as perishable foods since the former can be stored for future use or returned to the sales officer. There were indications that the relatively high waste of vegetables was needlessly cutting into civilian supplies of vegetables through a lack of local administration of supply and planning of menus in relation to the dietary habits of the troops.

3. The caloric intake showed a considerable range and varied from approximately 2,774 to 4,644 calories. The average caloric consumption, 3,468 calories, was less than the soldier had been consuming in previous surveys (4,100 calories supplied and 3,888 calories consumed in 1941–42, and 3,900 calories supplied and 3,633 calories consumed with approximately 365 calories in the post exchange in 1917–18). Since the ration was usually planned for the average of a station, some organizations will require less and some more food. This means that food, particularly the staple energy foods, should be distributed according to the needs of the various organizations or additional quantities of these foods be made available to organizations that need them. The differences between caloric intake observed, in relation to past experience, indicated that the soldier may depend upon the food eaten outside the mess to complete his caloric requirements. Troops were less active than they were formerly, or they ate more food in the past than was required. It is not possible from these data to determine which factor or factors were operating. There was considerable use of excess water and overcooking and the service of food was delayed to such an extent

that serious losses were occurring in the labile vitamins and soluble minerals, which tend to invalidate the careful planning of rations.

A comparison of the food issued and consumed by Negro soldiers as compared with white troops indicates that the consumption of the two sets of soldiers was essentially the same.

Material was developed to aid food and nutrition and Medical Department officers in the evaluation of rations, including data on food consumption. The general principles of an adequate acceptable dietary were prepared in mimeograph form and distributed, and finally published in War Department Technical Bulletin (TB MED) 23, 23 March 1944. A rapid, fairly accurate method of determining the approximate nutritive value of dietaries was developed from the experience of the Bureau of Nutrition and Home Economics, United States Department of Agriculture.[18] The weighted average composition of roughly similar classes of foods was represented in tables. It was only necessary to apply the values to the weights of particular classes of food as used or provided. Distributions of food were studied for the fall-winter and spring-summer periods of the year. The tables proved to be very useful and these percentages were used in weighting the composition of the various classes of food. Tables for classifying foods and factors for conversion of unit packages to pounds for use in dietary analysis of rations were also developed and published in TB MED 25, 28 March 1944. The use of the per capita consumption of the various classes of food which follow a given food pattern in relation to the per capita consumption of a given mess may also be used as a first approximation of adequacy of dietaries or rations.

Motorized troop energy expenditure in all varieties of tanks, and to a limited extent also for artillery troops, was determined at Fort Knox, Kentucky. Many universities doing experimental work for the Army made contributions. Much of these data were brought together and summarized by the Chief, Chemical Section, Armored Medical Research Laboratory, and his report was made available to The Surgeon General and to The Quartermaster General.

At the end of 1944 it was possible to make reasonably accurate estimates of the caloric requirements of troops in all kinds of activities and to arrive at a reasonably, properly weighted estimate of a mean value which was applicable to the whole Army. To support this evidence another simultaneous nutrition survey of the actual food intake of troops at a large number of camps scattered over the entire United States was made in the spring of 1945.[19]

---

[18] (1) Berryman, G. H., and Chatfield, C.: A short method of calculating the nutritive value of diets. J. Nutrition 25: 23–37, Jan 1943. (2) Berryman, G. H., and Howe, P. E.: A short method of calculating the nutritive value of diets. J. Nutrition 27: 231–240, Mar 1944. (Erratum p. 434, May 1944.)

[19] Rpt No. 36, Med Nutrition Lab, 5 Apr 48, sub: Simultaneous survey of food consumption in various camps of the United States Army, 22–28, May 45. AFML.

Table 3 shows the average quantities of the various food groups consumed in the mess per man per day during the period under survey; for comparative purposes, food consumption figures as reported in 1943 by Howe and Berryman [30] are shown in column 2 of this table. In order to determine the nutritional adequacy of the food consumed it was necessary to estimate not only the amounts of food prepared but also the amount of each food item wasted and subtract the nutrients contained therein from the nutrients in the food prepared. To obtain data on food wastage, all plate waste was segregated by food groups and weighed, and all kitchen waste was also segregated and weighed. The range of food wastage in the different messes was from 0.08 pound to 0.66 pound per man per day, resulting in an overall average of 0.24 pound of edible food per man per day or approximately 5 percent of the food issued by the Quartermaster Corps. This figure, as compared with an average edible food waste of 0.38 pound per man per day reported in 1919, 0.3[illegible] pound per man per day in 1941, and 0.32 pound per man per day in 1943, in[illegible]the creditable strides made by the Army in food conservation.

TABLE 3. AVERAGE QUANTITIES OF FOOD CONSUMED IN 44 ARMY MESSES DURING THE PERIOD 22–28 MAY 1945

Food groups	Pounds consumed per man per day	
	1945	1941–43*
Meat, fish, and poultry	0. 834	0. 909
Eggs	. 165	. 149
Milk and milk products (fluid milk equivalents)	1. 260	1. 016
Fats, butter, and spreads	. 070	. 083
Fats, other	. 044	. 069
Sugar and syrups	. 280	. 262
Cereals and grain products	. 512	. 567
Beans; other legumes, dry; nuts, dry	. 036	. 055
Vegetables, leafy green or yellow	. 302	. 359
Tomatoes	. 162	. 155
Citrus fruits	. 332	. 248
Potatoes	. 562	. 561
Vegetables, other than leafy green or yellow	. 248	. 252
Fruits, other than citrus	. 211	. 358
Fruits, dried	. 028	. 026

*For comparative purposes, average food consumption in Army messes as reported by Howe and Berryman in 1943, Am. J. Physiol. 144: 588–594, Sep 1945.

Source: Rpt No. 30, Med Nutrition Lab, 5 Apr 1948, sub: Simultaneous survey of food consumption in various camps of the United States Army, 22–28 May 1945. AFML.

[30] See footnote 14 (1), p. 96.

During this study, data were also obtained on messing practices, i. e., total elapsed preparation times. The methods of cooking and preparation of food were satisfactory in the majority of messhalls. In some instances, however, improper preparations and cooking practices were employed, resulting in lowered nutritive value of the food consumed. The most common infraction of good cooking practices was poor timing of food preparation: meat was cooked and salads prepared too far in advance. Another factor, also having bearing upon the amount of food left over, and wasted, was the overdrawing and underdrawing of rations. A comparison was made of rations drawn with the number of men actually fed, based on head counts made by each nutrition officer and a compilation of rations drawn. Of the messes surveyed, 79 percent overdrew rations and 20 percent underdrew rations. Overdrawing rations to the extent of 5 percent was the average for the 44 messes surveyed.

The approximate nutritive value of the food consumed for the period is shown in Table 4. It will be noted that the quantities of essential nutrients as calculated are liberal, and exceed, in every instance, the National Research Council's recommended dietary allowances for moderately active men.

TABLE 4. CALCULATED NUTRITIVE VALUE OF AVERAGE FOOD CONSUMED PER MAN PER DAY AS DETERMINED IN 44 ARMY MESSES DURING THE PERIOD 22–28 MAY 1945

Nutrients	Consumed	Standard Deviation	NRC*
Calories	3, 744	299	3, 000
Protein, gm	127	11	70
Fat, gm	181	28	----
Carbohydrates, gm	411	54	----
Calcium, gm	1. 3	. 2	. 8
Phosphorus, gm	2. 2	. 2	----
Iron, mgm	23. 3	2. 1	12. 0
Vitamin A, I. U	10, 042	1, 960	5, 000
Thiamine, mgm	1. 6	. 2	1. 5
Riboflavin, mgm	2. 9	. 4	2. 0
Niacin, mgm	23. 0	2. 4	15. 0
Ascorbic acid, mgm	89. 0	12. 6	75

*1945 National Research Council recommended daily allowances for a moderately active man.

Source: Rpt No. 36, Med Nutrition Lab, 5 Apr 48, sub: Simultaneous survey of food consumption in various camps of the United States Army, 22–28 May 45. AFML.

The various organizations and units surveyed were of widely different composition and had a broad range of duties and levels of physical activity. Included were artillery, cavalry, engineer, infantry, medical, military police, quartermaster, signal, tank transportation, replacement center, and miscel-

laneous troop units. The average caloric value of food consumed by the various types of units ranged from 3,471 calories for 2 basic training units to 4,078 calories for 2 quartermaster units, with a total average of 3,744 calories per man per day. These figures, when considered in terms of the strength of the various units, indicate there was no significant variation of the average caloric intake with degree of activity of troops. The estimated average caloric intake (3,744) agrees closely with the estimate of the previous simultaneous survey in World War II in 1943 (3,694) and with Murlin and his associates in World War I (3,633). The observation by Howe and Berryman that the calculated caloric value of food consumed in the mess rarely lies outside of the range of 3,000 to 4,000 calories was corroborated by these data.

Similar surveys were made in isolated camps periodically throughout the war. Nutrition surveys of the actual food consumption of carefully selected representative samples of troops in most of the larger bases of the Pacific theater were made in the spring and summer of 1945. In the summer of 1944 a controlled experiment was carried out in the Tarryall Mountains at Camp Carson, Colorado. Its primary purpose was to test ration acceptability but at the same time very precise records of the actual caloric intake of troops were maintained. These troops (a battalion of infantrymen) were on very rigid advanced infantry training.

There was good, general agreement from all of the sources of information concerning the caloric intake of American soldiers and it was, therefore, possible to write a prescription for the diet of the Army based upon scientific appraisal of soldier requirements.[21] There may appear to have been some unnecessary delay in getting this prescription written but as a matter of fact much of the information was used informally by The Quartermaster General in setting up both the master menu of the A ration and the components of the various expeditionary forces' rations for many months before the official prescription was published. The errors in diet construction were always on the high side prior to the publication of these standards.

A national food shortage and the tremendous food requirement of Europe and the Orient were in part responsible for the publication of this diet at the relatively low level of 3,600 calories. Previous to this time all of the rations of the Army ranged from 3,750 calories up to over 4,500 calories.

The content of other nutrients which go to make up a diet were arrived at by using the National Research Council standards as a guide but lowering the amounts to what was deemed to be safe but satisfactory levels after carefully studying nutrition survey data in many parts of the world. For example, it will be found that the thiamine requirement of the Army ration is considerably lower than that of the National Research Council. The Army figure was arrived at by studying troops in the Pacific who had lived on a B ration, much

[21] WD Cir 33, 5 Feb 46.

lower in thiamine content than the requirements of the National Research Council, for a period of over 2 years and showed no detectable evidence of thiamine deficiency. The same applied to the other components of vitamin B complex. The figures actually used were also supported by experimental data, particularly that from the University of Minnesota [22] and by information obtained from other investigators.

It was the opinion of the officers of the Nutrition Division, Office of The Surgeon General, that a single dietary standard for the Army was a fallacious concept and that the various components of the Army should be fed in the terms of their physiologic needs. Such a procedure would call for a diet of nearly 5,000 calories in some engineering organizations and for approximately 2,500 in many headquarters. However, the administrative mechanism for handling such a plan was not well worked out. Although covered in effect in War Department Circular 208, 13 September 1943, the new concept was never put into effect except as a trial proposition in the feeding of prisoners of war. The actual dietary prescription was a mean value which could be raised or lowered by local commanders with Medical Department approval.

Realizing that under certain circumstances rations may be inadequate because of the inability of troops to consume them or to get all of the normal components, policies were written permitting the supplementation over and above the basic standards as required—the requirement being determined by Medical Department officers.

PRISONER OF WAR FEEDING

Providing food for German prisoners of war in the Zone of Interior created many problems. If the number of prisoners had been small the feeding problem would have been of minor importance. But on V–E Day there were between 300,000 and 400,000 prisoners of war distributed in main and branch camps in the Zone of Interior. The first prisoners of war were received in the United States in May 1942. Their presence in the Zone of Interior posed many questions of feeding. The most important was how much and what items of food should be used in the dietary of the German prisoners of war. Answering this question required the interpretation of that part of the Geneva Convention article pertaining to the feeding of prisoners of war. The Geneva Convention reads, "The food ration of Prisoners of War shall be equal in quantity and quality to that of troops at base camps." The obvious way to conform to this was to feed prisoners the same items and amounts of food as American troops received.

So, from 1942, when the first German prisoners of war were received until 1944 when the first directive on prisoner of war feeding was issued, German

[22] Keys, A.: Human starvation and its consequences. J. Am. Dietet. A. 22: 582–587, Jul 1946.

prisoners were fed approximately the same ration as American troops or, namely, the foods listed on the service command menu for troops.

The first circular on prisoner of war feeding was published 1 July 1944.[23] This circular was not very forceful. Some of the pertinent provisions contained therein were:

> . . . . In no case will the issue of critical or rationed items exceed quantities stipulated in the Office of The Quartermaster General master menu. . . .
>
> * * * * *
>
> . . . . The menu board may find it necessary to alter the percentage of increases, decreases, or the deletion suggested, based upon experiences in feeding the prisoners in their particular camp. If, for example, it is known that prisoners will consume the regular post menu issue of apple butter, beets, carrots, or tomatoes without waste, the regular issue should be made. The value of the garrison ration must not be exceeded, however. . . .

Thus, it can be seen that no restrictions of consequence were made. As long as the prisoner of war menu did not exceed the value of the garrison ration or the amounts of rationed items on the Office of The Quartermaster General menu, it was satisfactory. Also, it can be seen that in some instances prisoners of war could be fed a ration equal or greater than that of United States enlisted men. This was found to be true in some cases. In 1945 four circulars on prisoner of war feeding were published, namely, Army Service Forces Circulars 39, 72, 150, and 191. Parts of the first three circulars were in effect at the same time; this caused confusion.

It can be safely said that serious, effective attention on a wide scale was never given by anyone to the maximum usage of noncritical foods in prisoner of war feeding until the following occurred: First, the Allied armies overran prison camps in Germany and found in them starving, malnourished prisoners of war, Americans and others; second, civilians in the United States protested vigorously when they learned through newspaper accounts and radio commentators that the German prisoners of war were being fed a diet luxurious in comparison with the one they (housewives) could provide for their families. Response by the War Department to the foregoing protests was immediate: All agencies involved in feeding the prisoners of war were instructed to cut the use of civilian-scarce food to a minimum and to substitute civilian-plentiful food. The Geneva Convention was reinterpreted by joint agreement of the Office of The Surgeon General, Office of The Quartermaster General, and Office of The Provost Marshal General, with concurrence of the Commanding General, Army Service Forces, as follows: The word "equal" does not mean "identical," therefore, if American troops were fed 100 gm. of protein in the form of grade A beef, while German prisoners had to be fed the same amount of protein, it did not have to come from the same part of the carcass. Furthermore, while troops

[23] WD POW Cir 35, 1 Jul 44.

were authorized from 3,600 to 4,000 calories per day their actual consumption was a function of their energy requirements (the work they did) and might be considerably lower than the authorized figure. It was, therefore, agreed to feed prisoners of war in terms of their energy requirements and to feed them low-cost nonrationed foods which were nutritionally adequate, as determined by accepted American standards. (See Army Service Forces Circular 235, 1945.)

In haste, as a stop-gap measure, Army Service Forces Circular 150, 27 April 1945, was written, principally by the Office of The Quartermaster General, and dispatched to the field accompanied by a menu guide for prisoners of war. This circular and menu required that use be made of the following or similar items: pig's snouts, pig's feet, pig's tails, green bones, hearts, and similar items of meat in amounts not to exceed 4 ounces per man per day (this did not mean inedible meat), bread in amounts up to 130 pounds per 100 men per day and flour in addition. They would not eat this much bread. No substitutions were permitted. This resulted in a sad state of affairs: (1) The items specified in the menu could either not be obtained at all by market centers or in only limited quantities, (2) inability to obtain the foregoing items resulted in an inadequate diet, and (3) some thought the dietary standards were too low when, as a matter of fact, this was not the trouble—the trouble was in the unavailability of foods and a poorly planned menu. Soon there were reports of prisoners of war fainting on the job, inability to meet established work quotas, and loss of weight. Then the public again bombarded the War Department, this time the letters stating, in effect, that to starve the Germans was to lower ourselves to the same level as the Germans who starved their American prisoners in Germany.

At this point, a joint meeting of representatives from the Office of The Quartermaster General, The Surgeon General, and The Provost Marshal General was held to consider what could be done to feed the German prisoners a nutritionally adequate diet with noncritical items of food. This meeting was called by the Office of The Quartermaster General. It marked the first time that joint consideration by all interested agencies was given to the prisoner of war feeding problem. Preceding this first meeting most of the directives on prisoner of war feeding had been written by the Office of The Quartermaster General with the approval of The Provost Marshal General. In this joint meeting several decisions were made:

1. To have teams make brief surveys of the status of prisoner of war subsistence—the teams to consist of representatives of The Surgeon General, The Quartermaster General, and the Director of Food Service from the headquarters of the service command in which the surveys were conducted or, namely, the First, Second, Fourth, Fifth, and Sixth Service Commands;

2. To have a committee review existing directives on prisoner of war feeding and to formulate recommendations concerning them; and

3. To have a committee make a survey of previous surveys of prisoner of war feeding and to render a report thereon.

There were, therefore, three committees at work simultaneously: (1) the survey teams at work in the service commands; (2) the committee to review existing regulations; and (3) the committee to review reports of previous surveys, which had been conducted by both nutrition officers and food service officers. The findings of all these committees were briefly as follows: The committee surveying prisoner of war camps in the Zone of Interior found, in general, noncompliance with the existing directives. The committee which studied existing directives found that specificity was lacking and the mere existence of such a large number of directives confused the officers in the field responsible for implementing the directives. The report of the committee to review previous surveys revealed that the findings of the committee working in prisoner of war camps merely substantiated previously reported findings. These committees brought to a focal point conditions of long standing pertaining to prisoner of war feeding. Not of minor importance was the sale of scarce food items not available to the civilian public from the post exchange to German prisoners.

The second joint meeting of representatives of the interested agencies was held to discuss the results of the survey and to map out the general plan for a single new directive to supersede all existing directives. The real problem was one of policy on nutrition standards for prisoners of war. The Office of The Surgeon General contended that the terms of the Geneva Convention article were met when the standards of the National Research Council were attained and that prisoners of war should be fed according to their degree of activity. These two contentions were upheld and became a part of the directive, Army Service Forces Circular 191, 29 May 1945.

The directive stated specifically the duties of all concerned with the feeding of German prisoners of war. Some of the more important duties to be discharged by the Medical Department through nutrition officers in conformance with Army Service Forces Circular 191 were: to assist in the formulation of a service command prisoner of war menu; determination of the caloric expenditure of energy by prisoners of war—the results would indicate to the sales officer the amounts of food to issue; and frequent inspection of feeding and sanitation. The provisions of this circular were carefully worked out and, with a few exceptions, proved satisfactory.

The Nutrition Division, Office of The Surgeon General, published a set of criteria by which prisoner of war camps could estimate the caloric requirements of troops and by the simple process of periodic weighing could determine the adequacy of the ration issue.

It should be made clear here that the key to feeding the prisoners properly with food not in short supply was a well-planned menu composed of food

procurable by market centers in proper amounts. Procurement of food items not commonly used in GI rations was very difficult, as aforementioned, for market centers to effect. For example, to procure enough pig's tails to make one issue of them to German prisoners of war was an almost insurmountable task, particularly when the number of German prisoners of war to be fed was large. Many items of this sort were never used; instead other meats (non-rationed) such as fish, bologna, et cetera, were issued. There was a lag period between the time when the circular was written and when procurement could be effected. As soon as procurement "caught up" with the circular the plan devised jointly by the Office of The Surgeon General, the Office of The Quartermaster General, and Office of The Provost Marshal General worked satisfactorily.

Everyone who assisted in writing the directive was cognizant of the fact that the circular could not possibly be perfect. In order to find out as soon as possible its faults and to correct them a study was to be conducted in prisoner of war camps by a survey team planned as soon as Army Service Forces Circular 191 was put into effect. The teams consisted of representatives from the Office of The Surgeon General and the Office of The Quartermaster General. Surveys were made and reported but the number of recommendations was small. V–J Day occurred before action could be taken on these recommendations. V–J Day had an immediate effect on the whole outlook of prisoner of war feeding inasmuch as plans were made at once for the return of the entire number to Germany by March 1946.

A record to indicate what the German prisoners of war needed, on the average, is as follows: a ration providing 3,400 calories was usually sufficient; a ration providing as much as 4,000 calories was permitted for prisoners of war laboring in lumber camps, in beet harvest, or in other arduous work whenever it was determined by the proper medical authority that there was a need for it; a low-calorie ration, 2,500 calories, was issued to those German prisoners of war who refused to work. To some it may seem that the German prisoners of war were overfed. The fact that they afforded the primary source of labor in Army camps, harvest fields, pulpwood mills, and other locations should not be overlooked when considering whether prisoners of war were fed too liberally. To produce efficient work any personnel must be well fed and it was on this hypothesis that the Office of The Surgeon General recommended feeding of a ration equal calorically to the caloric expenditure of energy.

CIVILIAN FEEDING IN LIBERATED AND OCCUPIED AREAS

With the cessation of hostilities in Germany it became the duty of the Army to maintain law and order and to prevent the spread of disease. The

food problem in Europe was acute. The Office of The Surgeon General supplied five nutrition survey teams for the purpose of appraising the nutritional state of the civil populations in the occupied countries. The purpose of this appraisal was to determine the minimum food requirements for all groups of the population. It was believed that only by this technique could the inadequate supply of food be distributed equitably in the best interest of the Army, and also the quantity of food available through all sources, including the black market, be estimated. Invariably, actual measurement of people showed 500 calories more food intake than agriculture supply surveys indicated was available. Failure of populations to lose weight proved the correctness of the survey findings and saved millions of dollars in rations. By 15 August 1945 more than 40,000 people had been examined in Germany. This group was a carefully selected miniature sample of the population of 20 of Germany's most important cities. A similar procedure was planned for Japan, provided the food supplies of that country were inadequate to meet the needs of the occupying forces. There was no effort to supply an optimal diet to these people but rather to supply a diet which would prevent civil unrest, the spread of disease, and would allow the civil populations to carry out such work as might be necessary for the effective running of the country by American forces. Further details of this program and the nutritional state of civil populations in occupied countries will be found in another volume in this series.

REGIONAL FOOD HABITS AS RELATED TO FOOD ACCEPTANCE

Food acceptance is tied up with many factors which are largely psychological—the strongest is probably the food habits of the family from which an individual comes. Here, unfortunately, methods of food preparation, good or bad, play a significant role. Food habits of a locality in the United States are undoubtedly based on two major factors: (1) the predominating nationality of the country from which the people come, and (2) the food available in the community. Even in the latter case the methods of preparation characteristic of the nationality of origin modify the use of the abundant foods of a region and introduce a secondary factor in the acceptance of the same foods by persons of another region.

Factual evidence of the effect of previous food habits on the acceptance of food in the Army is very limited. The failure to accept new foods or methods of preparation is so much more obvious that it is much easier to notice and relate than the lack of effect or acceptance after a period of exposure to particular foods.

An example is the method of preparation of a meal at Fort Meade, Maryland, where parts of two companies messed together—one largely from the New England States with a New England mess sergeant and the other from the

South with a mess sergeant from the same region. The mess sergeants supervised the cooking on alternate days. In a survey of the mess it was noted that the consumption of food was greater by the men from the region from which the mess sergeant came on the days he was in charge of the kitchen.

There were many cases of failure to accept fresh vegetables other than the standard potatoes, tomatoes, corn, string beans, spinach, and cabbage. In some cases even some of these foods were not accepted. In the case of other vegetables, they were well prepared even when the cook knew that only a small portion of the quantity he was preparing would be eaten, the rest to go into the garbage or elsewhere if the garbage can was under close scrutiny.

Regional food habits are very definite with regard to certain basic carbohydrate foods—rice and potatoes, and individual foods—cornbread and beans. Lamb, or as it is usually called, mutton, is also a regional problem. In the latter case the difficulty in acceptance may be due to the small size of the bulk and consequently the difficulties of getting full-sized slices of meat.

At times variety or greater profusion of so-called acceptable foods was resorted to when all that was needed was a slight variation in method of preparation and good cooking.

The psychological conditions under which food is eaten plays a part in food acceptance. It has been noticed in Army messes that were not consuming certain foods satisfactorily that, while at most of the tables there would be considerable waste, at an occasional table there was no waste and the serving dishes were completely emptied. One possible explanation is that someone showed an interest, no one objected, and the rest fell in line. This is, in effect, the condition that determines the food habits in youth.

From a national point of view, a British officer engaged in studying the nutritional problems of the Royal Air Force told of the delight certain Royal Air Force troops had in our rations when they first lived on them. Later their established habits prevailed and they insisted on returning to British rations.

It is obvious that regional food habits, in the broadest sense, are a factor in the acceptance of foods and that such habits persist for a long time. The opinion has been expressed that the soldier after a year or so gradually becomes accustomed to the foods he obtains in Army messes and accepts them.

There are two or three phases of the extent to which regional food habits interfere with or promote the eating of basic foods or unusual foods: (1) when they first are presented or after they have been presented for a relatively short time, and (2) when they have been presented for a season or longer. The ultimate test of acceptance might well be when two foods or methods of preparation are presented simultaneously and the individual eats the new food or method of preparation in preference to the one to which he was previously accustomed, or at least 50 percent of the time.

Since previous food habits do influence acceptance of food, at least temporarily, profitable studies might well be conducted with individuals from different regions on such questions as to the best methods to modify acceptance of foods, the classification of foods and methods of preparation that present the least and most difficult problems of acceptance, the extent to which texture (fine, coarse, soft, or hard), color (colorless, colored, and the kind of color), and flavor (acid, sour, sweet, strong, milk, highly flavored, or bland) affect acceptance, and which of the factors have the greatest influence. Along with such studies could well be included studies of the qualities of food that promote the acceptance of the same foods for long periods of time and those that cause early dissatisfaction and even rejection under conditions of monotony. While subjects from the United States are rather well conditioned to variety there is evidence that some types of food are acceptable over longer periods of time than others. Results on studies of the effect of regional food habits in relation to food acceptance can be useful in the development of a sound nutritional program for the country as a whole. They should reveal nutritional deficiencies and their causes. As a member of the Food and Agriculture Organization of the United Nations, the United States agreed, at the first conference at Quebec, Canada, "to take all measures within its power to raise the level of nutrition and the standard of living of the people under their jurisdiction" and "to report to one another . . . on the measures taken and progress achieved."

THEATERS OF OPERATIONS [24]

Overseas Problem

The feeding of the soldier in the overseas areas was essentially one of supply, experience of mess personnel in the preparation and serving of the field ration, and the use of the packaged rations, C, K, and five- or ten-in-one. The character of the rations was determined in the Zone of Interior. Supplementation of the ration from sources within or near the field of operations was not the policy of the Army. In the China-Burma-India theater, this policy was modified to some extent before supplies of the B ration reached the authorized level. Troops were fed the British field service ration, supplemented by fresh supplies purchased locally and by available items of the B ration.

The basic major difficulty in the adequacy of the diets was failure to conserve the food available, whether the field or B ration or the packaged rations. The length of the supply line and the rapid movement of troops into new areas, which characterized amphibious operations, resulted in unbalanced rations. The rations were unbalanced in relation to the articles of the ration, more than in actual nutritional adequacy. This was not true of the packaged rations,

---

[24] This section was prepared by Dr. Audrey A. Bill from historical reports and other archival material.

which were units in themselves but also restricted in caloric content. The problem of acceptance was more pronounced, however, with the packaged rations, which were planned for short periods of time. Their convenience in transportation, distribution, lack of need for kitchen facilities for preparation, and relative nonperishability or difficulties of supply resulted in their continuous use, without relief with the B ration, for longer periods than contemplated. Under these conditions the soldier chose the parts in which he was most interested and discarded, bartered, or gave away the others. The result was a lowered caloric intake and some slight malnutrition.

Nutrition in North African Theater [25]

The Consultant in Medicine, Office of the Surgeon, Headquarters, North African Theater of Operations, functioned as the nutrition officer from 3 January 1943 until the responsibility for this subject was transferred to the section of preventive medicine on 1 August 1944. At the time of his arrival at Allied Force Headquarters in Algiers on 3 January 1943, the American forces in North Africa had been engaged for less than 2 months. A short review of the tactical situation as it existed at that time will aid in the understanding of certain of the problems of nutrition encountered by the American forces in forward areas.

In the original planning for the OPERATION TORCH, it was contemplated that while there would be a considerable number of personnel of the Air Forces east of Algiers, the Ground Force component in that area would be relatively small. However, due to changes in operational plans, by January the bulk of the Tactical and Bombing Air Force, one regimental combat team, and numerous smaller units were in Eastern Algeria and in Western and Southern Tunisia; one regimental combat team was guarding the line of communications from Algiers to Souk-Ahras; and II Corps and its attached troops were moving into Southern Tunisia. This meant that a sizable increment of the American forces in North Africa were east or south of Constantine, Algeria. As far as supply lines were concerned, 3 small, frequently bombed ports (Bougie, Philippeville, Bone), 1 single-tracked railroad from Oran to Constantine, and 1 fairly good road from Algiers east were available for supplying this force and for the British First Army and troops along the line of communications. The American supply lines which stretched primarily from Casablanca and Oran were long and tenuous, and it is not strange that during this period of time the combat forces operated on a "shoestring" basis insofar as supplies were concerned.

---

[25] This section is based on material submitted by Perrin H. Long, formerly Colonel, MC, Consultant in Medicine, Office of the Surgeon, Headquarters, North African Theater of Operations. Material was originally presented in Long, P. H.: The History of nutrition in the North African Theater of Operations, 3 January 1943 to 1 August 1944. HD: 314.7–2.

In the course of a tour of inspection of British hospitals in North Africa made by the consultant in medicine with the British consulting surgeon and physician from 13 to 20 January 1943, complaints were heard from American troops about their rations. Many of them were receiving the British Composite Pack which they stated did not "fill them up" and which contained items foreign to the American dietary and, hence, disliked. The C and K rations also came in for criticism because of the tastelessness and their monotony. However, on this trip no evidence of nutritional disturbances were seen in American troops.

During a tour of inspection in II Corps which was made in February 1943, the Consultant in Medicine, North African Theater of Operations, heard further complaints about the inadequacy of the "Compo," C, and K rations which were being issued to American troops. During this month, reports began to reach the Office of the Surgeon, Headquarters, North African Theater of Operations, from Ground and Air Force units concerning alleged deficiencies in the rations which they were receiving. However, it was not until April 1943 that evidence was obtained by the Consultant in Medicine in the course of a tour of II Corps, in Northern Tunisia, of the development of definite nutritional disturbances in the troops of that Corps. He observed that instances of avitaminosis had been noted in patients received from II Corps. As far as could be ascertained, these disturbances occurred in individuals who were supposed to be on full C rations, but there was no way of telling whether or not they had consumed their rations. There seemed to be general agreement among those concerned that cold C rations were unpalatable for prolonged consumption and if the statements of the enlisted men were correct, cold C rations produced certain digestive disturbances. Because the problem involved various interested sections of the headquarters and because of its importance, he recommended that a board consisting of representatives from G–1, G–4, the Quartermaster, the Surgeon, and an infantry battalion commander from either the 1st or 9th Divisions be created for the purpose of ascertaining the facts and making recommendations concerning the diets of combat troops.

The recommendation in respect to the forming of a board of officers to survey the rations was favorably considered by the Surgeon, North African Theater of Operations, and was forwarded as a memorandum to the Deputy Theater Commander on 15 May 1943. It was returned with the suggestion that the difficulty lay in the misuse of the C ration, rather than with the ration itself. In his reply the Surgeon, North African Theater of Operations, pointed out that this was well understood by him, and that his proposal was in part made to explore methods by which the responsibility for the proper use of rations could be impressed upon the command, as well as any other methods which would result in an improvement of the nutrition of troops in combat.

The Deputy Theater Commander was not impressed by this reply and the board was not appointed.[26]

Late in May 1943, as a result of discussions which had taken place in the conference of the Chief Administrative Officer (British), Allied Force Headquarters, the Deputy Theater Commander suggested to the Chief Administrative Officer that a joint Anglo-American committee be set up to explore the possibility of devising a common Anglo-American ration scale for Allied Force. The Chief Administrative Officer acceded to this request and the following committee was appointed:

Brigadier H. M. Hinde, OBE, DST (Chairman)
Col. T. Young, DDH, Allied Force
Lt. Col. E. R. Herbertson, ADST
Lt. Col. R. F. Locke, QMC, North African Theater of Operations
Lt. Col. Perrin H. Long, MC, Consultant in Medicine, Allied Force, and
Capt. P. F. Stannard, RASC (Secretary).

After a considerable amount of work upon the part of British and American medical officers in the Allied Force Medical Section, an agreement on a common ration scale was reached and presented to the committee. The circumstances surrounding this agreement are perhaps best described in a report entitled "A Personal Memorandum Upon the Nutritive Value of Existing and Proposed Army Rations, Together with Comments upon the Utilization of Rations in NATOUSA and the Adequacy of Existing and Proposed Rations" which was made by the Consultant in Medicine to the Deputy Theater Commander on 29 June 1943. The common ration scale suggested was considered possible of implementation without sacrifice of American dietary standards. The common ration was broken down into its components and was finally approved by the whole committee and forwarded to the Deputy Theater Commander on 28 July 1943. This ration was never adopted because at the time it was made, the two branches of Allied Force were separating into their components, and each was developing its own line of communications and sources of supplies. The introduction of the common ration at this point probably would have increased the difficulties which each force was experiencing in the problem of procuring and distributing rations. It was, however, an interesting idea and one well worth considering, even though it was never realized.

The period between the end of the Tunisian campaign and the amphibian assault upon Sicily was one of intense activity, especially in the Eastern Base Section, as men were being trained and retrained and supplies were being built up in "dumps" for use during the coming attack. It is not surprising therefore, that the B ration became unbalanced during this period of time, and that by July due to "elimination and substitution" of the various items, the caloric

[26] Annual Rpt, Surg NATOUSA, 1943. HD.

value of this ration had fallen to a level which fluctuated between 1,800 and 2,700 calories per day, with the average daily ration for that month having a value of 2,400 calories. During this time three divisions and attached troops, which had been engaged in Tunisia, were undergoing amphibian training in the course of which emergency C and K rations were used. Thus when II Corps entered Sicily, a number of its component troops had been for a considerable period of time on rations which were deficient in calories.

The troops had better and more varied food during the 38-day campaign in Sicily than at any other period of combat up to that time. This resulted from the fact that five-in-one rations were widely used, a considerable number of first-class German rations were captured, lemons and certain other fresh fruits and vegetables were fairly abundant and were procured in considerable amounts in one way or another. Because the campaign was short and troop reliefs frequent, the individual soldier had an opportunity "to stoke up" in a manner which had been denied him in North Africa.

Despite the fact that there had been some improvement in the level of nutrition in the ground combat troops engaged in the Sicilian campaign, reports of varying degrees of undernutrition were constantly being received from components of the Army Air Forces, together with requests that multivitamin capsules be issued to these units. During the absence of the Consultant in Medicine in Sicily, the Surgeon, North African Theater of Operations, took cognizance of these demands, and upon his recommendations, the issue of such vitamin concentrates was authorized in Section III, NATOUSA Circular 153, 7 August 1943. The phrasing of this section in which it was stated that no requests for vitamin concentrates would be submitted until "a medical officer or nutritionist has analyzed the diet provided from the menu in use," produced many administrative difficulties because it was obvious that a unit medical officer who lacked scales and nutritional charts and tables would have a difficult time in analyzing the diet of his unit. This, coupled with the fact that vitamin concentrates were frequently in short supply, made their distribution a problem. At about this same time, and without consultation with or advice from the Consultant in Medicine, Section III, NATOUSA Circular 164, 29 August 1943, which directed that the part of War Department Circular 208, 1943, dealing with the percentage reduction in rations would be in force in the North African Theater of Operations, was issued. This action was ill-timed and badly conceived because it not only cut down the caloric value of the total rations for any one unit, but also, as it was shown later, penalized the soldier in combat severely.

The opening of the campaign on the mainland in Italy with its attendant logistic problems created an unbalance in the rations. This was due to the fact that the bulk of the ground forces was removed from the neighborhood of the fixed bases in North Africa, large numbers of service forces were likewise sent

to Italy, the tactical air force, which when Sicily had been secured had moved there, quickly followed the ground forces into Italy, and the strategic air force moved from its bases in North Africa to the eastern side of Italy. These movements of large numbers of men and supplies necessitated the building up of new lines of communications and of new "dumps" in remote and often inaccessible places. It soon became apparent from reports reaching the Office of the Surgeon, Headquarters, North African Theater of Operations, that the rations in certain parts of Italy were badly unbalanced and that nutritional disturbances were occurring. In November 1943, the theater was fortunate in having as its guest Col. Paul E. Howe, SnC, then the nutrition officer in the Office of The Surgeon General. Colonel Howe, in company with the Consultant in Medicine, made a tour of inspection, in the course of which studies upon nutrition were carried out in the base sections, Fifth United States Army and in the Fifteenth Air Force. It was concluded that the ration as issued to troops in the Fifth United States Army during the past 3 months had been inadequate. This was demonstrated from calculations of the nutritive values of the rations as issued and from evidence of weight loss and other nutritional deficiencies which had been noticed especially in forward divisional troops. It was realized that this inadequacy had been in part the result of the tactical situation, in part the result of difficulties and failures in transportation, and in part the result of the increased nutritive requirements associated with cold, wet weather.

The recommendations made on the basis of these studies reflect the nature of the observations made. In order to improve conditions found in the Fifth United States Army, it was advised that hot food be supplied to combat infantry for at least one meal a day whenever the tactical situation permitted the use of stoves; that unit commanders be impressed with the necessity for the consumption of "Lemon Juice Powder Synthetic," a chief source of vitamin C; and that, because of nutritional inadequacy, C and K rations which were used of necessity under certain combat conditions not be utilized without supplementation for more than 3 days. Because of the estimated daily caloric requirement of Fifth United States Army personnel at that time, it was recommended that five-in-one ration be issued to 4 instead of 5 men per day. For the same reason, it was suggested that ten-in-one ration be issued to 8 men daily. Issuance of the full allowances of food for B ration was advised, including all components necessary to make bread when bread per se could not be provided. Supplementation of B ration was considered necessary for service troops involved in strenuous work. It was deemed desirable that a nutrition officer be provided for duty with army troops and that one be assigned to each corps. Nutritional rehabilitation was urged for organizations which had been subsisting continuously or largely on C and K rations when troops were with-

drawn in reserve positions or regrouping areas. For this purpose, B ration, supplemented for strenuous work, was advised.

Problems in nutrition of Army Air Force troops which were disclosed by these studies included those which arose from "improper substitution and eliminations of ration components" of B ration. Heavy bomber groups were voluntarily eliminating "gas-producing components of the diet such as cabbage, beans, etc.," from the ration consumed because of gastrointestinal discomfort during long missions. The caloric value of the ration consumed was thereby lowered, and weight loss ensued. Missions of 7 to 8 hours in length made it impossible for fighter pilots to eat for that period of time; and as for bomber personnel during such lengthy missions, "the cold . . . makes it difficult and dangerous to open 'K' rations because fingers are frost bitten quickly at such altitudes." In areas out of normal lines for supply, Army Air Force units had to subsist on emergency rations for periods up to some 5 months at a time. Menus were scarce in some units, and there were difficulties due to percentage reduction in rations.

Upon receiving the recommendations made on the basis of these studies, the Surgeon, North African Theater of Operations, sent a memorandum outlining the damage which was resulting from the percentage reduction in rations, to the Deputy Theater Commander. The latter, after a careful consideration of all of the factors involved, called a meeting of the Chief of Staff, the Quartermaster, and the Consultant in Medicine, North African Theater of Operations. In the course of the meeting the decision was taken not only to do away with the percentage reduction in rations, but also to activate that part of War Department Circular 208, 1943, which permitted the drawing of excess rations under special conditions. The immediate promulgation of this policy in the theater was welcomed by all who were engaged in heavy work. It was a step in the right direction towards providing a more adequate diet for members of units whose duties were of a strenuous nature.

In January and February 1944, the Chief Nutrition Officer, Office of the Chief Surgeon, European Theater of Operations (Lt. Col. W. H. Griffith, SnC), paid a visit to the North African theater. His observations were recorded in a report made to the Surgeon, North African Theater of Operations, on 18 February 1944.[27] "No evidence of nutritional inadequacy (was) observed." However, it should be made clear at this point that when Colonel Griffith was discussing "evidence of nutritional inadequacy" in his report, he was referring to frank nutritional disturbances and not to weight loss, minor anemias, et cetera. It is also of interest to note that the forces on the Anzio Beachhead were subsisting on emergency rations, while along the front west of Cassino, B-type rations were in general use, due to the stalemate in that area.

---

[27] Gordon, J. E.: History of preventive medicine in the European Theater of Operations, United States Army, 1941–1945. MD: 314.7-2.

There can be little doubt about the improvement in the B ration as issued in the North African theater during December 1943 and January 1944. Frozen meat and butter were ordinarily available for three or more meals a week, fresh vegetables, nuts, and a certain amount of fruit became surplus as far as civilian needs were concerned in Italy and North Africa, and hence were procured by the Army. Fresh eggs were also in fairly good supply. Local shortages in certain items existed due to planning mistakes and to transportation failures, but the bulk of the troops who were not actually in frontline duty received a much more nutritious, palatable and varied diet than they had at any previous period in the North African theater. That this was true was shown by a study, initiated by the Consultant in Medicine, North African Theater of Operations, of the nutrition of "trainees" in the North African Disciplinary Training Center. The study was carried out by a board of medical officers during the summer of 1944. The Disciplinary Training Center was at that time located in a very torrid section of North Africa about 25 miles southwest of Oran, and the "trainees" were being put through 16 hours of strenuous exercises each day. One hundred general-service men were studied. The results of this study were of interest because despite very heavy exercise over the 90-day period, the average "trainee" in the group lost only 3 pounds of weight, none developed anemia, and no other evidence of nutritional deficiencies was noted.

The situation in respect to rations for prisoners of war in the North African theater after the surrender in Tunisia, and subsequent to that time, was always relatively good. Of course, local shortages in food did occur from time to time when unexpected numbers of prisoners were taken, but this existed only until they arrived at the permanent cages. The ration for prisoners of war was essentially a modified American B ration with fresh vegetables and fruits added, when such items were in surplus in quartermaster supplies. The ration was modified on a sliding caloric scale so that it provided between 2,500 and 3,000 calories a day for idle prisoners, and up to 4,000 calories a day for prisoners who were engaged in strenuous labor. Sick, wounded, or injured prisoners of war who required hospitalization received the diet provided for American sick, wounded, or injured.

Another problem of rations which was of considerable interest in the North African theater was that of the hospital ration. Because of logistic reasons and the tactical situation, the hospital ration was not widely distributed in the early days of the theater, and was used only in the Mediterranean and Atlantic Base Sections. The hospitals in Eastern Base Section were forced to use the B ration. When dysentery and malaria became prevalent in May and June 1943 it was noted that not only the B ration but also the hospital ration was inadequate because the content of such components as fruit juices, custards, and cocoa was not great enough, and the desired special diets could not be prepared. Coupled with this deficit in the content of the interesting items of these diets

was the fact that as a result of the supply situation which existed in Eastern Base Section, the B ration was short in calories due to eliminations and substitutions, averaging but 2,500 calories a day during June, July, August, and September 1943. In view of this, and with the knowledge at hand which had been gained during the campaign in Sicily in respect to the difficulties in placing the hospital ration where it was needed, it was decided to abandon this ration in the North African theater, and as a substitute, to provide the B ration, plus a purchase allowance of 35 cents a day per patient with which to purchase from the Quartermaster Corps those items necessary to prepare the required diets. This was authorized in Section III, NATOUSA Circular 179, 13 September 1943, and was amended to include patients occupying beds in dispensaries, by Section IV, NATOUSA Circular 199, 10 October 1943.

In general, it can be said that this plan was satisfactory and especially so in newly created base sections and in forward areas in which, as experience had previously shown, great difficulties were encountered in maintaining the hospital ration. It also provided a means of augmenting the standard B ration for those patients who did not require special diets, but in whom a state of undernutrition had developed because of the prolonged consumption of C, K, ten-in-one, or unbalanced B rations. This system of providing diets for hospitalized personnel, while approved by Col. Paul S. Howe, did come in for a certain amount of criticism from Lt. Col. W. H. Griffith. At the time this criticism was made, part of it was considered valid, but that part which dealt with the automatic issue of the hospital ration was thought unjustifiable because experience within the theater had always demonstrated that the automatic issue system for rations, sooner or later, broke down. It was considered that the plan for building up the ration which had been devised, met the conditions as they existed in the North African Theater of Operations, and that these conditions were different from those encountered by Lt. Colonel Griffith in England.

One of the major disease problems in the North African and Mediterranean Theaters of Operations was infectious hepatitis, in which a special problem in nutrition was presented because of the anorexia, nausea, vomiting, and loss of weight which are characteristic of the disease. It was noted in the winter of 1943–44 that difficulties were being encountered in preparing appetizing and tempting diets for these patients out of the items in the rations which were available, and that most of the patients convalescent from the disease were definitely underweight. That this should have occurred is not extraordinary, if one remembers that many of the patients were underweight at the time they contracted infectious hepatitis. In a planned series of dietary tests which were carried out early in 1944, it was shown that patients with hepatitis would consume a diet high in certain proteins and carbohydrates, but low in fats, with avidity. Further experiments showed that their dislike of fats was probably based on the fact that under the conditions which existed in the theater, fats

were very likely to be slightly rancid, and hence not well tolerated by these patients. As a result of these studies a special diet which contained 200 or more grams of protein, 25 to 50 gm. of fat and 400 or more grams of carbohydrate was devised for patients with hepatitis. By special arrangements made with the Quartermaster Corps, amounts of lean frozen beef and of dried skim milk were obtained which were adequate to provide the protein component of the diet, and patients with hepatitis had the first call upon all fresh fruits and vegetables procured by the quartermaster. Proper menus covering a 10-day cycle were prepared for the basic diet, and hospital dietitians throughout the theater were instructed in its preparation. This diet was very successful (if its success can be judged by its consumption) and was relished, with the result that most patients suffering from this disease showed a gain in weight at the time they left the hospital.[28]

The question of the waste of food was brought out in the report of Lt. Colonel Griffith [29] and there can be no question but that much food was wasted in the North African Theater of Operations. Two factors were responsible for this waste: Poor menu planning and preparation of the ration as issued, and the high percentage of unacceptable items within the B ration. Interested members of the staff of the 17th General Hospital conducted a study in 1944 upon the acceptability of the ration as offered to patients. It is of interest that sources of protein showed a very high percentage of waste. Hospital patients were found to waste up to 25 percent of food offered, and ambulatory patients, 17 percent. A fresh educational campaign was found to reduce food wastage markedly. It was concluded that: [30]

> These studies definitely indicate that one evaluation of certain items of the Expeditionary Force "B" Ration for temperate and tropical areas should be made. The palatability and acceptability of the items just reviewed are low and the waste from them considerable. It seems likely that the percentage waste noted for ambulatory patients quite accurately reflects the waste occurring when the "B" ration is consumed by field or service troops. Hence, the waste, in terms of total food and money value is enormous. With a full realization of the difficulties of planning for procurements, processing and distribution of the "B" ration, it is still considered that an intransigent point of view in respect to changing these items should not be taken, and that every effort should be made by experiment and trial to replace them with satisfactory items in order that the world's largest "swill" barrel may be eliminated.

Little can be said about this report because, first, it is true, and secondly, the Quartermaster Corps had been long aware of the unacceptability of certain of the items in the B ration, but had done nothing about them in the period in which the Consultant in Medicine was acting as a nutrition officer in the North African theater.

---

[28] Ltr, Col M. H. Barker, MC, to Surg NATOUSA, 2 Nov 44, sub: Dietetic studies with suggestions for infectious hepatitis. HD: 710 Jaundice.

[29] See footnote 27, p. 118.

[30] ETMD, NATOUSA, 1 Jul 44. HD: 350.05.

The general level of the preparation of food in the North African theater was low, and menu planning was essentially a lost art. In the recollections and experiences of the Consultant in Medicine there were but three good messes in the theater, and these were good because they were frequently illegal in respect to the types of food served and because they had capable cooks. The fault for the poor planning and preparation of food can be about equally distributed among command, mess officers, and cooks. The higher echelon of command in this theater, because of military exigencies, had little time to be interested in the details of unit mess operations. Such personnel, because of their position and responsibilities, usually ate in small well-operated messes. On the other hand, many mess officers were inadequately trained for their responsibilities and lacked the fundamental knowledge required for excellent mess operations. Few properly trained cooks were available, and these were most frequently found in kitchens of higher echelons. Poor selection of menus and poor preparation of food was generally responsible for the waste of food which occurred in the North African theater.

In summary, it can be said that many factors contributed to the problem of nutrition in the North African theater. Among these were:

1. The use of canned rations which were unpalatable, monotonous, and nutritionally deficient.
2. The misuse of emergency rations, a factor which was most difficult to eliminate, because logistically the compact emergency ration was the planner's delight, as so much else could be placed in the space which was saved by the use of emergency rations.
3. The utilization for more than a year of the Expeditionary Force Menu No. 1, B ration, which was finally shown in the Camp Lee, Virginia, tests to be a deficient menu.
4. The substitution and elimination of items in the rations.
5. The inexpert procurement of rations by mess officers.
6. The poor preparation of food.
7. The percentage reduction in rations for a 3-month period.

Nutrition in the European Theater of Operations [31]

A nutrition branch was established in the Division of Preventive Medicine of the Office of the Chief Surgeon, European Theater of Operations, late in August 1942. The branch began activities, therefore, early in the history of the theater and at a period when the ration scale for troops in the European Theater of Operations was still a subject of discussion. From that time it set

[31] This section is based on material submitted by Wendell H. Griffith, formerly Colonel, SnC, Chief of Nutrition Branch, Division of Preventive Medicine, Office of the Chief Surgeon, European Theater of Operations. The material was originally presented as a part of Gordon, J. E.: History of preventive medicine in the European Theater of Operations, United States Army, 1941–1945. HD: 314.7–2.

the dietary standards for rations provided by the Quartermaster Corps and determined the nutritional needs of the Army personnel. The nutrition branch grew with the theater, as did also the magnitude of its responsibility for the nutritional health of troops and of hospital patients and the variety of its interests in all phases of Army messing. It was recognized that the functions of nutrition officers were investigative and advisory and that the accomplishment of the mission of the nutrition branch depended upon complete coordination with commanding officers, responsible for mess operation, and with officers of the Quartermaster Corps, responsible for the procurement and issue of rations and for the training of mess personnel.

Activities of the nutrition branch centered on the preventive aspects of sound nutrition but included the nutritional rehabilitation of malnourished recovered American prisoners liberated from German stalags, a problem which turned out to be one of the most important purely medical problems confronted by the Chief Surgeon's Office, European Theater of Operations. Field tests of the suitability of standard operational rations for combat troops in Europe were planned and directed, an activity of especial importance in the case of the new ten-in-one ration which had not previously been subjected to trial under field conditions. As a result of these trials and of other accumulated experience, pertinent recommendations were made concerning the composition of C, K, and ten-in-one rations and particularly concerning desirable changes in the B ration. The unofficial move to supply a so-called Americanized version of the British Army ration to American forces in the United Kingdom was opposed and new ration scales for troops and hospital patients were pioneered. A troop ration was described in terms of groups of foodstuffs, in accordance with their nutritive significance, for the first time in a theater of operations of the United States Army; and, for the first time, hospitals were issued a type A patients' ration which did not require an added monetary allowance. The nutritional welfare of troops in combat was constantly emphasized in theater directives and by personal contact with officers of combat units. This was doubly necessary because of the tendency to exaggerate the value of convenience of transport and issue of operational rations with resulting potential damage to the nutritional fitness of soldiers. This program, which was actively supported by the Chief Quartermaster, European Theater of Operations, was so successful that the great majority of combat units received the modified type A ration rather than C or K rations, even when in contact with the enemy. Nutrition officers were particularly prominent in the supervision of special procedures which were designed to maintain mess operation on a high level in the marshalling areas from which troops embarked for the liberation of France. Participation in programs to prevent waste of food and to develop a sense of individual responsibility for proper eating was encouraged.

TROOP RATIONS IN THE UNITED KINGDOM

British and British-American Rations. The first American units which arrived in Northern Ireland on 26 January 1942 were issued British rations and were loaned British Army cooks who familiarized American cooks with the ration components and with the stoves and other kitchen equipment. The same procedure was used as additional forces reached Ireland and England. The British Home Service ration included a cash element of 2½d (pence) per day which was used by British messes in the purchase of condiments and other items. This dietary was soon found unsuitable for the American Army and the amounts of meat, grain products, sugar, evaporated milk, and dried fruit were increased. Troops engaged in hard labor were authorized a 15-percent increase in this augmented British or so-called British-American ration.

According to American standards and tastes, the British ration was unsatisfactory because of its low caloric value and low content of milk, egg, beef, pork, tomato products, canned fruits and fruit juices, and coffee. On the basis of consumption, it failed to provide the levels of calcium, riboflavin, and ascorbic acid recommended by the National Research Council. The inadequacy of the Home Service ration for British troops was recognized by the British War Office and improvements were made in 1943. The British-American ration was more than adequate in calories but was deficient in tomato products, fruits, and fruit juices. Its nutrient supply was greater than that of the British Home Service ration but, on a consumption basis, it failed to supply the recommended levels of calcium, riboflavin, and niacin.

Early Development of the American Ration. American rations were authorized on paper in February 1942 but no menu was published and troops continued to receive either the British ration or the British-American ration. The components of the authorized type A field ration were the same as those of the garrison ration except that 4 ounces of wheat flour and 8 ounces of bread replaced 12 ounces of wheat flour. The listing of the garrison ration as the basic field ration in an overseas theater is inexplicable in view of the fact that the garrison ration was designed for the calculation of the monetary value and not for the issue of a ration. There was concern over the authorization of this ration because of its weight (4.55 pounds) and caloric value (5,127 calories), and in May a revised ration was published in which beef was decreased from 7.43 to 5.20 ounces, potatoes from 10 to 8 ounces, sugar from 5 to 4 ounces, bread from 8 to 7 ounces, and flour from 4 to 3 ounces. These changes lowered the caloric value from 5,127 to 4,562 but still left the ration far in excess of the British Army ration so that pressure was continued to decrease the difference between the rations of the 2 armies. Undue attention was paid at this time to the weight of the authorized ration and to the shipping which would be required to transport it across the Atlantic. No consideration was given the fact that

ıe list of components did not constitute an acceptable ration nor the fact that he weights were not significant because boneless meat would be shipped rather han carcass meat, dehydrated potatoes rather than fresh potatoes, evaporated nd dried milk rather than fresh milk, et cetera. On 28 July 1942 the first ıenu was published by the Office of the Chief Quartermaster, European Theater of Operations, and this served as the tentative basis of issue to units djacent to the relatively few depots which were in operation at that time. The activation of quartermaster depots proceeded rapidly during the early fall nd units were transferred from the British-American ration to the American ation accordingly. This changeover was nearly complete by the end of Octoer except for those units of the Army Air Forces which shared stations with he Royal Air Force. At these stations either British or American rations ere issued depending upon which force was numerically greater. It is interesting that neither group was satisfied with the ration to which it was unaccustomed. American Air Force enlisted personnel at stations issued the British ation (not the British-American ration) were particularly unhappy and requests for supplementation of the ration with canned fruits and fruit juices ere not infrequent. Supplementation in these instances was impracticable nd was not approved. Fortunately this situation did not continue long beause incoming Air Force personnel made possible the general issue of Amerıan rations.

The first menu for the type A field ration (Table 5), which was published n 28 July 1942 as a tentative basis of issue, was authorized by the Commanding ieneral, European Theater of Operations, United States Army, on 6 Septemer 1942. The letter of authorization directed that the services of the newly ssigned nutrition officer would be utilized to make the best possible use of ubsistence and that the contents of the proposed menu should be modified hen justified by further study. It became the first duty, therefore, of the utrition branch to determine the adequacy of the ration prescribed by menus repared by the Subsistence Division, Office of the Chief Quartermaster, Euroean Theater of Operations, and to recommend improvements, if necessary. The reports of the resulting studies of the first menu authorized on 6 September 942 and of the second menu (Table 5) authorized on 12 October 1942 paved ıe way for the subsequent complete revision of the ration scale upon which ıese menus were based. The reports, which were forwarded to the Chief)uartermaster and which served as a basis for the first of many regularly ccurring conferences at which theater rations were discussed and evaluated uring the ensuing 3-year period, emphasized the following points:

1. The caloric levels of the first and second menus were approximately ,800 and 4,500 respectively, both of which were in excess of the actual energy equirement of troops. Adjustment of this level should not be accomplished the expense of the nutrients of the ration.

TABLE 5. NUTRITIVE VALUE OF TROOP RATIONS IN THE UNITED KINGDOM, WITH AND WITHOUT CORRECTION FOR MINIMUM LOSSES DURING ISSUE, STORAGE, PREPARATION, AND SERVICE OF FOOD [1]

Nutrients	British [2] Home Service ration 1942	British-American ration 1942	United States ration August-October 1942	United States ration November-December 1942	United States ration January 1943-January 1945
Energy, cal	3, 060	4, 182	4, 766	4, 465	4, 049
	(2, 776)	(3, 704)	(4, 170)	(3, 940)	(3, 624)
Protein, gm	96	124	149	136	130
	(91)	(118)	(142)	(129)	(123)
Fat, gm	117	197	215	205	165
	(97)	(156)	(164)	(161)	(132)
Carbohydrate, gm	406	478	557	519	536
	(385)	(457)	(532)	(494)	(486)
Calcium, gm	0. 63	0. 77	0. 88	0. 87	0. 96
	(0. 60)	(0. 73)	(0. 84)	(0. 82)	(0. 91)
Iron, mg	19	25	2[illegible]	28	27
	(18)	(24)	(28,	(27)	(25)
Vitamin A, I. U	3, 050	1, 233	1, 503	2, 474	2, 448
(Animal)	(2, 890)	(1, 170)	(1, 428)	(2, 350)	(2, 330)
Carotene, I. U	4, 647	9, 695	9, 638	9, 842	11, 482
(Plant)	(4, 415)	(9, 200)	(9, 156)	(9, 350)	(10, 910)
Thiamine, mg	1. 98	2. 69	3. 01	3. 05	2. 61
	(1. 50)	(1. 99)	(2. 18)	(2. 13)	(1. 88)
Riboflavin, mg	1. 83	1. 97	2. 43	2. 42	2. 40
	(1. 58)	(1. 71)	(2. 11)	(2. 08)	(2. 07)
Niacin, mg	20	24	32	28	27
	(16)	(19)	(26)	(22)	(21)
Ascorbic acid, mg	100	147	134	164	167
	(45)	(69)	(104)	(97)	(96)

[1] Uncorrected and corrected values represent "as issued" and "as consumed" values respectively. Corrected, or "as consumed" values, are estimated by making the following deductions from "as issued" values:

a. Deduction of 5 percent to cover wastage loss during issue, storage, preparation, and service of ration components.

b. Deduction of 25 percent of meat and cooking fat which is assumed to be uneaten.

c. Deduction of nutrient losses.

The corrected value in the table is the value in parenthesis.

[2] This value was calculated according to the procedure used in estimating caloric values of U. S. Army rations. The British War Office estimates the average value of the monetary allowance as 214 calories, thus increasing the total ration value to 3,274. The energy content of the ration was increased 284 calories in May 1943 and an additional allowance of 200 calories was authorized troops undergoing hard training.

2. Forty percent of the calories were from fat, a large part of which would not be eaten. Special measures to salvage unused fat were therefore necessary.

3. The substitutive table which was patterned after the one described for the garrison ration listed vegetables, in general, as substitutes for plant sources of vitamin A. In order to safeguard the adequacy of the ration it was essential that substitutes for leafy, green and yellow vegetables should be limited to

vegetables in that category. Similarly, substitutes for tomatoes should be limited to tomato or citrus fruit products.

4. Increased issues of fresh cabbage and potatoes, milk and tomato products were necessary in order to provide an acceptable ration.

5. Menus should be used as an instructional medium for mess personnel and should include data on methods of conserving nutrients during the preparation of food, on the necessity of complete utilization of the nutritionally important foodstuffs, and on other pertinent phases of mess operation.

Waste of Food in 1942. During November 1942 an extensive survey of American units in the United Kingdom was made by representatives of the Nutrition Branch, Office of the Chief Surgeon, of the Subsistence Division, Office of the Chief Quartermaster, and of the British Army Catering Corps. This investigation demonstrated that the issue of excess food was resulting in widespread wastage because of failure to use the ration economically and to return unused items to depots. It not only represented financial loss and the futile transportation of supplies across the Atlantic but also had an unfortunate effect on the British who were campaigning for the maximum prevention of waste.

Revision of Ration Scale. On 12 December 1942 the chief of the Nutrition Branch, Office of the Chief Surgeon, was specifically ordered to recommend whatever changes in the current directives on rations were deemed appropriate as a result of his investigations in the theater. As a matter of fact, the third menu, published 22 December 1942, was satisfactory in most respects because most of the earlier recommendations of the branch had been approved by the Subsistence Division, Office of the Chief Quartermaster, and incorporated in the menu. The caloric level had been decreased temporarily to 3,800 as a means of emphasizing the necessity of complete utilization of the ration. None of these changes were in accordance with the theater ration directive so that there was need of a restatement of the basic components and allowable substitutive items of the rations. Advantage was taken, therefore, of this opportunity to describe the field ration in terms of food classes composed of nutritionally similar foodstuffs. Substitutive items were rigidly restricted to those of nutritional equivalence and both basic components and substitutes were limited to those known to be available. The proposed new directive on rations was published on 11 February 1943. Only minor changes in the troop ration scale were necessary in subsequent revisions of this circular.

Average Type A Menu in the United Kingdom. The composition of the average type A field ration issued in the United Kingdom between 1 January 1943 and 1 February 1945 was adequate in all nutrients except riboflavin which was 10 percent less than the recommended allowance. This was not believed significant and there was no evidence of ariboflavinosis in the troops. It is highly probable that 2.0 mg. of riboflavin daily are more than sufficient. From

a practical standpoint it is very difficult to provide this level even in a varied diet containing meat, milk, and eggs without occasional servings of liver and without riboflavin-enriched flour and bread. Worthy of emphasis is the fact that United States Army rations in the United Kingdom contained neither white flour (70 percent extraction) nor white bread. British flour (85 percent extraction) and British bread were used and the consumption by the troops was very satisfactory (0.424 pound daily). The average intakes of evaporated milk and of dried egg were the equivalent of one pint of whole milk and of one egg daily. Servings of cabbage and of brussels sprouts were in excess of American food habits. The average daily issue of all fresh vegetables, other than tomatoes and potatoes, amounted to 0.375 pound, 28 percent of which consisted of cabbage and sprouts.

Hospital (Patients') Ration. The first theater directive on hospital rations in February 1942 authorized one field ration plus a monetary allowance of one shilling (approximately 20 cents) for the feeding of patients. Quartermasters were directed to procure the extra foodstuffs, requisitioned by hospital commanders, from "any available source." Later, hospitals were allowed to purchase food supplies for patients from local civilian sources as well as from the quartermaster. The monetary allowance was unsatisfactory in the United Kingdom because of the very limited number of foodstuffs which could be procured by local purchase. The theater abolished the monetary supplement in February 1943 and adopted a special patients' ration at the same time that the revised troop ration was authorized.

In November 1943, the availability of supplies permitted revision of the hospital ration scale and small increases were authorized in meats, milk products, fruit juices, and potatoes. These additions were offset by decreases in legumes and grain and the energy content remained approximately 4,000 calories. Up to this time the majority of patients consisted of sick individuals without particularly hearty appetities. As more and more wounded Air Force personnel arrived in the hospitals, the ration which heretofore had been adequate required supplementation. Provision was therefore made for significant augmentation whenever necessary. Prior to D-day, increases were authorized in the hospital ration in anticipation of the expected change in the type of hospital patient. The greater appetite and food consumption of average battle casualties compared with average patients is noteworthy.

The hospital ration in the United Kingdom was never the same as that issued on the Continent because of the greater supply of fresh meat and vegetables in England. Menus described the regular patients' diet only. Provision was made for modification of the ration issue whenever the need for special diets increased above 20 percent. This was the case if certain hospitals specialized in specific types of patients, such as those with hepatitis, with jaw injuries, et cetera. Provision was also made for the feeding of soup, sandwiches, egg-

nog, fruit juices, and coffee at airstrips receiving casualties by plane from the Continent. Similar arrangements were made at so-called "transit hospitals" receiving casualties transported by water.

The special hospital ration used in the United Kingdom was composed of the items appearing in the troop ration, plus skimmed milk powder (for fat-free diets), malted milk powder, egg noodles, brown sugar, canned soups, purees, et cetera. It supplied 100 percent more chicken and fruit juices, 65 percent more milk, 20 percent more eggs, and 40 percent more fruit than the troop ration.

Planning for Rations in Combat. The continuation on the Continent of the excellent ration supplied in the United Kingdom was impossible for many months after the establishment of a beachhead. The enormity of the problem of transport across the channel and from beach depots to rapidly moving armies demanded the temporary use of nonperishable, conveniently packed, and easily prepared rations. Operational rations, such as C, D, and K, and the nonperishable type B ration were already stocked in depots in the United Kingdom. Because the latter ration consisted of more than 100 different foodstuffs in as many different containers, the Chief Quartermaster, European Theater of Operations, proposed the preparation of a so-called twelve-in-one ration which would supply in a single box an assortment of type B components sufficient for 1 day's supply of food for 12 men. Before more than a few units of the twelve-in-one had been assembled, the theater was informed of the availability of the new ten-in-one ration in the United States. The ten-in-one appeared to fill the need for a ration intermediate between C and K and the type B ration, and plans for the twelve-in-one were therefore dropped.

In order to familiarize the theater with the advantages or possible disadvantages of operational rations, a ration board headed by the chief of the Nutrition Branch, Office of the Chief Surgeon, was appointed in 1943 and directed to conduct comprehensive field tests on rations which would be used later in combat. In the first of these field tests it was noted that troops remained in reasonably good physical condition during a 10-day period on C, K, and five-in-one rations but that the rations were deficient in calories, especially for large men. The report listed the following recommendations: The use of the D ration as a supplement only; the restriction of the use of C and K rations to 5-day periods unless supplemented; the replacement of the wholly unsatisfactory dextrose and malted tablets of the K ration with a desirable confection; the replacement of the fruit powder component of C and K rations with a source of ascorbic acid which would guarantee the utilization of this nutrient; and, the addition of cigarettes, gum, matches, and toilet tissue to the rations which lacked these articles.

The report of the second trial noted the acceptable quality of the majority of the components of the recently developed ten-in-one ration and the excellence

of its packaging but emphasized its marked inadequacy in calories (3,300–3,400) for troops during 15-day maneuvers in moderately cool weather (35°–55° F.). The following recommendations were made: An increase in caloric value to 3,900 calories; a limitation of 30 days in its issue and of a total of 40 days in the issue of ten-in-one and unsupplemented B rations; the replacement of the dehydrated baked beans, the fortified fruit powders, the K–1 biscuits, and the dextrose and malted milk tablets; and the addition of cocoa beverage powder, pea or bean soup powder, extra cereal mixture with increased sugar in the mixture, components for hot drinks twice daily, heating units, and extra paper tissues.

The conception of the ten-in-one ration was basically sound but it was obvious that it was developed for use in warmer areas than Western Europe. Because of the demonstration of the marked caloric deficiency of this ration, the theater decided to use it on an 8-man basis or to supplement it with additional food if it was issued on a 10-man basis.

Specific recommendations were made to the Chief Quartermaster, European Theater of Operations, with respect to feeding troops on the Continent: Shipment of bakery units and of fresh meat to the Continent at the earliest possible moment after D-day so that the maximum period for subsistence of troops on wholly processed rations (D, C, K, ten-in-one, and B) would not exceed 40 days; substitution of canned roast beef or canned meats for less desirable components of the B ration; replacement of the butter substitute; modification of the ten-in-one ration; supplementation of C and K rations with miscellaneous nonperishable foodstuffs (sardines, peanuts, jam, et cetera) as a means of avoiding monotony; supplementation of C and K rations with multivitamins after 15 days in the event these were the only rations available; and provision of individual heating units, preferably tablets of the hexamine type.

These efforts to improve the quality of processed operational rations were supported by the Chief Quartermaster and were successful insofar as the ten-in-one ration was concerned. The theater was informed in April 1944 that the caloric value of the ten-in-one had been increased from 3,400 to 3,700 and that in future procurement in the United States the ration would provide 3,900 calories. These improved types were received before the termination of hostilities on the Continent but improved C and K rations were not available until the later spring of 1945. Additional type B meat components, such as canned beef and gravy, pork and gravy, sardines, et cetera, were received but not until after the type B ration had been replaced by the A ration with its fresh foodstuffs. Individual heating units of the wax candle type were received but were little used because of their unsatisfactory character.

A supplementary ration for the nourishment of casualties in beachheads was essential because C or K rations were wholly unsatisfactory for this purpose. The procurement of such "patient's operational ration" was one of the

first activities of the Nutrition Branch, Office of the Chief Surgeon. The Office of the Chief Quartermaster agreed to prepare cases, each containing fruit juice, milk, sugar, and coffee for 20 men, if an equivalent ration could not be procured from the United States. Subsequently, the 25-in-1 hospital supplement was developed in the United States and was used with great benefit in Italy and in France. Procurement of this supplement from the United States became impossible in the spring of 1945 so that an additional quantity was assembled from supplies in the United Kingdom for use by the armies in Europe.

In addition to the 25-in-1, a second supplement, the B–C pack, was requested by the theater and supplied from the United States. This unit contained bouillon cubes and cigarettes and was designed for issue to aid stations. These components were selected following a survey of battalion medical officers in experienced divisions which had arrived in England from the North African theater. The value of this supplement was questionable, mainly because of the successful provision of other nourishment to frontline units.

RATIONS ON THE CONTINENT

Type C and K rations, supplemented with the D chocolate bar, were used on the Continent until D-day plus 5, at which time ten-in-one rations were available for issue to troops in rear areas. The latter ration was widely used until D-day plus 33 when type B components were distributed. By D-day plus 40 fresh bread and meat were issued in limited quantities. The supply of bread increased rapidly as new bakery companies arrived and went into production. The early establishment of bakeries on the Continent and the movement of these with the armies contributed immeasurably to the maintenance of the nutritional health of the troops.

Operational rations were supplemented with captured enemy foodstuffs and with fresh vegetables and eggs which were surplus in many districts of Normandy and Brittany. Shipments of potatoes and carrots were received from the United Kingdom after D-day plus 90 and, at the same time, arrangements were made with French authorities to obtain tomatoes, onions, celery, and cabbage whenever these were in surplus of civilian requirements. The listing of fresh meat and vegetables in monthly menus of the modified type A ration was possible starting with the September menu. It is estimated that about one-half of the meat and vegetable issue during the fall and winter consisted of fresh items. Combat troops and hospital patients were given first priority on fresh meats. The meat issue in the armies was augmented by the capture of large cold storage plants well stocked with carcass beef. As an illustration, the After-Action Report of the Third United States Army, 1 August 1944 to 9 May 1945, states that the army captured 2,600,000 pounds of frozen beef and 500,000 pounds of canned beef, property of the German Army, and issue to frontline troops was started at once.

346336 O 55 - 10

Vigorous efforts were made by the Nutrition Branch, Office of the Chief Surgeon, and by many Quartermaster Corps officers to minimize the use of operational rations, except as emergency rations for frontline troops. Supply officers were inclined to overemphasize the convenience of transport and issue of the C, K, and ten-in-one rations at times when convenience was not a tactical necessity. The justification for the use of the modified A ration with its hot, varied meals did not depend on a theoretical effect upon physical fitness and morale. These positive effects were real and were recognized by the personnel of experienced divisions. The contrast between old and new combat divisions in this respect was most enlightening. Table 6 shows the proportional use of operational rations on the Continent. The extent of issue of nonoperational rations to combat, as well as service troops, was most gratifying. It is significant that the Battle of the Bulge, which occurred in an area easily supplied with A rations, did not increase the issue of operational rations (December 1944 and January 1945, Table 6). This is in contrast to the requirement of these rations in the period of rapid movement away from supply depots during the overrunning of Germany (April–May 1945).

TABLE 6. ISSUE OF OPERATIONAL RATIONS

PERCENT OF RATIONS ISSUED

Period	A or B rations	Operational rations			
		C	K	Ten-in-one	Total
1944					
June	0	14	15	71	100
July	57	6	9	28	43
August	52	14	14	20	48
September	58	18	10	14	42
October	79	7	5	9	21
November	88	3	5	4	12
December	87	3	5	5	13
1945					
January	91	2	3	4	9
February	91	2	4	3	9
March	88	4	5	3	12
April	74	8	7	11	26
May	87	2	4	7	13
June	94	1	3	2	6
July	96	1	2	1	4

Source: Data supplied to author by Office of the Chief Quartermaster, Headquarters, European Theater of Operations, United States Army.

Troops were on a diet practically devoid of ascorbic acid whenever they subsisted on unsupplemented C, K, or ten-in-one rations in the cold weather which was general in Europe. This resulted from the refusal to prepare and drink the lemonade which may be made from the fortified lemon or other fruit powders. Revised forms of the improved C and K rations were on hand late in the war but the bulk used between D-day and April 1945 consisted of unimproved types. These were unpopular and were poorly utilized. Limited experience with the newest C ration indicated that troops preferred it to the K ration. The K ration appeared more desirable than the unimproved C ration except in units which made provision for heating the C ration. These units set up field ranges as close to the front as was feasible, heated the meat components of the C ration in boiling water, repacked the hot cans in cases and sent them forward for distribution. The taste of the C ration meat component was greatly improved if warmed.

The deficiency in thiamine and the questionable deficiency in riboflavin in the type B ration was corrected as quickly as fresh items became available. The ration was adequate by October 1944 and by February 1945 was superior in its content of nutrients to that supplied in the United Kingdom before D-day. The difference was primarily due to enriched flour, which was used on the Continent and which had a higher content of thiamine and riboflavin than the British National flour.

Extra ration allowances were authorized combat units occupying positions in contact with the enemy. These augmentations included a 10-percent overall increase for units receiving the A or B ration and additional meat, jam, bread, and coffee ingredients for troops receiving operational rations. Full advantage was taken of these authorizations and the service of sandwiches and coffee to frontline troops as supplements to C and K rations was a common occurrence.

In June 1945, rations for personnel engaged in nonarduous duties, except patients, were automatically decreased 10 percent. Fortunately the ration was rich enough in nutrients so that minimum allowances were still supplied. Overall deductions are hazardous because of the failure to distinguish between foods of high and low nutrient content. The decrease in June was necessitated by the theater shortage in rations. It should be noted in this connection that the average ration was insufficient for units performing very heavy labor and required augmentation.

Hospital Rations. The feeding of battle casualties was quite satisfactory. The rapid evacuation to the hospitals in the United Kingdom, both by air and by water, materially eased the load on the medical units which preceded general hospitals to the Continent. The result was that operation hospital rations were only required in the early stages of the invasion. Most of the casualties arrived very quickly in areas where type B or A components were

available. The hospital ration on the Continent differed from that in the United Kingdom in that the continental ration consisted of the troop ration plus a supplementary list of foodstuffs, whereas patients in the United Kingdom were supplied a separate special ration. The continental issues were generally excessive unless hospital mess officers refused components of the troop ration which were not needed. The authorization for the use of the special hospital ration on the Continent was refused by Headquarters, European Theater of Operations, United States Army, for the reason that depots would find it too difficult to provide 2 rations rather than 1 ration plus a supplement.

AUGMENTATION AND REDUCTION OF RATIONS

In August 1942 authority was granted the Commanding General, Services of Supply, European Theater of Operations, to increase the augmented British ration (British-American ration) 15 percent if not less than 75 percent of an organization was engaged in hard physical labor for 10 or more hours daily, 6 days per week. This augmentation ceased as troops received the American ration in September and October of 1942.

Early in 1943, upon the request of the Air Surgeon, members of air combat crews on operational status were authorized 3 fresh eggs and 3 oranges per man weekly and 0.0625 pounds of powdered whole milk daily. Later, Air Force combat and repair crews on operational status were allowed an additional augmentation. The request for shell eggs and oranges was approved by the Office of the Chief Surgeon, European Theater of Operations, as a morale measure and not because of nutritional necessity. The request for components for a fourth meal was granted without the reference of the matter to the Chief Surgeon for investigation and recommendation.

In view of the increasing number of requests for augmentation of rations, mainly from port and engineer battalions, an extra allowance for units performing arduous tasks was written into the theater directive on rations. Nutrition officers had been assigned to the staffs of base section surgeons by this time so that it was possible to make the augmentation contingent upon an investigation which "shows that the authorized ration issue is properly prepared, served and eaten and that a need for additional food still exists." The augmentation, which supplied approximately 400 calories, was purposely limited to bread or flour, potatoes and lard, although most units which requested extra food desired more meat. The basic ration was adequate in nutrients and generous in its meat components and it was believed to be sound policy, therefore, to confine supplements to reasonably available foodstuffs which provided the necessary calories. Units which were not interested in eating more bread and potatoes were not considered to be suffering from a shortage of food. As a matter of fact, few of the requests for augmentation were found to be justified.

These investigations by nutrition officers did prove to be excellent opportunities for instruction of untrained or careless mess personnel.

The above procedure which provided for a thorough survey of the physical well-being of troops as well as a determination of the adequacy of the quantity of the ration issue was a most satisfactory method of controlling the vexing problem of insuring that soldiers were well-fed without incurring the risk of waste of food because of oversupply. Unfortunately, it became necessary in July 1944 to replace this system with one which liberalized the issue of augmented rations and recognized the fact that it was easier to supply extra food to a unit than it was to insist upon efficient mess operation. Prior to the invasion of France requests for augmentation of the ration increased enormously due to the number of depot and port units which ran day and night shifts. Some units attempted to feed sandwich meals at night rather than hot meals prepared by a night shift in the mess. The ration was not adapted for sandwich meals. Night feeding was poor, therefore, and vegetables, canned fruits, et cetera, accumulated in storerooms. In other units, which served regular hot meals at midnight, men on the night shift were permitted to get up and eat the midday meal with the day shift. The total daily food intake of these men was no greater but this practice did deprive the day shift of its normal share of the more desirable components of the ration, especially of its share of the meat issue. Artificial shortages of certain ration items developed from these failures of mess officers to insist upon mess discipline and proper mess operation. During this period the Commanding General, Services of Supply, European Theater of Operations, believed it necessary to authorize many augmentations without the usual preliminary survey. All investigations were therefore discontinued and augmentation requests were approved as they were received. As soon as the emergency created by the main invasion operations had passed, the augmentation procedure was brought under control again by a new directive which rescinded all previous written and verbal authorizations for extra rations and which described the specific types of augmentation which might be requested. The ration increases for the Air Forces, referred to above, were reaffirmed. An automatic increase of 10 percent was allowed messes serving less than 50 men in order to provide adequately for the many isolated antiaircraft and similar groups consisting of 5 to 20 men. The Chief Quartermaster, European Theater of Operations, was authorized to grant extra food to troops engaged in hard labor, to noncombat sectors, to troops returned to rest camps after combat, and to troops operating under exceptional circumstances provided the Chief Surgeon recommended the augmentations as essential for the maintenance of physical fitness.

In June 1945 the theater ration and augmentation directives were drastically revised. The new directive, which took into consideration the cessation

of hostilities and the critical shortage of rations within the theater, included the following provisions:

1. All augmentations were discontinued except the 10-percent increase for small messes (under 50) and increases for crews of small watercraft. The way was left open for augmentations which were approved by the Chief Surgeon, European Theater of Operations, but it was emphasized that nutritional necessity, and not convenience in mess operation, would be the sole factor governing the approval of an augmentation request.

2. Decreases in normal ration issues were authorized for the first time in the theater:

a. Rations for all military personnel engaged in sedentary duties were automatically reduced by 10 percent.

b. Base section and other commanders were directed to review constantly troop lists in their respective commands and to apply reductions up to 10 percent for all troops engaged in light or moderately active duties.

c. A percentage reduction, as follows, was directed for all messes not affected by the provisions of paragraphs *a* and *b*, above:

Strength of mess:	*Percentage reduction*
Over 1,000	7
300–1,000	5
Under 300	0

None of the above reductions applied to ration items, such as shell eggs or fruit, issued on the basis of one per man. Furthermore, personnel in the following categories were exempted from all reductions: Hospital patients, troops undergoing vigorous training or engaged in hard labor, troops on leave or in officially designated rest areas, messes serving less than 50 men, and recovered Allied military personnel (RAMP's).

Vitamin Supplementation. The supplementation of rations with multivitamins was a relatively unimportant feature of rationing in the European Theater of Operations except in the case of hospital patients and Air Force personnel. The former required extra vitamins if the food intake was insufficient to provide the necessary levels of these nutrients. Combat crews were supplied multivitamins at the request of the Air Surgeon. This may have been justified as a preventive measure related to a possible greater need of certain nutrients by aviators. The basis of such a need was never demonstrated.

In February 1944 a survey of the dietary histories of the personnel of small detachments (1–15 men) of the Corps of Military Police, Finance Department, and Transportation Corps, located in cities, towns, and villages throughout the United Kingdom, showed that the intake of vitamins was well below the minimum standards. These men were isolated from United States Army messes and received a monetary allowance in lieu of rations. Obviously no control of their purchase of food was possible except that of the British rationing

regulations. Arrangements were made to supply multivitamins to these detachments although no evidence of nutrient deficiency was uncovered.

Provision was made for distribution of vitamins to combat troops in the event subsistence on unsupplemented rations continued for periods in excess of 15 days. Fortunately, few units were ever in this category. Conferences with division surgeons disclosed that few believed that vitamin supplementation was necessary. These conferences always served the purpose of reemphasizing the desirability of extending even more the common practice of augmenting operational rations with sandwiches and other items.

The initial survey of German stalags at Limburg, Zigenheim, and Heppenheim by the Nutrition Branch, Office of the Chief Surgeon, revealed the magnitude of the RAMP problem. It furnished the background for the measures adopted to insure nutritional rehabilitation of the men who required immediate hospitalization, or who were hospitalized during or after evacuation to the camps in the rear areas, and of the men who, although suffering from malnutrition, were not hospitalized and remained under the control of the Provost Marshal, European Theater of Operations. A directive was immediately distributed to hospitals outlining therapeutic dietary procedures for the various categories of malnourished patients. The nutritional care of nonhospitalized RAMP's was effected by the authorization of a special bland, high protein, high calorie ration for use in RAMP camps. Conferences were held with base section surgeons and with medical officers in these camps in order to guarantee the proper use of the bland diet. This dietary regime was necessary because of the extreme gastrointestinal sensitivity which characterized RAMP's. Diarrhea was almost universal before corrective measures were instituted. It was necessary to prohibit the distribution to RAMP's of peanuts, candy bars, doughnuts, et cetera, by the Army Exchange Service and by the Red Cross because it was evident that these well-intended measures were in reality harmful. Studies of nutritional rehabilitation in the RAMP camps were not undertaken because it was the original policy of the theater to evacuate these troops to the United States immediately. Provision was made for the continuance of the bland ration on the ships carrying them home.

OTHER RATION PROBLEMS

Milk and Ice Cream. Milk issues consisted almost exclusively of evaporated and dried whole milk. Small amounts of skimmed milk powder were included in the hospital ration for use in low-fat diets. One shipment of 3,200 quarts of frozen whole milk was received in good condition in the United Kingdom in March 1945, and was distributed to hospitals. Beverage milk and eggnog were prepared and served in hospitals but no serious attempt was made to popularize the use of beverage milk in troop messes although suitable instructions for its preparation were published in mess bulletins. The dried whole milk was very

acceptable, however, and yielded a reasonably good fluid milk if care was used in its rehydration and particularly if the product was flavored with chocolate or vanilla. In view of the lack of apparatus for the large-scale reconstitution of fluid milk from milk powder, emphasis was placed on the utilization of dried and evaporated milk in cooking, in cocoa, on cereal, and in similar ways. Consumption of the milk component of the ration was satisfactory. This would not have been the case in the absence of an intensive educational program.

Early ration directives authorized the daily issue of the equivalent of 5 ounces of evaporated milk per man. This was not considered sufficient and the Nutrition Branch, Office of the Chief Surgeon, was instrumental in having the allowance increased to 7 and 10 ounces, and later to 8 and 12 ounces, for troops and hospital patients, respectively. Thus, troops received the equivalent of 1 pint of whole milk daily. The additional milk added greatly to the acceptability of the ration and assisted materially in assuring satisfactory intake of calcium and riboflavin. The use of fresh milk from local sources in the United Kingdom and on the Continent was restricted and later prohibited because of the medical hazard involved and because of the scarcity of the supply for civilian use.

The manufacture of ice cream by British concerns was prohibited by governmental order as a means of conserving materials and of insuring a uniform distribution of available milk. The American Army supported this policy and ice cream was not supplied except as it was prepared by hand freezing in small quantities in a few messes. The British restriction was removed after the liberation of France and Belgium, and in January 1945 the use of ice cream by United States Army units in England and on the Continent was authorized and encouraged. It was specified, however, that ice cream would be prepared from ration components exclusively and that civilian manufacturing agencies must maintain United States Army standards of sanitation. In August 1945, ice cream mix became a normal component of the ration issue.

Dehydrated Foods. The issue of dehydrated foods was not a serious problem in the European theater because these items never predominated in the ration. Dried milk was acceptable. Dried egg was not received enthusiastically but it was a useful item if used as an ingredient. The wastage was excessive whenever it was served as an omelet or as scrambled egg because of the inability or refusal of cooks to prepare it properly. Onion was very satisfactory if used with ground beef. It was unsatisfactory if used as a vegetable. Potato was acceptable if reconstituted properly. Sweet potato was a good product but the amount in the B ration was excessive for the average soldier. Carrots and beets were reasonably satisfactory. Obviously, none of these dried foodstuffs was a good substitute for the canned product. The problem of dehydrated foods was worsened by the fact that relatively few cooks had received sufficient training on the handling of this type of foodstuff.

Local Procurement of Foodstuffs. The general policies governing the rocurement of foodstuffs from sources within the theater were designed to ave transoceanic shipping by the maximum use of local surpluses and, at the ame time, to protect the food rationing programs of the British and other llied governments by restrictions on miscellaneous purchases by individuals nd units of the American forces. The British Ministries of Food and of griculture made available large quantities of such foodstuffs as flour, bread, repared cereals, rolled oats, tea, marmalade, syrup, condiments, potatoes, and egetables. Procurement through authorized quartermaster purchasing officers as also authorized on the Continent but this was limited largely to fresh egetables and the supply permitted only occasional issue. The supply of otatoes, cabbage, carrots, beets, rutabagas, and brussels sprouts was prac-ically unlimited in England. Tomatoes and lettuce were only abundant uring short seasons so that the dietary was generally lacking in fresh salad omponents. Fresh fruits were notably lacking in the American ration. easonal apples and pears were unrationed in England and the same was true of pricots and grapes in France, but the former were of inferior quality and the tter were readily available only in southern France. Shipments of oranges, hich were received occasionally in 1944 and 1945, were therefore especially ppreciated by the troops.

The purchase of meals in public restaurants was prohibited on the Con-inent. No such restriction prevailed in the United Kingdom although the emand for meals sometimes exceeded the supply. The American Red Cross rovided snack bars which were well patronized. These were limited to British ources of supply and to British rationing in the United Kingdom but were llowed to purchase quartermaster subsistence supplies on the Continent.

RATIONS FOR PRISONERS OF WAR

A small number of German and Italian prisoners of war were brought to ie United Kingdom from North Africa in 1943. Prisoners captured in Nor-andy in 1944 increased the number but the total in the United Kingdom under ie control of the United States Army was never large. These prisoners of ar were issued a ration which did not differ greatly from that supplied Ameri-n troops. No distinction was made in the rations for working and nonwork-g prisoners.

Prisoners of war on the Continent were issued a similar ration until 7 De-mber 1944, except that nonworkers received 20 percent less than workers. t this time the worker's ration was reduced from 3,860 to 3,258 calories; non-orkers received 10 percent less. Another reduction was made in April 1945. or the first time separate rations were authorized nonworkers because it was t feasible to make an overall percentage deduction in the worker's ration to ing the caloric level down to the 2,000 calorie level ordered by the theater

for nonworkers. These ration decreases were the result of the disparity between tremendous numbers of captured prisoners and the relatively small stocks of available foodstuffs. Furthermore, the 2,000-calorie ration was authorized as the theater ration for displaced persons and others whose subsistence was the responsibility of Allied Military Government. The earlier rations supplied nonworkers were in accordance with the Geneva Convention and were in excess of the actual requirements of the prisoners. This original policy was bitterly criticized by Allied civilians because nonworking prisoners had more to eat than Allied workers. Following the German surrender in May 1945, practically all the prisoners held by the armies inside of Germany were classified as "disarmed forces" and their subsistence became the responsibility of the civilian food administration. Prisoners of war in the communications zone remained on the prisoner of war ration.

In February and March 1945 the Nutrition Branch, Office of the Chief Surgeon, was directed to investigate the nutritional status of prisoners of war in American custody. The survey team, consisting of 2 medical and 2 nutrition officers examined 800 prisoners in representative work camps and enclosures. The results showed that the nutrition of prisoners who had been in American hands for 50 days or more was satisfactory and considerably superior to that of newly captured Germans. This indicated that the prisoner of war ration in use during the early part of 1945 was superior to the ration of the German Army.

In August 1945 the Nutrition Branch, Office of the Chief Surgeon, was directed to make a second theater survey of the adequacy of the feeding of prisoners of war and of German disarmed forces. The 2,000-calorie ration was found to be insufficient for German prisoners under 21 years of age and for others who were classed as nonworkers but whose caloric needs were significantly increased by fatigue duties, calisthenics, or marching. The 2,000-calorie ration was adequate for individuals who were inactive in fact. The German civilian ration issued to disarmed forces varied from 1,200 to 1,500 calories at that time and was inadequate. This was especially true because there was no opportunity for the men in the enclosures to supplement their rations as German civilians were able to do from gardens, household supplies, et cetera.

Nutrition in the Persian Gulf Command

In the noncombat or less active areas such as the Persian Gulf Command and China-Burma-India theater, the problems in nutrition were of a different nature. In the Persian Gulf Command, troops were stationed primarily in fixed installations. The field ration was used throughout 1943, and supplemented by vitamin tablets up to June of that year when the practice was discontinued because the ration was felt to be nutritionally adequate. Local

produce could not be fed to soldiers because of the native's custom of using night soil for fertilizer. No fresh meat was provided for the command until just prior to the Teheran conference. No master menu was ever prepared in this command, the menu being largely dependent upon the arrival of reefer ships. There was some inequitable distribution of food; however, no vitamin deficiency diseases were known to have existed.

The problem of feeding Army employees who were local inhabitants of various religious faiths and food habits was encountered in the Persian Gulf Command. For example, Mohammedans were provided goat meat in lieu of pork. The problem also arose in the China-Burma-India theater, where nutritional deficiency disease developed among Chinese troops stationed in a training center at Ramgarh, India.

Nutrition in the China-Burma-India Theater [32]

The establishment of a theater of operations by the United States Army in India and Burma presented peculiar subsistence problems. Our forces were not invading a hostile country where subsistence could be requisitioned from the populace and where supply lines could be appropriated and set up without regard for the native population. They came as "guests" to a densely populated, Allied country in the throes of political unrest. Furthermore, a large proportion of the population was on the brink of a great famine which was to destroy by starvation a million and a half people in 1943. The United States troops could not be concentrated within a few well-consolidated areas, but because of military necessity were scattered in small groups separated by thousands of miles. The existing ground lines of communication between these areas were extremely primitive or nonexistent. Rations of the British or Indian Armies were not acceptable to our troops. It was intended, however, for these troops to "live off the land."

When the first contingent of troops arrived in India from the United States early in 1942, no provision had been made for the continuous supplying of these troops with subsistence from the Zone of Interior. A reserve stock of B rations was sent to the theater, but these were not to be used except in emergencies. It was intended that these troops should be fed on supplies obtained from local markets and on rations obtained through the British Army. In October 1942, a theater policy was adopted governing the subsistence of United States troops in India and Burma.[33] The ration consisted of the British troops field service ration obtained through the Royal Indian Army Service Corps, supplemented by local purchase of fresh supplies and by the issue of excess stocks of the reserve B ration. These reserves were augmented from time to time by ship-

[32] This section is based on material submitted by Karl J. Koehn, formerly Captain, SnC, Nutrition Consultant, India-Burma theater. The material was originally presented in Van Auken, H. A.: A history of preventive medicine in the United States Army Forces of the India-Burma theater, 1942 to 1945. HD: 314.7–2.

[33] CBI Memo 120, 30 Oct 42, sub: Rations for U. S. Forces in CBI. HD.

ments from the Zone of Interior which permitted rotation of stocks to prevent spoilage and which provided a reserve for subsequent incoming troops.

Unfortunately the excess stocks of B-ration reserve were slow to accumulate and confusion existed as to what constituted an emergency. It was often difficult to maintain the reserve at the authorized level because of the rapid expansion of the theater. The British troops field service ration was found to be unsuitable for United States troops because many items such as pork and soya links, corned beef and mutton, were not acceptable and hence were not eaten. The milk allowance received from the British Army amounted to only 2 ounces of tinned milk per man per day, which is not considered to be adequate for United States troops. Practically no fresh milk was available because of the insanitary conditions under which it was produced. Fresh meat was scarce and of inferior quality, because of the Government of India law which prohibits the slaughter of bullocks in good state of health under 10 years of age, pregnant cows, or cows in milk. Other fresh meats were not available. Difficulty was also encountered in obtaining sufficient quantities of high quality fresh fruits and vegetables. These were available to troops in the metropolitan areas such as Karachi, New Delhi, and Calcutta, but were scarce in isolated regions such as the Brahmaputra River Valley. Menus were prepared in the various section headquarters located in the above mentioned cities but these could only be used in the immediate vicinity because of difficulty of distribution.

Numerous complaints were received by the Surgeon of the theater that the dietary of the troops was deficient in calcium, thiamine, riboflavin, and vitamin C. Medical officers reported a reduction in the efficiency of the command which they attributed to malnutrition. A large proportion of the troops reporting for sick call complained of weakness, insomnia, lassitude, and gastric complaints which were suggestive of a deficiency state. An increase in the occurrence of gingivitis was also observed which may have been precipitated by a vitamin C deficiency.[34]

The situation became serious enough to warrant careful study of the adequacy of the ration and means of improving the nutritional status of the troops. In midyear of 1942 a nutrition officer, Capt. (later Maj.) M. J. Babcock, SnC, was assigned to the theater as Nutrition Consultant to the Surgeon, Headquarters, Services of Supply, China-Burma-India. He made a thorough study of the dietary of the troops and concurred in the opinion that the ration was deficient in calcium, thiamine, and riboflavin. Dietary studies of the troop ration continued throughout the autumn and winter and were summarized in a report in January 1943.[35] On the basis of these studies, the Surgeon recommended that:

---

[34] Ltr, Surg 45th Engr Regt (GS) to Food and Nutrition Off CBI, 26 Apr 43, sub: Inadequacy of diet. HD: 720.1.

[35] Rpt, Capt M. J. Babcock, SnC, 14 Jan 43, sub: Nutrition of U. S. Army Forces in India and Burma. AG: 331.4.

1. The allowance of canned milk obtained from the United States be increased to supplement the 2 ounces received from the British Army;

2. Troops in Base Section No. 3 (Ledo area) be issued the B ration instead of the British Troops Field Service Ration; and

3. The ration of other troops stationed in Assam be supplemented with canned fruits and vegetables.

Troops in the forward areas deserved preference in subsistence because they were fighting and doing heavy work under very adverse conditions and because local supplies were not available. These recommendations were put into effect. Stocks of B rations which were beginning to accumulate in excess of the authorized reserve were diverted to the use of hospitals and combat aircrews. The Surgeon, China-Burma-India, recommended that the Expeditionary Force Menu No. 1 (Tropical and Temperate Climate) be adopted as the field ration for this theater. No action was taken on this recommendation at that time and the policy of "living off the land" was continued except in the Ledo area.

As a result of the complaints that the ration was nutritionally inadequate, many requests for the issue of multivitamin tablets to supplement the ration were received by the Surgeon's Office. Since this item was in critical supply at that time, it was necessary to establish a theater policy governing the issue of multivitamin tablets to supplement the ration in order to insure expeditious use of available supplies. The issue of multivitamin tablets was authorized to supplement the ration of troops only upon certification by the unit medical officer that a specific deficiency existed and that no foods were available to correct this deficiency. Requisitions accompanied by the certificate were required to be submitted to the Surgeon, Headquarters, Services of Supply, China-Burma-India, for final approval. Later in 1943 this policy was liberalized to include the issue of multivitamin tablets to combat aircrews and units subsisting on emergency rations.

At this time an outbreak of nutritional deficiency disease occurred in the form of beriberi among Chinese troops at the Chinese Training Center at Ramgarh, India. This outbreak was investigated by the nutritional consultant.[36] Between 8 August and 25 September 1943, 199 patients were hospitalized with beriberi as the primary cause of hospitalization. Many patients were not admitted to hospitals but were treated as outpatients at dispensaries. Other symptoms of deficiency diseases such as night blindness, cheilosis, glossitis, and osteomalacia were also observed. These troops had recently arrived from China and most of them had a background of chronic malnutrition. The rice eaten by some of them had spoiled and required much washing which

[36] Rpt, Capt M. J. Babcock, SnC, 30 Sep 43, sub: Investigation of dietary deficiencies among Chinese troops at Ramgarh Training Center. HD: 314.7–2 Ref.

caused the extraction and loss of nutrients. The diet prescribed for Chinese enlisted men in India at that time had the following composition:

Item	*Amount*
Rice, polished	2 pounds
Meat	8 ounces
Vegetables, fresh (⅓ green)	8 ounces
Oil, cooking	5 gallons per 1,000 men
Salt	½ ounce
Tea	⅓ ounce
Firewood	3 pounds

A nutritional analysis of this ration made at that time showed the following daily allowances of nutrients:

Nutrient	*Chinese troop ration*	*Recommended*
Calories	3, 950	4, 000
Calcium, mg	170	800
Iron, mg	16. 2	12
Vitamin A. I. U	2, 570	5, 000
Thiamine, mg	. 57	1. 8
Riboflavin, mg	1. 46	2. 40
Niacin, mg	22. 5	20. 0
Ascorbic acid, mg	38. 6	75. 0

This dietary was obviously deficient in calcium, vitamin A, thiamine, riboflavin, and ascorbic acid. The ration was changed as follows: 1½ pounds of undermilled rice was substituted for the 2 pounds of polished rice, and one-half instead of one-third of the vegetable allowance was prescribed as green. The following ingredients were added: 2 ounces of dried beans, 2 ounces of peanuts, and 4 ounces of atta (whole wheat flour). Subsequent to these changes, no further widespread incidence of nutritional disease occurred among troops of the Chinese Army in India or Burma.

With large numbers of troops moving into Assam during the latter part of 1943 and in early 1944, the problem of supplying subsistence from the port of Calcutta became acute. The Bengal-Assam Railway system was sorely overtaxed and since the trip from Calcutta to Assam took 12 days, only nonperishable items were so shipped. Barges carrying supplies up the rivers of East Bengal were often stranded for days because of the great variations in the flow of water. There were no roads connecting Calcutta with Assam, so motor transport could not be used. Because of the uncertainty of supply, it was impractical to prepare a menu in advance for the forward areas. The local markets were quickly depleted of foods, and the reserve of B rations was seriously unbalanced. It was necessary, therefore, to employ airlift to transport much of the subsistence from Calcutta to Assam.

As the combat troops and those engaged in the construction of the Ledo Road, petroleum pipeline, and signal communications moved forward from Ledo into Burma, many of the units had to be supplied by airdropping. An

airdropped ration was formulated of B-ration components which was nutritionally adequate yet light in weight. This was accomplished by the full use of dehydrated products. C and K rations were also used for this purpose. Airdropped rations were always supplemented with multivitamin tablets.

Supply to the forward areas was always uncertain under optimum conditions, but it became precarious during the spring-summer season of 1944. It became necessary, therefore, to liberalize the theater policy on the issue of multivitamin tablets to supplement the ration. This was done by authorizing the issue of one tablet per man per day to all troops stationed in Assam and Burma until such time as transportation would allow the supplying of adequate subsistence to all units.

Early in 1944 Col. Paul E. Howe, Chief of the Nutrition Division, Office of The Surgeon General, visited the theater and studied the ration problems. In his report Colonel Howe attributed the inadequacy of the ration to the attempt to "live off the land," to dependence on British supplies which were often not available or acceptable, and to inadequacy or failure of transportation. He recommended that the theater adopt the Expeditionary Force Menu No. 1 (revised 1 October 1943) as the basic field ration. He also recommended that additional nutrition officers be assigned to the theater to work with the troops in the field.[37]

In March 1944, four nutrition officers were assigned to this theater. The following were their assignments: (1) Air Transport Command installations in India and China; (2) Services of Supply installations around Ledo and the Ledo Road as far as Myitkyina; (3) the eastern half of India; and (4) the Air Force installations in Northern Burma. The duties of these nutrition officers were to conduct nutritional surveys in troop masses in the field to determine the nutritional adequacy of the dietary consumed by the troops, to advise the surgeon in matters pertaining to nutrition, and to assist the quartermaster in preparing menus and in selecting nutritionally equivalent substitutes for unavailable items.

In July 1944, the Expeditionary Force Menu No. 1 was adopted as the basic field ration for this theater in accordance with Colonel Howe's recommendation. Such components as were available from the British were procured in bulk from the Royal Indian Army Service Corps under reverse lease-lend agreement. These items included flour, salt, sugar, condiments, fresh eggs, meat, fruits, and vegetables. Components not available locally were imported from the Zone of Interior and a 90-day reserve stock level maintained. The indigenous products were of low quality compared with United States Army standards. The flour was particularly subject to criticism by United States troops. It was not enriched and therefore was low in vitamin content, was heavily infested with weevils, and, because of its low gluten content, it was

[37] Ltr, Col P. E. Howe, SGO, to Surg CBI, 11 Mar 44. HD: 720.1.

unsuitable for breadmaking. The fruits were of fair quality, but many species were previously unknown to the troops and were not well received, for example, mangoes, papayas, and leechie nuts. The vegetables were generally of poor quality, picked after the optimum stage of maturity and were usually wilted or spoiled upon arrival at their destination. As in the case of fruits, many of the vegetables were unknown to the cooks who were at a loss to know whether a new botanical specimen issued to the mess should be boiled, fried, or baked; or whether it should be seasoned with salt or sweetened with sugar. The resulting product was usually highly unpalatable.

The troops in this theater subsisted for several months on the ration as prescribed by the Expeditionary Force Menu No. 1, supplemented with such indigenous fresh produce as could be obtained from the Royal Indian Army Service Corps. During that time complaints about the quality and quantity of the ration became more and more numerous. The following were the most commonly expressed complaints: (1) the caloric value of the ration was inadequate; (2) the canned meat components became monotonous, were unacceptable, and were not eaten by the troops; (3) the dried eggs and whole milk powder were rancid and therefore were not consumed; (4) insufficient bread and spreads were issued; and (5) cereal products were heavily infested with weevils.

The complaint that the caloric value of the ration was inadequate as prescribed by the Expeditionary Force Menu No. 1 was justified in many instances. The food prescribed by this ration contained 3,945 calories whereas nutritional surveys conducted in hard-working units such as port battalions and truck companies revealed that food actually consumed exceeded 4,000 calories if it were available. The port battalions and aviation engineer battalions, which worked three 8-hour shifts daily, often served as many as 6 meals a day. This was very difficult to accomplish with the food prescribed by the Expeditionary Force Menu No. 1. The canned meat components of the B ration were highly spiced and quickly became monotonous and therefore unacceptable. Much of the meat was not consumed, and therefore the ration as consumed was lowered in nutritional value.

The dried eggs and powdered whole milk components of the B ration were too perishable to be sent to a tropical theater so far from the source of supply. It required from 60 to 90 days' travel time to ship subsistence from the Zone of Interior to India and for most of that time the temperature was around 100° Fahrenheit. An additional 30 days were required to unload and transport the supplies to the various subdepots where they were stored for an additional 90 days at a temperature of 100° F. or higher. This latter storage was necessary for the proper rotation of the 90-day reserve stocks. Thus it was necessary to subject these products to high temperatures for a minimum of 6 months before they could be used. Actually they were from 1 to 2 years old before they were issued. The powdered eggs were discolored and had a disagreeable taste

which was difficult to disguise; consequently the mess personnel seldom bothered to prepare them as a breakfast dish and when they did, most of them were discarded. The powdered eggs, however, were extensively used in baking and cooking. The whole milk powder could not be made into a palatable beverage unless it was mixed with chocolate or some other flavoring to mask its disagreeable taste. It could be used satisfactorily, however, in cooking and baking.

Because of the long storage at high temperature, the dehydrated vegetables had deteriorated considerably. Many of the cooks in the theater had not had previous experience in the preparation of dehydrated vegetables and, therefore, were not adept in preparing appetizing dishes from them. Consequently the dehydrated vegetables were not acceptable and considerable waste resulted. This had a deleterious effect on the nutritional adequacy of the ration. The surgeon recommended that a food service program be established in this theater to correct these difficulties, but the recommendation was not favorably considered at that time.

The hospitals found it difficult to operate on the field ration and hospital supplement ration as prescribed by the Issue Chart to Expeditionary Force Menu No. 1. The hospital ration did not furnish adequate subsistence for patients under the climatic and epidemiologic conditions of this theater. The high proportion of patients admitted with febrile and diarrheal diseases resulted in the use of a large percentage of special or restricted diets. The subsistence issued was particularly deficient in fruit juices and the more acceptable canned meat items. An attempt to correct this was made in Base Section No. 2 (eastern half of India) by issuing one field ration for each patient and allowing the hospital a monetary credit with the quartermaster equal to one-half the cost of the field ration for each patient in lieu of the automatic issue of the hospital supplemental ration. This did not work out satisfactorily because the purchase of certain items of the hospital supplemental ration in excessive quantities by some hospitals quickly depleted stocks of these items, which were being sent to the theater on the basis of troop strength as prescribed by the Issue Chart to Expeditionary Force Menu No. 1. Thus, many hospitals were not able to obtain the subsistence items required for the formulation of the special or restricted diets.

In September 1944, the Surgeon, Headquarters, United States Forces, India-Burma Theater, requested that the ration scale for troops in the theater be revised, that a more liberal hospital supplemental ration be provided, and that a uniform ration system be adopted for all hospitals. The Nutrition Consultant to the Surgeon assisted by the nutrition officers of the base sections and hospital dietitians, in cooperation with the Quartermaster, drew up a new ration scale in the form of the Basic Subsistence Issue Chart for India and Burma and also set up a uniform ration system for hospitals. This was accomplished in October 1944, and the new policy submitted to the Commanding

346336 O—55——11

General, India-Burma Theater, for approval in November. It was put into effect 1 January 1945.[38]

The revised ration provided a maximum of 4,500 calories with a greater variety of meats including canned ham (to increase the thiamine content of the ration), canned pork and gravy, frozen boneless beef, and lamb carcass. The frozen and fresh meats provided more of the B vitamins than the canned beef components of the Expeditionary Force Menu No. 1. An increase in juices, fruits, bread, and spreads were also provided.

All hospitals in the theater were authorized to draw one field ration for each patient plus an automatic issue of the revised hospital supplemental ration prescribed by the Basic Subsistence Issue Chart for India and Burma. This revised hospital supplemental ration prescribed more liberal allowances of canned meats, milk, fruit juices, and canned vegetables than the Expeditionary Force Menu No. 1. The quantities of the less useful items such as dehydrated soups and vegetables purees were reduced.

Early in November 1944, Captain Babcock was returned to the Zone of Interior under the theater rotation policy and he was replaced by Capt. (later Lt. Col.) K. J. Koehn, SnC, as Nutrition Consultant to the Surgeon.

With the adoption of the Basic Revised Subsistence Issue Chart for India and Burma it became necessary to publish a monthly master menu for the theater. The preparation of this menu was undertaken jointly by the Quartermaster and the Surgeon, India-Burma. The menu was used as the basis of issue of subsistence to all unit messes in the theater. This was necessary to insure equitable distribution of all ration items, particularly the fresh and frozen meat components. The menu was also used to exercise control over the stock levels of subsistence items. For example, if it appeared that the supply of a certain item was diminishing at such a rate that it would be exhausted before the supply could be replenished from the Zone of Interior, the quantities prescribed by the menu would be reduced so that the supply would last until replenished. Conversely, if stocks of an item greatly exceeded the reserve level, an increased issue would be prescribed. If stocks of certain items began to accumulate in the messes, the rate of issue would be reduced in the menu. The master menu was subjected to nutritional analysis each month before publication to insure that the optimum quantities of nutrients were prescribed with the available foods.

The increase in the ration, particularly for hospital patients was very well received in the field. Some difficulties were encountered, however, in making adjustments to the new ration scale. Subsistence supplies due in to replenish stocks depleted by the increased issues failed to arrive when expected. Shipments of canned ham were cancelled. This deficiency of supply was apparently

[38] Cir 21, Hq India-Burma Theater, 15 Dec 44, sub: Rations for U. S. Forces, India-Burma theater. HD.

related to increased demands by other more active theaters. Fortunately the shortage of subsistence was confined to staple and nonperishable items. The supply of frozen boneless and imported carcass beef was uninterrupted. This issue of fresh meat boosted the morale of the troops more than any other factor connected with food. It served to break the monotony of an otherwise tiresome ration.

The frozen boneless beef, obtained from the Zone of Interior via reefer ships, was conveniently packed in 50-pound boxes and was separated into three cuts: roasts and steaks, stewing and boiling meat, and ground meat. These were unloaded from the ships at Calcutta to a nearby cold storage warehouse where they were kept frozen while awaiting transshipment. They were then loaded into cargo planes and flown to the general depots and subdepots in the forward areas. Here the meat was kept frozen in cold storage plants until picked up by unit ration trucks. This system worked remarkably well and very little meat was lost through spoilage. All of the meat received from the Zone of Interior was shipped to the forward areas. The frozen boned and carcass meat obtained through the British Army was distributed in the rear areas.

Some difficulty was encountered in the feeding of Chinese patients in American hospitals in the forward areas. The basic ration for Chinese enlisted patients was the revised Chinese troop ration described earlier in this discussion. The components of this ration were obtained through the Royal Indian Army Service Corps and were prepared by the Chinese themselves. Cooking was done in large drums or tubs over an open fire where they prepared their rice, stews, and soups. An attempt was made to exercise supervision over the cooking and serving of the food by United States personnel, but it was almost impossible to change centuries' old customs. For example, when fresh meat was issued, it was necessary to cut it up and issue it to each patient. The patient then cooked it himself according to his particular custom or entrusted its cooking to some friend. Because of their customs of cooking their foods in large volumes of water, many of the water soluble nutrients were lost. In order to prevent the occurrence of deficiencies, Marmite, a brewers' yeast preparation, was added to the soups. To supplement the ration further, all of the hospital comfort items of the British troops field service ration were made available to hospital commanders who decided which items were necessary for the welfare of the patients. These items consisted of canned milk, meats, fruits, sugar, et cetera. Upon the insistence of the Chinese, these items were issued individually to each patient by an American in order to insure equitable distribution. It was over the issue of these comfort items that trouble arose. It was natural that hospital commanders had different ideas as to just which comfort items were necessary and in what quantities. A Chinese patient would find out that a neighboring hospital was issuing an item he was not receiving; he would then

complain that he was not getting what he was entitled to. This became widespread among the patients of all hospitals in this area and no hospital escaped criticism on one score or another. The Chinese found these tactics very useful in playing one hospital against another to secure more comfort items than were necessary. A patient would insist on going to one particular hospital and would boycott the others. Since all of the patients were well fed, this situation was absurd, but rapidly became intolerable. A meeting was called by the Surgeon, Advance Section, which was attended by the nutrition officer and the hospital commanders concerned. A uniform scale of hospital comforts was evolved which was put into effect in all hospitals caring for Chinese patients. After the Chinese were made to understand that the food was the same in all hospitals, the trouble subsided.

Nutritional surveys conducted in Advance Section in 1945 showed that in spite of the more liberal ration prescribed, it was still deficient in thiamine, the average daily intake being 1 mg. per man. The riboflavin intake was also low. The ration as prescribed was low in these vitamins because of two factors; the lack of fresh pork, and the use of unenriched, indigenous flour which comprised 40 percent of the issue. Although few cases of clinical avitaminoses were ever seen in United States troops in this theater, an increasing number of patients were seen in the forward areas who complained of vague symptoms suggestive of subclinical thiamine deficiency, i. e., anorexia, nervousness, indigestion, or fatigue. Some of these patients responded to therapy with thiamine hydrochloride although it was not proved that other factors coincident to hospitalization were not the cause of improvement. The use of thiamine preparations by hospitals in the forward areas increased considerably in 1945 indicating that the long continued low intake of thiamine was beginning to show effects.

Since lean pork products contain approximately five times as much thiamine as lean beef, the Surgeon recommended that pork loins and hams be requisitioned in lieu of half of the beef being procured monthly from the Zone of Interior. He further recommended that the use of unenriched flour be discontinued and that 100-percent enriched flour be procured from the Zone of Interior. The former recommendation was acted upon and the first shipment of boneless pork loins and hams arrived in the theater in July 1945. This pork not only substantially increased the thiamine content of the ration but relieved the monotony of the previously predominantly beef dietary. The second recommendation was not favorably considered at that time because of the theater policy to procure as many items locally as possible to conserve shipping space.

In April 1945 the War Department directed that the ration scale for this theater be reduced so that the total quantities of foods within the various food groups (with several exceptions) conformed with the quantities prescribed

y the Issue Chart to Expeditionary Force Menu No. 1. The revised ration rovided approximately 4,150 calories, 2.06 mg. of thiamine, and 2.78 mg. f riboflavin daily. The increase in thiamine content of the ration in spite f the decrease in calories resulted from the inclusion of 0.13 pound per man er day of lean pork products. It was necessary to reduce the total weight f issue of leafy, green, and yellow vegetables, but this was compensated for y reducing the weight of the canned vegetables and increasing the dehyrated. Since fresh vegetables were usually substituted for the dehydrated, ıe net result was an increase in this group. The reduction in calories was ıused by the decrease in the issue of fats and potatoes. Adjustments were ıade between the various food groups so that the overall decrease in the ıtion could be accomplished without seriously affecting its nutritional value.

The limitations placed upon the ration by the War Department also pplied to the hospital supplemental ration. It was necessary, therefore,) place the hospitals back on the ration prescribed by the Issue Chart to Expeitionary Force Menu No. 1. Within 1 month, reserve stocks of supplemental ems on hand in the hospitals were exhausted and the subsistence issued was ısufficient to allow for the proper dietary management of patients. The utrition Consultant to the Surgeon and the quartermaster subsistence officer ıdied the situation very carefully in order to determine how the hospitals ɔuld be furnished adequate subsistence without exceeding the overall allotıent of subsistence to this theater. They arrived at the following conclusions: lospital supplemental ration items were allocated to this theater on the basis f troop strength, assuming 15-percent hospitalization of the command. Under ıe existing theater policy the hospital ration items received with 10,000 rations ere, therefore, issued to 1,500 patients. Statistics revealed, however, that ı this theater only 5 percent of the command was hospitalized. Thus, twoıirds of the items earmarked for hospitals remained in the depots unused. he problem could be solved, therefore, by prorating the essential hospital ems received with 10,000 rations among 500 patients without exceeding the ıantities of food allotted this theater. The hospital supplemental ration as revised, therefore, to increase the allowances of fruit juices, canned meat, ıd other essential items effective 1 August 1945.

During the summer monsoon of 1945, nutritional surveys conducted in e forward areas indicated that the consumption of thiamine and riboflavin as not optimum. This was attributable to lack of fresh foods in the ration ıd to the impossibility at times of transporting fresh or frozen meats to the rward units along the road. Transportation failure resulted from temɔrary washouts of the Stilwell Road caused by torrential rains and from low sibility which grounded aircraft. The Surgeon, therefore, requested that e Commanding General, United States Forces, India-Burma Theater, obtain thority from the War Department either to procure vitamin preparations

containing thiamine, riboflavin, and niacin for the enrichment of the indigenous flour or to procure 100-percent enriched flour from the Zone of Interior. The authority for the procurement of bulk vitamins or 100-percent enriched flour was granted.

The enriching of the indigenous flour appeared to be the most practicable means of increasing the vitamin content of the ration. Before requisitions were placed for the vitamins, theater headquarters was requested to allow the United States Army to provide bulk vitamins to the Indian mills furnishing us flour for the purpose of enriching this flour. This request was not favorably considered since the flour for United States troops and for the British and Indian troops all came from a common stockpile, and they considered it impracticable to enrich the flour for the United States troops without enriching all of the flour. The project, therefore, had to be dropped. Before the question of procuring 100-percent enriched flour from the Zone of Interior could be considered, the end of the war with Japan had occurred. Since early evacuation of the theater was contemplated, reserve stocks of enriched flour were released for issue which were sufficient to provide 100-percent flour for the troops until evacuation of the theater had been accomplished.

The difficulty in maintaining an adequate dietary arising from the use of unenriched flour is just one example of the problems encountered in an attempt to feed troops in a foreign country on indigenous foods. This applies not only to flour but to such foods as fresh vegetables, which are raised from undeveloped strains on infertile land, and meat from malnourished animals. A comprehensive nutritional survey of India and Burma prior to the entry of the troops into these areas would have allowed our forces to anticipate the difficulties later encountered and steps could have been taken to prevent them. The obvious course that would have been followed is the continuous supplying of these forces from the beginning with the balanced B ration. In case such items of this ration as flour were required to be obtained locally, arrangements could have been made to correct the resulting deficiencies. The most practical means of accomplishing this is by furnishing tablets containing thiamine, riboflavin, and niacin for use in enriching bread. The proper quantities and proportion of each vitamin could be incorporated into a tablet to be used for each unit of flour used in making bread. This can be dissolved in the water so that uniform distribution throughout the bread can be accomplished.

Experience in this theater has shown that it is impracticable to send such dehydrated products as powdered eggs, whole milk powder, and dehydrated vegetables to a tropical climate unless a quick turnover can be arranged or facilities provided to store these items under relatively cool conditions. Surveys conducted in this theater showed that over 50 percent of all dehydrated vegetables prepared in the messes were discarded, which represents a waste of effort in their manufacture and waste of the original product which could have been

l to feed the civilian population. If at all possible only canned foods should ent to theaters in tropical climates.

Although it may be economical to feed relatively small forces on the rations llied troops, this procedure was found to be highly unsatisfactory in this ter. There is a great difference in food habits between various countries, between such closely Allied countries as the United States and England. United States troops almost unanimously condemned the British rations. s is attributable to their dislike of such items as mutton, corned beef, and and soya links, and to the inferior quality of many foods. Since the ted States standards and specifications for foodstuffs are the highest in world, it appears unwise to attempt to subsist American troops on the rior rations of other countries.

Another cause of dissatisfaction with the ration among the United States ps in this theater was the lack of skill on the part of the cooks in preparing B-ration components. Many of the men serving as cooks had no training ooking and many of those who had, had left the Zone of Interior without ning how to prepare such foods as dehydrated eggs, vegetables, and the ous stew and hash components of the ration. The Surgeon repeatedly mmended that a food service program be established in this theater to ect this deficiency. This recommendation was not favorably considered by theater general staff, which was unfortunate because such a program would allowed the training of competent mess personnel in the theater and ld have provided competent supervision over the preparation of food for enlisted men. It is strongly recommended that in future operations, a food ice program be made an integral part of the organization of every theater perations.

In summary, it may be said that the history of nutrition in the India-Burma ter is one of constant struggle against odds to improve the nutritional ade- y of the ration. The difficulties encountered were the inability of India Burma to supply appreciable quantities of acceptable subsistence to sustain Army, the length of the supply line from the Zone of Interior which was longest in the world, the priority in subsistence given the more active ters of operations, the adverse climatic conditions encountered, and the equate transportation facilities in the interior. In spite of these difficulties, ow but steady improvement in the nutritional quality of the ration was ined. Except for the outbreak of beriberi among Chinese [illegible], there no significant indications of malnutrition in this theater.

ition in the Pacific Area

The problems experienced in Europe and Asia were often accentuated dur- mphibious landings in the Pacific area. Americans found the food pro- l them by other nations to be often unacceptable and, in turn, met difficulties

in feeding their Allies an American ration unpalatable to those with different food habits. Varying local situations made procurement of native food difficult or inadvisable and supply lines not infrequently embraced great distances. Limitation of refrigeration for transport and storage resulted in spoilage, and the lack of ability to obtain perishables at times resulted in a monotonous diet. This situation was sometimes aggravated by climatic differences between source of food and forward bases. As in other parts of the world, problems at times arose on the basis of lack of personnel, or of their skill in the preparation of food, with the attendant complaints of unpalatability and failure to consume the ration served. Inspection was not always all it might have been under the circumstances, and there were occasional unfavorable comments on mess management.

Difficulties were sometimes encountered in the preflight and in-flight feeding of Air Force personnel on long missions. Refusal by troops of certain items in the diet occurred. Dried and evaporated milk, and lemon crystals, were mentioned as such items. Comment was made on the loss of water-soluble vitamins during the handling and preparation of food, and the requirements for certain of them were felt to be in excess of supply in areas where troops were subjected for long periods of time to excessive heat and humidity.

Special problems arose in respect to the hospital ration, the feeding of oriental laborers and troops of Allied countries, and in the provision of food to prisoners of war. Here, as elsewhere, hospitals received priority in the ration scale and hospital diet was supplemented by special purchase of food. However, the need for hospital dietitians was at times keenly felt. An unfavorable reaction on the part of troops from the Philippine Islands to a special ration scale was recorded. Nausea and vomiting among Philippine civilians was at one time felt to be due to the Army diet.

However, in spite of not infrequent untoward circumstances in respect to food supplied or consumed which resulted chiefly from the great problem of supplying a nutritious and acceptable diet to troops operating in areas at long distances over water from the source of supply, and in tropical or semitropical areas where geographic and climatic factors considerably enhanced the problem, there was remarkably little severe disability due to malnutrition. Weight loss by troops was often considerable. However, it should be remembered that psychic as well as dietary factors may affect the intake of food by troops under combat conditions or even during acclimatization in tropical areas. In addition to dietary inadequacy in calories, inadequacy of calcium and the water-soluble vitamins was most often commented upon in the Pacific area, as it was in other theaters of operations. Apparently, slow clotting time was encountered in at least one instance, and chronic fatigue, skin infection, untoward oral conditions, and other signs and symptoms suggestive of avitaminosis were noted by various observers. Beriberi and pellagra were regarded as principal causes of mor-

bidity and mortality due to disease among our citizens who were prisoners of the Japanese.

Some of the observations of individual commentators on nutrition in the Pacific theater are recorded as examples of the type and number of problems in feeding troops and of their dispersal throughout the area. An interview with the Surgeon, 37th Division, stationed on Guadalcanal and New Georgia islands is illustrative of the situation in regard to nutrition encountered early in operations in the Pacific area.[39] The surgeon believed that very few clinical signs of vitamin deficiency had been seen in troops of that division and that their supply of multivitamin capsules prior to combat had been adequate. However, he recounted that the weight loss of the individual soldier during the battle of Munda had been in the neighborhood of 20 to 30 pounds.

The C ration was used by this division in combat, and it was supplemented by D (chocolate) bars. Logistic difficulties arose out of the tactical situation, and the diet became unpalatable. On the whole, the surgeon thought that the ration had been low in calcium and inadequate in perishables, including fresh fruits, vegetables, meat, and fish. It was his impression that inspection of food obtained in New Zealand and the Fiji Islands had not met American desired standards, and that problems in refrigeration resulted in its improper freezing. Up to 40-percent spoilage of evaporated milk obtained from New Zealand was attributed to climatic factors. As a result of this experience, the division surgeon believed that the use of powdered milk was preferable to that of evaporated in such a geographic area. Fish were simply not available. There was a relative shortage of water due to porous ground and no rivers, and it was necessary to collect rainwater or to obtain it from the United States Navy.

Historical reports provide information on problems in nutrition related to island warfare, to meeting the special problems of hospitals, and to feeding natives of other countries. During the assault of Saipan, K, C, and B rations were used. The first fresh food received by troops on this island was a shipment arriving on D plus 136, a striking example of the adverse relation of the tactical situation to the feeding of soldiers. From 15 June to 31 December 1944, only about 10 days' supply of fresh food per man was provided, yet no nutritional disease was observed among troops in spite of their uniform weight loss. After the latter date, fresh food became available for a meal daily. Troops on the islands gradually took advantage of the fresh fish, vegetables, and fruits that were available from native and Foreign Economics Administration sources. On Saipan fresh fish were accepted from native fishermen beginning in June 1945 and an average of 40 tons of fish was issued per month. Fresh fruits and vegetables produced under Foreign Economics Administration supervision were accepted for quartermaster issue and the supply was adequate. Ice cream manufactured from standard ice cream mixture was a

[39] Interview, Dr. Bill with Lt Col Hobart Mikesell, MC, Surg, 37th Div, 18 Nov 43. HD.

welcomed addition to the menu. The quartermaster bakery began functioning early and furnished good bread for all troops. Food poisoning which occurred was attributed to faulty handling of food and not to food defective when issued.

An example of the priority for fresh food enjoyed by hospitals was that provided by USASOS Regulations 30–16, 20 February 1945. This regulation provided for a supplemental list of foods for special diets required in hospitals. Nutritional analysis of hospital diets so insured found them to meet National Research Council standards for nutritional adequacy.

The regular Army menu was unpalatable to civilians in the Philippines, and many developed acute episodes of nausea and vomiting believed to be related to the high fat content of their unaccustomed diet.[40]

Reports of inspection trips in the Pacific area provide information on nutrition there from persons variously oriented to the situation. Reports included comment on the adequ[illegible] Australian ration when perishables were obtainable, and the monot[illegible]t when they were not. Weight loss but little clinical avitaminosis was seen in troops in forward areas. The transfer of procurement and distribution of food from Australian to American control was noted.[41]

The report of another inspection trip made in 1943 by Brig. Gen. Charles C. Hillman, (MC), USA, included an account of the complaints which he heard in respect to hospital rations.[42] These included reference to the inadequacy of the number and use of hospital dietitians, to the limited facilities for refrigeration available in hospitals, and to nutritional inadequacy of certain diets. Based on his observations, General Hillman advised provision of the Southwest Pacific and Pacific areas with more officers of the Veterinary Corps for the purpose of augmenting local meat and dairy inspection.

Nutrition was often a subject of discussion in regularly recurring reports received from the Pacific area. In one, the problems in feeding which were encountered in New Guinea in 1942 and 1943 were described in some detail. As for nutritional adequacy of the diet, comment was made only on the probable loss of ascorbic acid and thiamine during the handling of food products. Problems in the handling of food included unsatisfactory inspection, lack of cool and cold storage, pilfering, spoilage in containers due variously to the geographical environment, distribution of food products, and mess management. On the whole, however, nutrition officers found the quantity and quality of food "very satisfactory" at the time of writing the report.

At that time, fresh meats, fruits, and vegetables were being obtained from Australia, and a few gardens had been planted locally. Ninety percent of the

---

[40] (1) Quarterly Rpt, 168th Evac Hosp SWPA, 1945–1. HD.

[41] 2d Ind, Hq USASOS, SWPA, Office of the Surg, to ClnC SWPA, 9 Mar 43 on Ltr, SG to CG Gen Hq SWPA, 4 Dec 42, sub: Information on adequacy and acceptability of the ration. HD: 720.1 (Food) SWPA.

[42] Observations, Brig. Gen. C. C. Hillman, SWPA, 12 Jul 43. HD: 333.

troops were receiving bread from field bakeries, although there was spoilage of flour. Canned fruits and corned beef, fresh boneless meat, ham, and bacon were readily available, but there was little fish. Army rations used included C ration, which had been shipped to New Guinea in large quantities in 1942 and early in 1943. Large amounts of this ration had deteriorated in cans which had been stored in the open and subjected to high temperatures. D ration of both American and Australian origin had deteriorated in open storage save when stored in sealed metal containers. There was pilferage of peanuts from the bulky jungle ration. Troops had found K ration just palatable and soon tired of it. Mountain ration had been issued in New Guinea only on a trial basis. It is evident that these difficulties were related more to matters of immediate concern to the Quartermaster than to the Medical Corps.

Sanitary reports from the Pacific area contained references to calcium deficiency in certain troops, diagnosis of that condition having been based on the doubtful criterion of poor (carious) dentition, and on slow clotting time. Dietary intake low in ascorbic acid, thiamine, and riboflavin was described. There were descriptions of lack of desirable fresh meat, eggs, fruits, and vegetables, and of problems related to supply, transportation, preparation, and palatability of food as well as its nutritional adequacy. However, observations on clinical evidence of malnutrition—with the exception of those noted above—and of weight loss were strikingly absent.

At least one example of the reaction of those concerned with effecting action on the basis of these reports should be described because it is indicative of the different perspective of persons not then subjected to the conditions under which these reports were made and thus able to comment upon them from a dispassionate point of view. Such an example included acceptance of the factual basis of complaints that certain processed and fresh foods received from Allied Nations did not meet our best standards.[43] However, it was pointed out that the reports came from troops who had been overseas for some 2 years, that their morale was lowered, and that their neuropsychiatric case rate was rising. It was advised that efforts be made to improve the quality and acceptability of food in the Pacific area.

Numerous surveys were made of the nutritional adequacy of food issued and consumed and of the nutritional status of troops in the Pacific area. Those available for perusal point to the same dietary and potentially nutritional deficiencies already described: calcium, thiamine, riboflavin, ascorbic acid, and total calories. For example, a quantitative study of diet provided and consumed on a small tropical island in a forward area in the tropics showed the primary deficiencies to be in calcium, and the vitamins listed above.[44] A careful

[43] Ltr, Col J. B. Youmans, MC, to OQMG, 22 Sep 44, sub: Observer's report on subsistence in SWPA. SG: 430.2.

[44] Rush, A.: A field study of the Army diet as provided to troops stationed in a forward area in the tropics. HD: 700.7.

study of Eighth United States Army messes for a period of 20 days, 20 February through 15 March 1945 showed less than desirable amounts of calcium, thiamine, and riboflavin.[45] One such study reported the finding of nutritional inadequacy in ascorbic acid, a conclusion based on the determination of the plasma levels of that vitamin.[46]

Major Problems in Nutrition Overseas

To attempt to generalize the problems of overseas theaters in nutrition is to invoke a storm of criticism by those intimate with individual situations. However, certain of these problems were apparent at one time or another in all areas outside the United States. They evolved from difficulties in supply and in meeting demand. Problems in logistics derived from the tactical situation were not uncommon. Accordingly, rations designed for use over short periods of time were actually consumed over very long periods. Their caloric constitution was not always suited to the needs of troops under such circumstances; their limited number of food items provided a very monotonous diet when unrelieved for many days or weeks; and the food habits of troops so fed varied markedly. Caloric inadequacy due to the constitution of the rations and to their rejection by the individual soldier resulted in weight loss. Difficulties met in the provision of fresh foods including meats, fruits, and vegetables, and in the handling of food products, including their storage and preparation, not infrequently resulted in diets inadequate in calcium and the water-soluble vitamins.

Certain special problems in nutrition were more or less common to all theaters. These included temporary or permanent need for nutritional officers or dietitians. The feeding of Air Force personnel on lengthy missions was rarely solved to the satisfaction of the personnel. Provision of special diets in hospitals often constituted a problem, in spite of the fact that it was general practice to give hospitals priority in respect to food. The feeding of Allied troops and civilians, and of prisoners of war raised many questions. Although these problems were considerable and their solution difficult of accomplishment, and although the feeding of troops overseas undoubtedly left something to be desired, the remarkably little evidence of deficiency states reported attests to the fact that on the whole the nutritional status of the Army overseas spoke well for the technical and professional skill of those concerned with its feeding during World War II.

---

[45] 5th Ind, Lt Col W. D. Cartwright, AGD, to CG 8th Army, on Sanitary Rpt, 8th Army, Apr 1945. HD: 720.1 SWPA.

[46] Golden, W. R. C., and Schechter, M. S.: Evaluation of vitamin C status of troops in the tropics. HD: 700.7.

CHAPTER V

Malnutrition and Deficiency Diseases

John B. Youmans, M. D.

The record of World War II is notable for the virtual absence of nutritional disease among troops. The Army operated under a high standard of nutritional adequacy in the soldier's diet (as set up by the Food Nutrition Board, National Research Council, together with a set of minimal allowances for short periods for use in emergencies), and an assumption that adequate nutrition is necessary for maximum efficiency and health. Concern was felt with regard to deviations from these standards—during the time the soldier drew upon his body reserves when there was a shortage of food, either because of logistic problems, or personal reactions to the food available as issued, prepared, and served. Under such circumstances frank nutritional disease, except for loss of weight, seldom occurred. This is in great contrast to what might have been expected and would probably have occurred only a few years earlier. The magnificient development and use of new knowledge of all matters concerned with nutrition made possible, and successful, operations of great magnitude, conducted under serious logistic difficulties occasioned by extremes of environment and distance, such as the tropical heat and humidity of the jungles of the South Sea islands and the frigid climate of Iceland. It is safe to say that many operations of World War II would not have been possible or could have been carried out only partially had it not been possible to prevent nutritional disease.

Only under extreme conditions, mostly in prisoners of war subjected to the neglect and cruelties of their captors, and in sporadic instances of individuals conditioned by injury, disease, or some personal peculiarity, did those terrible spectres of other wars—scurvy, dropsy, pellagra, beriberi, and xerophthalmia—return. Such was the achievement of preventive medicine.

To refer, as will be done below, to the occurrence of an appreciable amount of nutritional deficiency is not the contradiction that it seems. It is to be explained by the changing concept of nutritional deficiency states, the recognition of the fact that there are degrees of deficiency, insufficient to warrant such diagnoses as scurvy, pellagra, or beriberi which require a considerable period for development even under controlled conditions. Partial deficiency may exist to an extent sufficient to prevent the fullest state of health, physical strength, and fitness, without causing overt or gross disability. Such conditions existed in the general population before the war and their presence was

reflected in a similar occurrence in the troops under average conditions, although as their service lengthened it was decreased by the highly efficient control of food and nutrition in the Army. It is in this respect that preventive medicine finds its greatest opportunity in the field of nutritional deficiency disease and the opportunity to ensure optimal health and physical fitness as far as nutrition can secure them, by preventing even slight deficiencies.

INCIDENCE AND EPIDEMIOLOGY

It is impossible to state accurately the prevalence of nutritional deficiency in the Army as a whole or in any considerable portion of it. Fully developed clinical forms of the deficiencies such as scurvy and beriberi are reportable in rates, as hospital admissions, per annum, but these give but little indication of the actual prevalence of deficiencies. The prevalence of nutritional deficiencies below the level of the classical expressions of disease is uncertain because individuals with deficiencies of these grades alone are not usually patients, nor are they considered ill; the opportunity and special needs for diagnosis are lacking and the conditions exist unknown and often unsuspected.

Some idea of the prevalence of nutritional deficiency disease can be secured, however, from special research studies and from a search of hospital records. The special research studies were made on groups of presumably healthy troops under field conditions, giving information on the prevalence of the mild or slight forms of the deficiency, and on special groups such as prisoners of war and patients in hospitals with advanced deficiency disease. The latter will give only the incidence of advanced stages as they are recorded in hospital practice under the standard forms of diagnosis.

MINOR NUTRITIONAL DEFICIENCY DISEASE

It has been known for some time that a number of apparently well persons have minor grades of nutritional deficiencies, sufficient to present recognizable evidence on physical or laboratory examination. It was this group which was of particular concern from the point of view of preventive medicine because of the subtle effect of such disease on efficiency and morale. Also, a potential result could be a large number of troops who were "under par" and would be quick to succumb to severe disabling nutritional disease during periods of stress arising from injury and disease or temporary *severe* dietary restriction. It was clearly recognized that under some unavoidable circumstances severe undernutrition might develop despite all efforts to prevent it. It was known, however, that by *proper care and attention* good nutritional state and good reserve could be maintained in all but rare instances. Such action would lessen and prevent the frequency and severity of advanced deficiency states when circumstances

tended unavoidably to produce them. Thus injury and disease may produce nutritional disturbances which in turn diminish the resistance to and recovery from illness and injury. Good nutrition prior to injury or illness offers some protection against the effects of such nutritional disease. Similarly, periods of severe restriction of food are less serious if nutrition is good before the starvation begins.

Evidence of the prevalence of those milder forms of deficiency was found in the ration trials at Camp Carson, Colorado, May to August 1944.[1] In this experiment, incident to the study of the effect of a variety of special rations, the test subjects were examined for evidence of nutritional deficiency disease by physical and laboratory examinations before the start of the experimental period. These troops consisted of a battalion, approximately 1,000 strong, undergoing rigid advanced infantry training, and may be considered fairly representative of a considerable number of similar troops training at that time in the western part of the Zone of Interior. The prevalence of minor nutritional deficiency, as interpreted from the physical signs, are shown in Table 7.

TABLE 7. MEN IN VARIOUS COMPANIES SHOWING SIGNS OF THE DEFICIENCIES LISTED

Company	Vitamin A (number)	Thiamine (percent)	Riboflavin (percent)	Niacin (percent)	Ascorbic acid (percent)
E	11	6	15	1	19 percent
F	8	1	2	1	
G	13	4	5	0	
H	7	0	8	0	
X	4	2	3	1	
Y	2	5	5	3	

Source: Rpt, Armored Med Research Lab, Proj. 30, 22 Nov 44. HD: 430 (Rations).

Data on the prevalence of these deficiencies under other conditions are available from a survey of nutrition of troops in the Pacific area made during April–June 1945.[2] Troops examined in this study included selected samples of the garrisons of Hawaii, Guadalcanal, Guam, Iwo Jima; casualties from Okinawa; and combat troops on Luzon and Leyte. The details of the physical examinations were essentially the same as those of the Camp Carson experiment and, in addition, included a record of the dietary. The dietary was more nearly representative of that occurring under a variety of ordinary field conditions in that theater than was the dietary in the Camp Carson study. The

[1] Rpt, Armored Med Research Lab, Proj. 30, 22 Nov 44. HD: 430 (Rations).

[2] Rpt, Nutrition Div SGO, 22 Aug 45, sub: Nutrition survey in Pacific Theatre of Operations. HD: 720.1.

prevalence of the various deficiencies as determined by physical examinations is shown in Table 8.

TABLE 8. PREVALENCE OF NUTRITIONAL DEFICIENCIES AMONG TROOPS IN THE PACIFIC AS SHOWN BY PHYSICAL SIGNS

Location	Vitamin A (percent)	Thiamine (percent)	Riboflavin (percent)	Niacin (percent)	Ascorbic acid (percent)
Hawaii	0	0	0	0	8
Guadalcanal	0	0	0	0	2
Guam	32	0	0	0	0
Iwo Jima	12	0	0	0	0
Okinawa casualties	18	2	2	0	2
Luzon	12	0	0	0	2

Source: Rpt, Nutrition Div SGO, 22 Aug 45, sub: Nutrition survey in Pacific Theatre of Operations. HD: 720.1.

Certain differences in the various groups comprising the Pacific study are interesting and their significance and possible explanation is discussed in the report. In view of the great environmental and operational differences the groups involved are too small to permit general conclusions as to variations between broad classifications of troops, as between garrison and combat units. The situation is too likely to be modified by a great variety of local circumstances. It is of interest, however, that the combat troops examined were in as good or better nutritional state than the garrison troops (except for body weight) and had the better physical fitness scores.

Evidence of a somewhat different sort is attained from more detailed studies of small numbers, such as those of Rush,[3] Beach and Miller,[4] and Golden and Schechter.[5] However, part of the evidence often interpreted as indicating nutritional deficiency disease was a discrepancy between the intake of various nutrients and the recommended allowances of the Food and Nutrition Board of the National Research Council. It must be remembered that these allowances were liberal and had a large margin of safety. There is also the factor of body store to consider. Nevertheless, there may have been some reduction in tissue stores and, in these cases, actual mild deficiency, particularly of vitamin C.

It would manifestly be unfair to use the evidence presented here to establish the prevalence of minor nutritional deficiency disease in the Army as a whole. The sample is too small and not sufficiently representative. Such data, except under conditions of great stability and uniformity, is of little value except for

[3] Rush, A.: Study of Army diet in the tropics. Bull. U. S. Army M. Dept. 2: 43, 6 Nov 44.

[4] Beach, E. F., and Miller, O. N.: Chemical determination of nutritional state of full duty troops, Manila area, July and August 1945. HD: 720.1.

[5] Golden, W. R. C., and Schechter, M. S.: Vitamin C status of troops in the tropics. Bull. U. S. Army M. Dept. 4: 711-717, Dec 1945.

purposes of a broad comparison, as, for example, of overall prevalence by decades. The figures obtained suffer from all the disadvantages of an average value. The finding of an average value for the hemoglobin of 100 men of 14.5 gm. (within the range of normal) does not reflect sufficiently the seriousness of the fact that an undetermined number may have had hemoglobin concentrations of but 10 grams. A prevalence of minor nutritional disease of only 5 percent in the Army as a whole is of little consolation if a task force of 25,000 fails because minor nutritional deficiencies have rendered 90 percent of the command incapable of putting out their maximum effort. Such an occurrence may be excused if it is clearly recognized at the time and is the result of circumstances beyond control. It is inexcusable if it exists unknown or unsuspected or, if known, without every effort having been made to prevent it. It can always be detected by proper inquiry and, with proper management, can often be predicted and prevented.

Nevertheless, it seems fair to conclude that except for special instances, probably limited to small groups, and for short periods, the prevalence of nutritional deficiency disease in the troops, even in overseas theaters of operations, did not exceed that presented in Tables 7–9. This may be compared with the prevalence among the civilian population from which these troops were drawn as shown in the following tabulation which was calculated for use in connection with the feeding of civilians in Europe.

Deficiency	*Percent*	*Deficiency*	*Percent*
Protein	4	Niacin	4
Vitamin A	10	Ascorbic acid	10
Thiamine	2	Vitamin D	5
Riboflavin	15	Iron	10

TABLE 9. PREVALENCE OF NUTRITIONAL DEFICIENCIES AMONG TROOPS IN THE PACIFIC AS SHOWN BY LABORATORY TESTS

Location	Thiamine (percent)	Riboflavin (percent)	Ascorbic acid (percent)	Hemoglobin (percent)	Serum protein (percent)
Hawaii	0	0	2	0	0
Guadalcanal	2	0	45	0	0
Guam	2	8	2	0	0
Iwo Jima	2	9	5	0	0
Okinawa casualties	0	6	8	0	0
Luzon	0	2	4	0	0

Source: Rpt, Nutrition Div SGO, 22 Aug 45, sub: Nutrition survey in Pacific Theatre of Operations. HD: 721.1.

Some question may be raised concerning the validity of the criteria on which these diagnoses were made. It is recognized that none of the physical signs are pathognomonic in the degree of deficiency encountered. Some dis-

agreement may be had with the criteria used for interpreting and evaluating the laboratory data. Nevertheless, these criteria have been employed by experienced examiners in a large number of similar studies and have received fairly general acceptance. It should be noted that they at least set rather clearly the minimal amount of nutritional deficiency—more than there may have been if one accepts finer and less clearly established criteria, but there was probably no less.

SPECIFIC DEFICIENCIES

Mild caloric deficiency, due simply to an insufficiency of food, was fairly common in the Army under combat conditions. This was usually the result of a combination of causes—difficulties of supply, the necessity of using packaged rations calorically inadequate for the energy expended, and decreased consumption of food because of emotional strain, fatigue, and exigencies of the situation. Except among prisoners of war, however, such caloric deficiencies rarely were great enough over long enough periods to cause protein deficiency and physical disability. For example, the nutritional survey of troops in the Pacific theater showed that although troops fresh from combat had some caloric deficiency, as evidenced by loss of weight, their physical fitness was equal to that of troops in the Zone of Interior and in at least one instance, superior.[6] Neither were these mild caloric deficiencies often accompanied by vitamin or mineral deficiencies. The reduced caloric intake lessened the need for vitamins and minerals, and the rations, even when only partly consumed, supplied a considerable amount. This circumstance, together with the fact that existing body stores under the system of Army feeding and practice were nearly always high at the outset of a campaign, was sufficient to prevent significant deficiencies except in occasional individuals in whom it could usually be classed as conditioned.

Beriberi (Vitamin B_1, Thiamine). Beriberi, as a primary, idiopathic disease in noncaptured American troops was almost nonexistent. For example, in Cutts' report of over 125 cases of beriberi,[7] none occurred among American troops. All cases were observed in Chinese troops. Although 5 cases in the entire Army were reported in admissions to hospitals in 1942, most of these must have been "conditioned cases." Occasional reports, mostly rumors, of mild cases of B_1 deficiency were received, especially from the China-Burma-India theater, but in most instances the diagnosis was not sufficiently established and the evidence consisted of nonspecific signs and symptoms such as nervousness and fatigability. Such diagnoses were strongly controverted by evidence of a liberal intake of thiamine in the food.

[6] See footnote 3, p. 162.

[7] Cutts, F. B.: Observations on beriberi. India-Burma Field Med. Bull., vol. 2, No. 12, Dec 1943. HD: 461.

Riboflavin. No outspoken cases of idiopathic riboflavin deficiency disease were reported and the only possible instances of this deficiency were mild cases detected on special surveys and examination,[8] in which careful examination and laboratory tests were made. Even some of these may be considered doubtful in view of changing ideas of the specificity of certain signs such as cheilosis and vascularization of the cornea, previously thought to be due to this deficiency; also, because of a lowering of values formerly believed to represent intake requirements.

Niacin. A few cases of pellagra in otherwise well individuals occurred from time to time in all theaters of operations. For the most part, these were caused by a deficient intake of proper food due to habit, food dislikes and prejudices, irregularities of eating related to duty assignments, and similar causes, such as could be ascertained by questioning the patients. These cases exhibited no differences from those observed in civilian practice.

Vitamin C. A number of reports of scurvy and vitamin C deficiency as well as special studies of vitamin C nutrition were made.[9] Some reason for concern and a suspicion of the existence of this deficiency were justified because in certain of the rations, particularly in the C, K, and ten-in-one, the source of most of the vitamin C was the synthetic fruit juice powders, which, on the whole, were not well consumed by the soldiers. It was often forgotten, however, that the standard of daily requirements for this nutrient was set at a very high level, 75 mg. per day, an amount three times as great as that actually needed to protect against a state of true physiologic deficiency. It is, therefore, not surprising that in many instances, reported cases and outbreaks of scurvy and vitamin C deficiency could not be substantiated when subjected to careful analysis. There was also some tendency on the part of medical officers to attach too much significance to such signs and symptoms as gingivitis and bleeding gums, which, while suggestive, are not very specific or reliable, especially in mild or early deficiencies.

Vitamin A. Vitamin A deficiency, too, was very seldom seen, though it was often suspected, or diagnosed when it was not present. Considerable anxiety was expressed concerning it, especially in relation to visual acuity in dim light or the dark (night blindness), particularly in the Air Forces. Again, it was forgotten that it takes months, probably over a year, to deplete a normal adult's stores of vitamin A and that the diet of all troops before being subjected to any dietary shortages was high in vitamin A. It was also commonly forgotten, or not known, that much of the vitamin A is ingested in the form of carotene, obtained from such foods as green and yellow vegetables and that vitamin A is quite stable. It is not necessary to have all or even most of the

[8] See footnotes 1 and 2, p. 161.
[9] See footnotes 3, 4, and 5, p. 162.

vitamin A as such, as in animal foods. Finally, it is probable that the standard of requirements, 5,000 international units daily, which was in general well supplied and consumed even under conditions of difficult supply and feeding, was so high as to provide a large margin of safety.

It is not surprising then that there was little or no primary vitamin A deficiency of a significant grade in American troops. This does not exclude the probability, however, of a slight dietary deficiency for long periods *prior* to Army service, and the existence of a chronic low-grade deficiency yet insufficient to produce such classical disease as xerophthalmia. Some evidence of such a mild deficiency could be found in any body of troops if one was willing to take as evidence the presence of mild perifollicular hyperkeratosis of either the dry, horny, or the acneform type, which though not highly specific is suggestive. Such evidence can be found in any group of the population in this country.

Vitamin D and Calcium Deficiency. Much concern also was expressed concerning vitamin D and calcium deficiency. Such deficiency was not infrequently reported in Essential Technical Medical Data (ETMD) reports. For the most part these reports came from the more distant or remote overseas theaters, especially the China-Burma-India, the Pacific, and some of the Arctic stations. This concern and such diagnoses were based largely on two circumstances: the lack of milk and the presence of subjective symptoms, the latter usually highly unreliable and susceptible of numerous other explanations. In the Arctic, lack of sunshine was sometimes considered a factor. Again, the rations, even under restricted conditions, usually provided calcium in amounts equal or close to standard requirements which are probably very liberal. There were shortages as the result of difficulties in supply and failure of mess personnel to incorporate the milk and milk products in the prepared foods. So far as it is known, no instances of idiopathic calcium or vitamin D deficiency, established by blood calcium studies, demonstration of significant demineralization of bone, or the occurrence of tetany were observed. It should be remembered that the normal adult possesses a large reserve store of calcium in his skeleton and deficiency must be severe and long continued to produce an actual pathologic state of calcium deficiency in otherwise normal persons. Vitamin D requirements are, of course, very small in adults and deficiency of this vitamin is uncommon.

Iron. Iron deficiency anemia is likewise very unusual in the normal adult male and in the nonchildbearing female because of the extreme conservation of iron by the body. Such iron deficiency anemia as might occur would most likely have existed before entry into the service and would have constituted a probable cause for rejection.

Recent studies, however, particularly those on "folic" acid, have shown that an anemia of the macrocytic type might occur with a restriction of foods

ierally considered to furnish much of the B complex vitamins. The presence troops in areas where tropical anemia (probably a macrocytic type) existed gested such a possibility. Reports of anemia among Army nurses in the ific area led to the inclusion of an inquiry into this disease in a general vey of nutrition during March–May 1945 in the Pacific theater. However, ignificant degree of anemia was found to be relatively uncommon, and its endence on dietary factors was not established.

As has been indicated, frank nutritional disease was extremely rare among troops. It must be realized that these cases include only those of primary ritional disease admitted with the diagnosis. Undoubtedly, additional cases severe nutritional deficiency occurred as complications of other injury and ease and, even though recognized, failed to be included in the diagnosis ause of the tendency to omit the diagnosis of complications. This is par-ularly true of the less well-known and established deficiencies such as the tein, iron, and riboflavin deficiencies. Even sodium chloride deficiency is to be omitted. Therefore, even the hospital records will fail to give all of h cases.

soners of War

The greatest incidence of evident nutritional deficiency disease occurred ecovered Allied prisoners of war and in civilians of liberated and conquered ntries. In the Asiatic and Pacific theaters the number of instances of these eases was much greater than in Europe. No reliable data are available as he actual prevalence because of lack of records. The best sources of informa-n in this field are the reports of the examination of prisoners of war made ing the period of incarceration and following their release and return to country.[10]

These cases of deficiency diseases, while conforming in general to the tern traditionally established, revealed certain characteristics of unusual rest, particularly in the cases of starvation edema and in cases of thiamine ciency. In these subjects, both those in Europe and in the Pacific, loss of y tissues (emaciation) caused by inadequate caloric intakes was the most nounced and most frequent deficiency state accompanying this starvation. re was, in many cases, an edema characteristic of starvation or famine na. Such edema has ordinarily been considered in recent years to be a ni festation of protein deficiency dependent for its immediate production on oproteinemia. Studies in many of these subjects revealed normal serum ein concentrations. Furthermore, many of the subjects with extreme de-

[10] (1) Morgan, H. J.; Wright, I. S., and van Ravenswaay, A. C.: Health of repatriated prisoners ir from the Far East. J. A. M. A. 130: 995–999, 13 Apr 46. (2) Musselman, M. M.: Nutri-disease in Cabanatuan. Wad Med. 8: 325–332, Nov–Dec 1945. (3) Navarro, M. D.: Observa-on vitamin deficiencies during the occupation. Santo Tomas J. Med. 2: 205–208, Jul 1947. Report of the Health Survey of Repatriated Prisoners of War from the Far East. HD: 383.6.

grees of emaciation failed to present edema. These discrepancies were also observed in experimental studies of nutritional deficiencies to be described [illegible].

In April and May 1945 a considerable number of Japanese prisoners of war suffering from nutritional deficiency disease were seen by the writer in Leyte. Among some 20 or 30 such patients the principal disease seemed to be starvation and protein deficiency. Though many had been diagnosed as beriberi, the persistence of the tendon reflexes, the absence of significant sensory changes, and atrophy and muscle weakness, indicated that the edema present was more probably a result of caloric and protein deficiency.

In attempting to discover the explanation for these observations, in apparent variance to previous concepts, the following facts must be kept in mind. In many instances the observations consisted of a single determination of the serum protein concentration which was interpreted in its relation to edema without consideration of such factors as salt and water intake, diarrhea, dehydration, physical activity, and other factors known to affect the relationship between serum protein concentration levels and the occurrence of edema. Nevertheless, as will be discussed below, the observations were made so frequently and under so many independent circumstances that they strongly suggest another important factor in the production of edema in these persons.

With the severe emaciation (caloric and protein deficiency) there were seen a percentage of other nutritional deficiency diseases as shown above. These were for the most part beriberi and pellagra.

There was, however, a great difference in the two major theaters, European and Pacific, in this respect. The vitamin deficiencies in florid form appear to have been uncommon in the European theater but were fairly frequent in the Pacific. How much this was concerned with the factor of length of incarceration is not clear. There appears to be no data available indicating the relation between the occurrence of these other diseases and the period of captivity. It might be suspected, however, that such a relationship was at least a partial explanation for the difference in the two theaters. In general, the feeding of prisoners of the Germans was more nearly adequate until the last few weeks before release. In general, the prisoners in the Pacific were badly fed during the entire period.

Experimental studies as well as clinical observations suggest that the characteristics of deficiency disease resulting from relatively acute and chronic deficiency states vary considerably. This difference may be illustrated by some unusual features of the cases of thiamine deficiency from the Pacific. Among these, there occurred an unusual and unexpected number with evidence of

involvement of the second (optic) and eighth (acoustic) cranial nerves.[12] Involvement of the optic nerve in thiamine deficiency had only rarely been observed and reported previously. The writer has seen two cases, apparently of this kind, with atrophy of the nerve head and at certain stages an optic neuritis characterizing the findings. While some doubt has existed as to the etiology, and a suspicion of a toxic optic neuritis from methanol poisoning existed in some, this does not seem to be an entirely adequate explanation. There is, furthermore, the theoretical possibility that a primary thiamine deficiency may have predisposed and conditioned to an effect of methanol which would otherwise not have occurred. The cases in civilian life observed by the writer occurred in chronic alcoholics. So far the condition has remained stationary in most of these subjects with little or no evidence of improvement in function and no change in the morphologic appearance. Unfortunately, a variety of treatment and modification of the nutritional condition before studies were begun to determine the nutritional status and possible etiology made later studies essentially valueless.

Much the same situation occurred in those subjects with involvement of the eighth nerve. Deafness, partial or nearly complete, of a "nerve" type, with little tendency to improve was the principal finding.

Other findings of unusual interest in recovered prisoners from the Pacific suffering from nutritional deficiencies (thiamine) was a loss of libido, testicular atrophy, loss of hair (body hair in particular), and certain manifestations of feminization, particularly enlargement of the breast. These changes are of particular interest in view of recent work suggesting a relation between the sex hormones, liver function, and the B complex group of vitamins. Similar observations were made in the experimental studies already mentioned.

RESEARCH

Although much of the research in nutrition dealt with such aspects of preventive medicine as the requirements of the various nutrients, considerable new knowledge of actual nutritional disease was added by studies conducted by the Office of The Surgeon General or under its auspices.

Of these the most extensive was that conducted at the University of Minnesota by Keys and his associates,[13] supported in part by the Office of The Surgeon General. These studies consisted in the controlled production of starvation (caloric deficiency) in a group of young men. By careful adjust-

[12] (1) Bloom, S. M.; Merz, E. H., and Taylor, W. W.: Nutritional amblyopia in American prisoners of war liberated from the Japanese. Am. J. Ophth. 29: 1248–1257, Oct 1946. (2) de Ocampo, G.; Yambao, C. V.; Managas, P. J., and Sevilla, C. L.: Epidemic retrobulbar neuritis in the Philippines during Japanese occupation. Am. J. Ophth. 30: 698–704, Jun 1947.

[13] Keys, A.: Human starvation and its consequences. J. Am. Dietet. A. 22: 582–587, Jul 1946.

ment, the caloric intake was maintained at a level sufficiently less than a planned energy output to cause a steady, progressive loss of weight. The energy output was maintained at a moderately high level (3,100 calories). Protein intake was minimum (40 gm.), but animal protein was very low, possibly inadequate in amino acids. Other nutrients, vitamins, and minerals were at levels judged to be minimally adequate. After an initial period of adjustment the subjects were maintained on this regime for some 3 to 4 months. By this time all had been reduced to a severe stage of starvation, and restoration was accomplished by successive increments of food in a manner designed to simulate relief dietaries.

The results of these experiments, in addition to providing much new data on the physiology of such starvation, are of particular interest in comparison with the starvation observed in Allied and enemy prisoners of war, civilian inmates of prison and detention camps, and the general civilian populations. As in most of these latter examples, the outstanding deficiency disease was starvation (loss of weight) and loss of muscle tissue, presumably reflecting at least a relative protein deficiency. Evidence of other deficiencies were uncommon and minor in degree. Among the outstanding changes in both groups were the pigmentation, the loss of body hair, edema, bradycardia, hypotension, and muscular weakness, particularly that related to sustained or rapidly repeated acts. Changes in the emotions and psyche with a trend to the so-called psychoneuroses were observed. Rehabilitation was slower than might have been expected if all effects are included, and the most rapid and desirable rate of recovery required large feedings. There was some tendency to overweight with recovery. These studies have added much to the knowledge of the effects of starvation.

CHAPTER VI

Preventive Psychiatry During World War II

Marvin E. Perkins, M. D.*

At the outset of World War II the psychiatrists in the United States Army had no organized program of preventive psychiatry or mental hygiene. In fact, the years preceding the war have been characterized as being ones in which psychiatry was practiced primarily for purposes of diagnosis and disposition; furthermore, it was not until after the entry of the United States into hostilities that a separate branch for neuropsychiatry was established in the Surgeon General's Office in February 1942.[1] It was not until another year had passed that an officer was assigned to the Neuropsychiatry Division of the Office of The Surgeon General for the purpose of developing a program of preventive psychiatry.[2]

The condition of military psychiatry with respect to its preventive orientation was hardly less developed than that of the general practice of psychiatry in civilian medicine. For although such eminent psychiatrists as Adolph Meyer, William Alanson White, C. Macfie Campbell, Thomas W. Salmon, and Elmer E. Southard had emphasized the potential value of the wider application of psychiatry, preventive psychiatry as such could not be regarded as a clearly delineated discipline. Some psychiatrists were active in the mental hygiene movement, identified with the National Committee for Mental Hygiene, but the greater number were not associated with this type of psychiatric endeavor.

EARLY DEVELOPMENT OF MENTAL HYGIENE

Before attempting to trace the development in the Army during the war years of mental hygiene, or preventive psychiatry, as it was later designated by some, it is necessary to review briefly some earlier applications of the term "mental hygiene." Both terms were expressions which for most practicing psychiatrists had indistinct meanings; at least, it may be said that they were subject to variable interpretation.

Deutsch [3] has traced the variation in meaning of mental hygiene, since its introduction in this country in 1843 by William Sweetser. The original usage

*Chief, Psychiatric Services Division, Department of Public Health, Government of the District of Columbia. Formerly Major, MC, AUS.

[1] Caldwell, J. M.: Organization and administration of neuropsychiatry in the Office of The Surgeon General, 1942–1947. Mil. Surgeon 107: 19–25 Jul 1950.

[2] Menninger, William C.: Psychiatry in a Troubled World. New York, Macmillan, 1948, pp. 327–337.

[3] Deutsch A.: The history of mental hygiene. *In* Bunker, H. A.: One Hundred Years of American Psychiatry. New York, Columbia University Press, 1944, pp. 325–365.

was intended to convey an approach to illness somewhat analogous to the current concept of psychosomatic medicine or comprehensive medicine. George Cook in 1859 used the term to embody the problems attendant on the promotion of mental health and the prevention of mental disease. Cook emphasized the importance of observations that the inception of mental disease was in childhood. He also singled out the family unit as the proper focus for mental hygiene measures. During the Civil War, Isaac Ray issued a book in which he defined mental hygiene as "the art of preserving the health of the mind." Ray's presentation was one which attempted to give the individual a kind of prophylactic guidance. In 1876 the concept was expanded by John P. Gray to include not merely the individual application, but also the community aspects of mental hygiene, relating it to sociologic and social science studies. Thus, before the outbreak of the Civil War, the term "mental hygiene" had been used for two quite different purposes: (1) To define an approach toward the understanding of the etiology of an individual's illness in terms of the whole person (Sweetser), and (2) to indicate the practice of instituting measures in the family setting before illness affected an individual of that unit (Cook). These contributions had been made by institutional psychiatrists. Interest in mental hygiene continued to be manifest so that by 1880 two other usages had been introduced: (3) A formula for individual living (Ray), and (4) an approach to prevention of mental disease by the study of social problems and action taken at community level (Gray).

These four concepts, different in focus and emphasis, may perhaps be considered as phases in the natural evolution of the mental hygiene movement. The first requirement is an awareness by the physician that the patient's symptoms present something which has meaning in terms of the whole person: second, that current unhealthy symptomatic reactions follow a pattern which has had origin in the setting of early family experience; third, that such reactions may be adjusted for the better or avoided by providing individual guidance; and, finally, that such personal problems have implications which extend beyond the individual patient, affecting the social group of which he is a part and also affected by measures taken through the group.

The first step is the inquiring receptive attitude of the physician; the second, a conclusion regarding etiology based upon observation; the third, an effort at application of new-found knowledge in individual treatment based on etiology; and, finally, a recognition of the social factors and need for group preventive measures. These steps are analogous to the traditional pattern of the development of epidemiology.[4]

Up to 1880 there was no organized effort among psychiatrists for a program of mental hygiene and no organized body of thought which could be called

[4] Gordon, J. E.: Evolution of an epidemiology of health. *In* The Epidemiology of Health. New York, Health Education Council, 1953, pp. 24–73.

preventive psychiatry. However, the increasingly comprehensive concept had made mental hygiene a subject of common interest among psychiatrists and social workers. The first mental hygiene organization in this country was a joint professional undertaking of psychiatrists, neurologists, and social workers, called the National Association for the Protection of the Insane and the Prevention of Insanity, which was established on 1 July 1880. The main effort of the organization was not the prevention of mental disease but, rather, the institution of reform measures of a humanitarian nature. The organization did not crystallize a "mental hygiene" or "preventive psychiatry" and, after a short controversial existence, disappeared sometime after 1886. Twenty-three years later, the National Committee for Mental Hygiene was organized, the result of Clifford Beers' experiences as a patient in a mental hospital, his account of those experiences, and his recommendations for an organized effort to improve the lot of the mental patient. The efforts of this organization were of importance to various spheres of activity including the establishment of community child guidance clinics, in some ways a prototype for the military mental hygiene clinic.[5]

MILITARY PSYCHIATRY AND MENTAL HYGIENE BEFORE WORLD WAR II

The Civil War was a time of great ferment for the Army Medical Department. Many reforms were needed to meet the immediate problems of attending to the sick and wounded, and the term of office of William A. Hammond as Surgeon General was marked by vigorous action in instituting many of the necessary reforms. The important specialty of neurology had its beginning in the United States during the war as a result of the combined efforts of Hammond and S. Weir Mitchell. The former authorized the establishment of the Turner's Lane Hospital in Philadelphia for the study of nervous disorders and injuries and the latter was assigned for that purpose. The classical monograph by Mitchell, Morehouse, and Keen [6] is an account of the neurologic studies made at Turner's Lane Hospital. These studies embodied careful clinical observations of the injured nervous system and, important as they proved to be in the fields of neurology and psychiatry, they were not concerned with either of the concepts of mental hygiene which had been defined before that time.

Early in World War I, Thomas W. Salmon, under auspices of the Rockefeller Foundation, studied the experience of the British in the management

[5] Deutsch, Albert: The Mentally Ill in America. Garden City, N. Y., Doubleday, Doran, and Company, 1937, p. 325.

[6] Mitchell, S. W.; Morehouse, C. R., and Keen, W. S., Jr.: Gunshot Wounds and Other Injuries of the Nerves. Philadelphia, Lippincott, 1864.

of psychiatric problems and submitted a report which contains the following comment:[7]

> Although it might be considered more appropriately under the heading of prevention than under that of treatment, the most important recommendation to be made is that of rigidly excluding insane, feebleminded, psychopathic, and neuropathic individuals from the forces which are to be sent to France and exposed to the terrific stress of modern war. . . . If the period of training at the concentration camps is used for observation and examination it is within our power to reduce very materially the difficult problem of caring for mental and nervous cases in France, increase the military efficiency of the expeditionary forces, and save the country millions of dollars in pensions.

This recommendation, a relatively minor dictum in an important, thorough, and competent report, may well have been the basis for the practice of diagnosis and disposition referred to as in effect during the interim between the two World Wars. It may also have served as the basis for the optimistic opinion prevailing at the outbreak of World War II that effective prevention of psychiatric disorders would be accomplished by competent psychiatric screening. Lt. Col. Manfred S. Guttmacher, MC, who was assigned to the Neuropsychiatry Consultants Division during the latter part of World War II, for the purpose of providing professional supervision for the mental hygiene consultation services, made the following observation regarding preventive psychiatry during the First World War as it was reported in the official history:[8]

> Chapter IV of the volume on the history of neuropsychiatry during World War I states that the cantonment neuropsychiatrist became the "guardian of the mental health" of his military organization. When one reads the entire chapter, it is apparent that this was in nearly every instance an ideal rather than a reality, since there was no formal organiaztion of psychiatric facilities that brought psychiatrists into really close contact with enlisted or with officer personnel in the training camps. It is, however, clear that by the end of the First World War, it was realized that the training camps were fruitful fields for the early treatment of maladjusted trainees and that many of them could be prevented from becoming ineffectuals. But, prevention of psychiatric disorders by effective general indoctrination of the officers and the trainees was not conceived.

Psychiatry, in the interim between the two World Wars, suffered from several conditions. It lacked public acceptance and understanding to a large degree. As a specialty, it tended to be isolated from the general practice of medicine and, as specialists, psychiatrists had relatively little professional stature among other members of the medical profession. It was primarily interested in, if not preoccupied by, the problems of treatment. Little substantial knowledge had been accumulated by psychiatrists on problems related

---

[7] Salmon, T. W.: The care and treatment of mental diseases and war neurosis (shell shock) in the British Army. *In* Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1929, vol. X, pp. 497–523.

[8] Guttmacher, M. S.: Army consultation services (mental hygiene clinics). Am. J. Psychiat. 102: 735–748, May 1946.

to selection of men, occupational classification and placement, or the prevention of psychiatric disability.[9] In such circumstances and without an adequately organized body of information, it is not surprising that there were no well-formulated plans for the application of psychiatry to the practical problems encountered in the military service. As a further handicap, many psychiatrists were either not accustomed to collaborative effort with clinical psychologists and psychiatric social workers or were actually unaware of the potential value of mutual participation.

To recount the development of preventive psychiatry during World War II is to trace the changes in responsibility and utilization of three professionally allied disciplines: psychiatry, clinical psychology, and psychiatric social work. Psychiatrists, at the inception of the war, were predominantly engaged in diagnosis and disposition in hospitals and induction stations; psychologists were utilized in personnel work as officers of The Adjutant General's Department, but were not used in clinical activity;[10] psychiatric social workers had no commissioned or enlisted status at all in their professional capacity.[11] Each of these professions came to be employed in significantly new roles for the military service during the course of the war. The remarkable transition in the military roles of the psychiatrist, clinical psychologist, and psychiatric social worker took place largely in the training centers. It was in the training centers that the members of these professions became integrated into the effective military psychiatric team. The organized unit which resulted in this setting came to be known as the mental hygiene consultation service; and here the practice of psychiatry in this setting came to be considered as preventive psychiatry. For purposes of following the development of preventive psychiatry in World War II, this account will deal almost exclusively with development in the training center setting.

DEVELOPMENTAL PHASES IN REPLACEMENT TRAINING CENTERS

It may facilitate a review of the development of preventive psychiatry in the training centers to divide the period into four transitional phases. Because the growth of the different mental hygiene consultation services showed definite variations, there was no completely consistent developmental pattern in the field, although there were certainly similar problems to be dealt with in each replacement training center. The course of development of the individual unit seemed to be most dependent upon the psychiatrist's previous experience,

[9] Menninger, W. C.: The role of psychiatry in the world today. Am. J. Psychiat. 104: 155–163, Sep 1947.

[10] Zehrer, F. A.: The clinical psychologist in the United States Army, 1953. HD: 730 Neuropsychiatry.

[11] O'Keefe, D. E.: History of psychiatric social work in World War II. HD: 314.7-2.

his comprehension of the problems to be met, his preference in formulating a plan commensurate with his own abilities, his capacity to interpret these matters to command, and his ability to enlist the support of command in translating the whole into effective action. Because of the importance of the individual in establishing a mental hygiene consultation service, the developmental pattern at a given post was likely to be distinctly different from that of another only a short distance away. One consequence of such variation was that in practice some part of the field was consistently ahead of official directives concerning nearly everything which finally became established as approved policy. When official policy was published, that part of the field which had lagged behind the others in development tended to be brought up to the standards of the more advanced practices as approved. For these reasons the phases which will be described are arbitrarily fixed to reflect the principal emphasis of the time as contained in official directives.

Classification Phase

The initial phase may be called the "Classification Phase" in which the primary interest was in getting the right man promptly into training for the right job with the least waste of time and money. This phase began during the mobilization period, before our entry into active hostilities, and was carried on for the most part by psychologists and classification specialists.

One of the early steps in the development of consultation services for replacement training centers was initiated on 13 December 1940 when The Adjutant General sent a letter to the chiefs of arms and services proposing that the Adjutant General's Office undertake the following: [12]

1. Attempt to locate Reserve officers qualified in the testing field to permit assignment of one such officer to each replacement center after attendance at the replacement center school.

2. Request an increase in commissioned officer quotas for each center, stating that G–1 and G–3, informally, had indicated a favorable disposition toward an increase in authorized strength for this purpose.

The letter pointed out that selectees who reported to replacement centers from reception centers would have received an initial classification, including General Classification Test 1A. However, it was anticipated that considerable reclassification would be needed during the period at the replacement center and it was considered that the services of psychologists who could administer and evaluate various aptitude tests would be useful in selecting students to attend various courses. The letter cited the earlier favorable experience of the Air Corps in selecting students for the technical school at Chanute Field,

[12] Ltr, TAG to Chiefs of Infantry, Cavalry, Field Artillery, Engineers, Signal Corps, Ordnance, Chemical Warfare Service, Coast Artillery, QMG, SG, CG Armored Force, 13 Dec 40, sub: Additional commissioned personnel for replacement centers. AG: 210.31 ORC.

llinois. Recommendations were requested as to whether the services of these pecialists were desirable at the various replacement centers. With but one xception, all responded favorably to the proposal.[13]

A radiogram was sent to the commanding generals of the nine corps areas equesting that they report names of available Reserve officers qualified as ractical psychologists or classification experts. These men were to attend a 0-day course of instruction and then be assigned to replacement centers.[14] ıs a result of this wire, 18 officers were reported to The Adjutant General as otentially useful in the contemplated assignments, including 5 captains, 11 rst lieutenants, and 2 second lieutenants.[15]

During the same week, a memorandum mentioned that consideration was eing given to the assignment of a second lieutenant Reserve officer to one of the nfantry replacement centers.[16] This Reserve officer, a Regular Army master ergeant, was one of several considered for assignment to the Infantry replace- ıent centers, the majority of whom were warrant officers and sergeants of he first three grades with considerable experience in administration. The lan at that time was to assign 8 such officers to the Infantry replacement enters as had been requested.

Thus, in December 1940, at least 20 Reserve officers were being considered or assignments. This marks the first step in the direction of establishing an gency at replacement training centers to assist responsible commanders in the ffective utilization of manpower. The development of the mental hygiene onsultation services in part came from this early movement. Of these officers, held Reserve commissions in the Infantry, 5 in the Medical Corps, 3 in the 'ield Artillery, and 1 each in the Judge Advocate General Department, Advo- ate General's Department, and the Quartermaster, Cavalry, and Sanitary 'orps.

The Adjutant General conducted the 30-day course of intensive instruction :arting in January 1941. It covered the procedures of personnel administra- on with particular reference to replacement centers. After attendance at ıe school[17] these officers, who included practical psychologists, classification xperts, and other administrative officers, went on to their variously assigned osts where some were assigned as classification officers.

[13] Ltr, Chief of Cavalry to TAG, 17 Dec 40, recommended that the assignment of such personnel not considered for the Cavalry Replacement Center because ". . . it would appear that the rvices of a practical psychologist would be confined to assisting in the selection of individuals tended for horse elements and those intended for motor elements, which can be accomplished satis- ctorily from individual classification cards." AG : 210.31 ORC.

[14] Radio, TAG to CG each CA, 13 Dec 40. AG : 210.31 ORC.

[15] This does not include Second and Fourth Corps Areas whose responses were not on file with e others.

[16] Memo, TAG to Chief of Infantry, 17 Dec 40. AG : 210.31 ORC.

[17] The training of commissioned classification officers preceded the formal organization of The djutant General's School which was accomplished on 13 June 41. Hist Div WDSS.

The Engineer Replacement Training Center at Fort Leonard Wood, Missouri, received one of this first group of officers assigned to replacement training centers for the purpose of supplying expert guidance in the fields of classification and personnel counseling. This officer (1st Lt., AGD, later Maj., MAC, Francis P. Wickersham) was assigned first as a classification officer, but on 3 December 1941 he was relieved of this duty and designated as psychologist to the Engineer Replacement Training Center. Thus was established the Office of the Personnel Consultant, as a branch of the Personnel Division. This officer was charged with the tasks of—

1. Selecting men for special training.

2. Maintaining a check upon individual progress while in special training.

3. Advising as to the suitability for transfer of each man to the regular training company.

4. Recommending separations from the service under Army Regulations (AR) 615–360, section VIII.

The last function was an important one, initially, for it was the personnel consultant upon whom the major responsibility rested for such recommendations. He soon sought the assistance and advice of psychiatrists in formulating such recommendations for discharge. Inasmuch as a psychiatrist was not immediately available for assignment to the Engineer Replacement Training Center, arrangements were made for consultations to be accomplished by the staff at the hospital.[18] The wisdom of mutual effort in this area of activity was later to become generally recognized by making psychiatrists available for assignment to headquarters of each replacement training center. The basic directives during this period were concerned with establishing the necessary military occupational specialties[19] and outlining the functions required to accomplish the mission of proper classification and assignment. Although the planning for this type of activity preceded our entry into hostilities, the comprehensive regulation was not published until May 1942.[20]

Classification was considered to be a means which would facilitate the placement of individuals in assignments which would be of most value to the military service. This would expedite unit training by proper utilization of various abilities and skills of the individuals. The anticipated objective was to be a substantial contribution to the production of an efficient combat or technical team in the shortest possible time.

The primary objective in replacement training centers as explained in AR 615–28 was to assign each man properly to the type of training which he could best absorb. This was to be accomplished in the classification section by

---

[18] Davidoff, E.: A summary of the history and the program of the personnel consultation service at Fort Leonard Wood ASFTC. HD: 730 Neuropsychiatry.

[19] (1) WD Cir 12, 18 Jan 41. (2) WD Cir 269, 26 Dec 41.

[20] AR 615–28, 28 May 42.

'sonnel, officer and enlisted, who had either psychological or personnel ining, or both.

The testing program designed to furnish an estimate of a man's ability, luded the Army General Classification Test, the nonlanguage test 2 abc, de tests, aptitude tests, and individual tests. The latter were to be given required to the men who were unable to adjust to the Army without assist-'e because of a low mental ability. It was pointed out that such individuals y have been adjusted to a stereotyped mode of civilian living, but upon entry o Army life they experienced difficulties because of the sudden change. The lividual testing of these men was to be accomplished only by a personnel ısultant, because the result of such testing would be a factor in determining ether the man would be considered suitable for military service after train-' in the special training unit, or whether discharge from the service should effected without benefit of such training efforts.

The function of the special training unit was to instruct enlisted men o were not immediately suited to assimilate regular basic training. Indi-luals who were found in the course of regular training to require special istance were assigned to the unit. This group included the illiterates, non-glish-speaking enlisted men, and slow learners. Two other groups could assigned also—the emotionally unstable and those physically unable to 'ry out assigned duties.

It was pointed out in the regulation that personnel in this unit would have be carefully selected for interest in the type of work of the unit and interest the individuals who required such training. The only mention of the use psychiatrists was in connection with their possible utilization in the special ining units: "A personnel consultant will be assigned to each special train-' unit and use will be made of psychiatrists or neuropsychiatrists who may assigned to the replacement training center."

At Fort Monmouth, New Jersey, 1st Lt. (later Maj.) Harry L. Freedman, ', was assigned to duty as assistant to the Personnel Officer, Headquarters, stern Signal Corps Replacement Training Center, on 23 December 1941. short time later he was assigned to a position of direct responsibility to commanding general (20 January 1942). From this staff relationship, a vice was developed which was intended to be functionally distinct from the al services supplied within the hospital or as an outpatient clinic of the pital. Lieutenant Freedman stated it as follows:[21] "Out of this relation-p an organization and structure was conceived with functions which could utilized as services to all sections of the Command. It was, therefore, pos-le to develop a new resource to the Command, in a staff section to be known he Mental Hygiene Unit."

[21] Freedman, H. L., and Rockmore, M. J.: Developmental history of the mental hygiene unit in Army, 1946. HD: 730 Neuropsychiatry.

Using the staffing pattern of the community psychiatric clinic as a guide, Lieutenant Freedman first obtained the assignment to his staff of an enlisted man who was a professionally qualified psychiatric social worker already on duty with the classification section. This was probably the first time that a social worker was assigned to perform primary duties of this profession in the Army. The unit was officially established at Fort Monmouth on 24 February 1942. It was called "The Classification Clinic" which clearly reflects the main emphasis of the period. The professional triad was completed 15 March 1942 when a qualified clinical psychologist, an enlisted man, was assigned to the staff.[22]

Concurrently, other psychiatrists in replacement training centers had been moving independently toward establishment of a psychiatric unit in response to local requirements and with the tacit approval of the Neuropsychiatry Branch of the Office of The Surgeon General.

At the Engineer Replacement Training Center, Fort Belvoir, Virginia, an outpatient clinic had been established by Capt. (later Lt. Col.) Bernard Cruvant, MC, in May 1941 to meet the local needs for psychiatric services which could not be properly satisfied by hospitalization.[23] A referral procedure was mimeographed and distributed with a resultant increase in the number of psychiatric consultations. Liaison with the basic training supervisor was established in June 1941 and mutual effort was exerted toward solution of a problem having to do with the training program. As a result of this, a reclassification questionnaire was formulated to assist in the function of the reclassification board, of which the psychiatrist was a member. The further development of staff responsibilities and function in the training program was hampered by the psychiatrist's assignment to the station hospital which required more and more of his time. The result was that the main function of the psychiatrist was as a consultant in the outpatient clinic of the station hospital. The facility established at Fort Belvoir was the first in the Army to be called a "Consultation Service." [24]

At the Antiaircraft Replacement Training Center, Camp Callan, California, Capt. (later Lt. Col.) Julius Schreiber, MC, inaugurated a program in June 1942 which at first had its primary mission as an outpatient clinic to keep down the number of psychiatric admissions to the hospital.[25] A realization that more needed to be done led Captain Schreiber to work out a program which

---

[22] See footnote 21, p. 179.

[23] Cruvant, B. A.: Symposium on psychiatry in the Armed Forces: replacement training center consultation service. Am. J. Psychiat. 100: 41–46, Jul 1943.

[24] See footnote 8, p. 174.

[25] (1) Stilwell, L. E., and Schreiber, J.: Neuropsychiatric program for a replacement training center. War Med. 3: 20–29, Jan 1943. (2) Schreiber, J.: Psychological training and orientation of soldiers. Ment. Hyg. 28: 537–554, Oct 1944.

neant to inform the soldier on the issues at stake and thereby contribute to notivation and morale.[26]

At the Ordnance Replacement Training Center, Aberdeen Proving Ground, ,land, another station hospital physician had concluded that steps needed taken to assist in the adjustment period of the new soldier. A program of al conditioning by means of lectures was recommended on 15 August 1942 aj. (later Lt. Col.) R. Robert Cohen, MC. He conducted lectures to trainees ersonal adjustment and emphasized the importance of an informed group y personnel in the mental hygiene of trainees.[27]

Meanwhile, other significant developments for military psychiatry were ıg place. In the Office of The Surgeon General, establishment of the opsychiatry Branch had been accomplished in February 1942 as a sub- ion of the Medical Practice Division. Lt. Col. (later Col.) Patrick S. igan, MC, was the first chief of the branch.[28]

At a Selective Service seminar for psychiatrists of the Medical Advisory d and the Army Induction Board on 5 April 1941, Lt. Col. Madigan had ıasized the importance of screening: [29]

> In preparing for an adequate defense of our country in the present emergency, it is remely important that we exercise meticulous care and precaution in selecting only se individuals whose mental, intellectual, and personality suitability can reasonably expected to adequately adjust to the requirements of military life, not only for one r's training, but for the following ten years as a reservist. Soldiering must be con- ered as a possible vocation that is inherently and of necessity constricted in its uirements and standards. Those who do not fit into this general pattern because of sonality traits or other indications of unsuitability may be quite adaptable to other suits in a civilian status in our general plan of a total defense of our country. There uld, therefore, be no criticism of those who fail to meet the standards which experience shown to be the best possible for an effective Army.

He had concluded with the following admonition:

> The most important function of psychiatrists to the Advisory Board and induction ters is to keep in mind that the Army is one of the elements of national defense and present mission is one of preparation for an offensive-defensive type of warfare. It ı no sense a social service or curative agency. It is neither to be considered a haven rest for the wanderer or shiftless, or a corrective school for the misfits, the r-do-wells, the feeble-minded, or the chronic offender. Furthermore, it is neither a ınasium for the training and development of the undernourished or underdeveloped;

Schreiber, J.: Morale aspect of military mental hygiene. Dis. Nerv. System 4: 197–201, 43.

(1) Cohen, R. R.: Mental hygiene for the trainee: method for fortifying the Army's man- Am. J. Psychiat. 100: 62–71, Jul 1943. (2) Cohen, R. R.: Factors in adjustment to Army plan for preventive psychiatry by mass psychotherapy. War Med. 5: 82–91, Feb 1944. (3) R. R.: Officers and their relation to a mental-hygiene program for trainees. Ment. Hyg. 28: 0, Jul 1944.

Annual Rpt. Neuropsychiatry Branch SGO, FY 1943. HD.

Madigan, P. S.: Military psychiatry. Psychiatry 4: 225–229, May 1941.

nor is it a psychiatric clinic for the proper adjustment to adult emotional development. Therefore, there is no place within the Army for the physical or mental weakling, the potential or prepsychotic, or the behavior problem. If a person is a behavior problem in the civilian community, he will most certainly become a more intensified problem in the Service.

A year later, Lt. Col. (later Col.) William C. Porter, MC,[30] was warning of the "danger that we military psychiatrists may become psychiatrically overzealous and reject men who are capable of performing satisfactory military service and who are legally liable for service in the Army." Colonel Porter was pointing to the consequences of too fine a screening policy. Pointing out the need "to take stock," he posed the problem as follows:

. . . . Should we become more zealous in screening out potential and actual mental risks, or should we recognize that there is a field of usefulness in the Army for some persons who have theoretic disqualifications? Unfortunately, in our discipline we have no formula which may be applied in selection of mental risks. Each psychiatrist applies to his work such training, experience, and aptitudes as he may possess. He may have had no actual military experience and may be only indirectly aware of the psychologic hazards of the service and of the system of handling problem cases in a military organization. Unless he is personally familiar with these factors, he is apt to judge a risk from the standpoint of his experience in nonmilitary hospitals or in private practice.

Colonel Porter formulated the question, which had begun to create doubts among psychiatrists with regard to screening, thus:[31]

. . . . Whether the neuropsychiatric examiners have rejected too many men who might have become satisfactory soldiers, whether by rejecting all questionable persons more harm has been done them than would have occurred if they had been exposed to military life, whether there is a place in the Army for certain types of mental deviants are cogent questions.

In April 1942 Colonel Porter, Chief of Neuropsychiatry, Walter Reed General Hospital, sent a memorandum to Brig. Gen. C. C. Hillman, Chief of Professional Services, Office of The Surgeon General, outlining a plan for assignment of neuropsychiatrists to replacement training centers.[32] This was proposed as being consistent with the opinion of certain psychiatrists that there was a need to provide psychiatric advice away from the hospital setting. The objectives were to be: to assist in the adjustment of the soldier to minor difficulties of maladaptation; to provide assistance to the unit commander by screening out "obvious mental defectives, psychopaths or prepsychotics" who presented administrative, disciplinary, or training problems; and to "sell practical psychiatry to the line." Colonel Porter suggested that men between the ages of 30 and 40 be specially selected for this assignment and be given a 6-week training course in "administrative duties, relationship to the line, military orientation and indoctrination in practical psychiatry."

---

[30] Porter, W. C.: Military psychiatry. War Med. 2: 543–550, Jul 1942.

[31] Ibid.

[32] Memo, Lt Col W. C. Porter, MC, to Brig Gen C. C. Hillman, 3 Apr 42. SG: 211 Neuropsychiatry.

Colonel Madigan was favorably impressed by a report, made during the month of June, of the first 5 months of activities of the classification unit at Fort Monmouth. On 25 July 1942, The Surgeon General recommended that "qualified neuropsychiatrists be assigned to headquarters at each replacement training center." [33] The Director of Training, Services of Supply, supported the recommendation.[34] Following this, The Surgeon General recommended on 20 August: ". . . if the plan is approved, that the allotment of officers for duty at each replacement training center be increased by one Major, Medical Corps, to allow the assignment of a neuropsychiatrist." [35]

On 15 September, the Military Personnel Division, Services of Supply, initiated instructions to The Adjutant General through the Assistant Chief of Staff, G–1, to announce allotment of 1 major, Medical Corps, for each replacement training center under the Army Ground Forces.[36] An announcement of a similar allotment for each replacement training center under Services of Supply was held in abeyance because of impending transfer of allotments under AR 170–10, 10 August 1942. At the time of the issue of this authorization Col. Roy D. Halloran, MC, had succeeded Colonel Madigan.[37]

On 30 October 1942, The Adjutant General sent out the following letter as a result of having received requisitions for psychiatrists which had been previously authorized: [38]

1. In connection with your recent requisition for a neuropsychiatrist, it is intended that this officer be used to establish a clinic or similar setup for the replacement training center in accordance with the following plan.

a. The assignment of neuropsychiatrists to replacement training centers is intended to assist those normal individuals who may have correctible maladjustments to Army service and to eliminate those mentally unstable individuals who are or may become a distinct liability to military training, discipline, and morale during the early weeks of training.

b. The general functions of the neuropsychiatrist will be as follows:

(1) To institute an advisory service, assisted by a qualified psychologist and such other personnel as may be made available, to aid the newly inducted soldier to make a satisfactory adjustment to his military duties.

(2) To aid, by professional methods, individuals who have been brought to the neuropsychiatrist's attention, in order to make full use of their training and capabilities or to recommend reclassification of those who are being trained in a skill beyond their capacities.

(3) To study and recommend remedial measures for those individuals who manifest behavior problems

---

[33] Ltr, SG to CG SOS, 25 Jul 42, sub: Assignment of psychiatrists to replacement training centers. SG: 211 Psychiatrists.

[34] Memo, Brig Gen C. R. Huebner to ACofS for Personnel SOS, 12 Aug 42, sub: Assignment of psychiatrists to replacement training centers. SG: 211 Neuropsychiatry.

[35] Memo, Lt Col P. A. Paden, MC, to Dir Mil Pers SOS, 20 Aug 42. SG: 211 Neuropsychiatry.

[36] Memo, Dir Mil Pers SOS to SG, 16 Sep 42, sub: Assignment of psychiatrists to replacement training centers. SG: 211 Neuropsychiatry.

[37] See footnote 28, p. 181.

[38] Ltr, TAG to CGs various Replacement Training Centers, 30 Oct 42, sub: Assignment of neuropsychiatrists to replacement training centers. AG: 210.31.

(4) To recommend for immediate discharge from the service such men who, because of mental or emotional factors, cannot function adequately or who present a hazard to the other men.

(5) To develop a liaison with line and medical officers for the purpose of instructing and developing a better understanding of the principles of mental hygiene as applied to the military service.

(6) To aid in the morale program of the station by the use of the neuropsychiatrist's specialized training and knowledge.

c. Individuals will be referred to the neuropsychiatrist through the classification officer by any one of the following:

(1) Staff sections.

(2) School directors.

(3) Chaplains.

(4) Company, troop, or battery commanders.

(5) Provost Marshal.

All requests for action of the neuropsychiatrist will contain or be accompanied by a statement of the reasons therefor.

d. The neuropsychiatrist will recommend disposition of the cases referred to him by any one or a combination of the following methods:

(1) Reclassification, where considered advisable.

(2) Special programs, corrective in character, cooperatively developed through conference with school directors, company, troop, or battery commanders, staff sections, and others.

(3) Psychiatric observation and treatment.

(4) Recommend admission to hospital with view to discharge on Certificate of Disability for Discharge because of disability (within this category are psychotics, severe psychoneurotics, epileptics).

(5) Recommend disposition by a board of officers convened under Section VIII, AR 615–360 (within this category are psychopathic individuals, mentally deficient, chronic alcoholics, drug addicts).

e. Cases scheduled for action by boards of officers will be handled as provided by pertinent regulations.

2. It has been drawn to the attention of this office that certain replacement training centers already have similar facilities established which are operating satisfactorily. The special importance of this service during this critical training period and, therefore, the necessary careful selection of personnel, cannot be overemphasized. Since there is a shortage of officers with a suitable background for this duty, it is desired that duplication of experienced officers be avoided.

3. In view of the above, it is requested that The Surgeon General will be informed, as early as is practicable, with the following information:

a. Whether or not a similar service is now functioning under a neuropsychiatrist at your installation.

b. The names and qualifications of the neuropsychiatrists.

c. A recommendation as to the desirability of transferring that officer to fill the vacancy.

This letter may be considered to mark officially the end of the classification phase. From the foregoing account, it is seen that individual psychiatrists had already exceeded the bounds of classification and were performing some of the functions outlined in the above letter. However advanced the application of

psychiatry was in certain portions of the field, military psychiatry at large was not yet ready to exploit immediately the broad area of responsibility and activity as encompassed in this letter. A part of the difficulty, no doubt, rested with the traditional resistance of the military to innovations; part was lack of understanding by psychiatrists as to how to apply clinical experience in this broad way. Doubtless, also, there was some reluctance on the part of psychiatrists to give up the illusion of screening as the best contribution which psychiatry could offer. For although there was growing concern that psychiatry had failed at induction centers, it might yet succeed in screening at the next point of contact with the soldier—a better screening process might be accomplished at the replacement training center.

Notwithstanding the doubts of some experienced psychiatrists, the wisdom of careful selective screening grasped the imagination of many and was a significant factor which had led to the assignment of psychiatrists to replacement training centers. In fact, to the new Chief of the Neuropsychiatry Branch, Office of The Surgeon General, Col. Roy D. Halloran, screening appeared to have accomplished almost [illegible]hat had been expected in October 1942:[39]

> Neuropsychiatric screening has been developed at induction centers to a far wider degree than during the last war, and neuropsychiatric service at this point is considered of paramount importance, however tedious and demanding. In spite of the relatively large and necessarily rapid mobilization, evidence already indicates that a greater percentage of potential neuropsychiatric misfits have been prevented from entering the armed forces than during a comparable period in the last war.

He cited a need for a second echelon of screening to provide for the elimination of those who had been missed at the induction centers:[40]

> It is inevitable that under the most exacting examination possible some will be missed. An attempt must be made to weed these out during the training period. Accordingly, steps have been authorized already to place well qualified neuropsychiatrists on the staff of replacement training centers. The soldier after induction goes to a reception center and spends anywhere from a few hours to a few days becoming oriented, getting his uniform and going through certain forms of introduction, and then proceeds to the replacement training center. Here for the first time the problems incident to the new life in the Army begin to appear. The function of the psychiatrist at the replacement training center will be concerned with adjusting normal individuals and detecting and eliminating the mentally unstable who are or may become a distinct liability to military training, discipline and morale during the early weeks of training.

This was reiterated again approximately 6 months later by Colonel Halloran and Lt. Col. Malcolm J. Farrell, MC, at the 99th Annual Meeting of the American Psychiatric Association in May 1943.[41] Maj. (later Lt. Col.) John

---

[39] Halloran, R. D.: Presentation of the subject of Symposium II. *In* Sladen, Frank J.: Psychiatry and the War. Springfield, Charles C Thomas, 1943, pp. 421–431.

[40] Ibid.

[41] Halloran, R. D., and Farrell, M. J.: The function of neuropsychiatry in the Army. Am. J. Psychiat. 100: 14–20, Jul 1943.

W. Appel, MC, ascribes the delay in recognizing the extent of the problem as being mainly due to the absence of reliable figures.[42]

The difficulties in this matter were reported in July 1943:[43]

> Efforts have been made to improve screening at induction and training centers. At the induction centers large numbers of men are processed as rapidly as possible. But the time for examination is too short; psychiatrists lack adequate background information on the men; and psychiatrists are scarce. All these problems have been faced frankly, and appropriate measures instituted. But no test yet devised is so perfect that it can detect all the psychopaths and potential psychoneurotic individuals on brief examination. If a screen were tight enough to eliminate anybody who might possibly develop a nervous breakdown, it would be so tight as to eliminate nearly everybody.
>
> A second screening process is now instituted at the Replacement Training Centers. There, a trained staff of psychiatrists, psychologists, and psychiatric social workers, cooperating with line officers, chaplains and others, further observe the newly inducted soldier.

From the foregoing, it is clear that there was strong impetus for assigning psychiatrists to replacement training centers for what was considered to be a need for more screening of unpromising individuals.

Psychiatric Screening and Consultation Phase

The second phase brought psychiatrists into collaboration with the psychologists and classification specialists. In certain instances competition rather than collaboration resulted. This was undoubtedly because of overlapping areas of responsibilities outlined in The Adjutant General's letter of 30 October 1942 quoted above and AR 615–28. In most cases, this was satisfactorily resolved at the local level without benefit of clarifying directives from the War Department. The following letter illustrates that there were still ambiguities 2½ years later:[44]

> I am enclosing a copy of our new SOP which came out yesterday as a result of further conference with the C. O. and is the culmination of nine months of interpretation of the function of a Mental Hygiene Division, the administrative keynote of which has been differentiating its function from that of the Classification and Personnel Consultant's subsection of the Personnel Division. In this respect WD Cir 81 helped define both the administrative and functional relationship of this Division to the Command. This SOP now clears up the anomaly of having two Consultation Services existing side by side with overlapping responsibility.

During this period, the function of the psychiatrist was initially to be the prevention of psychiatric casualties by a process of eliminating individuals during training who would not be likely to serve profitably in the military

---

[42] Appel, J. W.: Cause and prevention of psychiatric disorders in the U. S. Army in World War II. HD: 314.7–2.

[43] Annual Rpt, SG, FY 1943. HD.

[44] Ltr, Maj H. L. Freedman, Mental Hygiene Div ASFTC, Camp Plauche, La., to Maj M. S. Guttmacher, SGO, 18 Apr 45. HD: 730.

service. This was, in essence, the type of activity that Maj. Thomas W. Salmon, MC, had recommended in his report in 1918.

This phase began during a period when an increasing awareness was developing that two important tools were not accomplishing the hoped for results in meeting the manpower problem. Reaction against the classification and assignment system—"vocationalism"—mounted during 1942 in the Army Ground Forces because under the system a disproportionately large number of men in the lower mental groups were being assigned the combat arms for training.[45] This produced many problems in the training situation in which psychiatric knowledge was deemed to be of value and, in some measure, helped to create a receptive attitude in the Army Ground Forces command toward establishment of the position of a staff psychiatrist. At the same time, realization grew that psychiatric screening as it was being performed at the induction stations would not alone accomplish the objective of prevention of psychiatric disorders and that psychiatrists could not be expected to eliminate all potential psychiatric casualties at the induction station. Without any intent to minimize the enormity of the task which was attempted, or reflect discredit upon those who labored conscientiously at it, it must be recorded that psychiatric screening at induction failed as a primary method of preventing the great majority of losses caused by psychiatric disorders. Although induction screening unquestionably served a useful purpose when individuals were eliminated who were mentally defective, overtly psychotic, psychopathic, or severely psychoneurotic, this group comprised only a relatively small proportion of the numbers who came to require psychiatric attention in the military service.[46]

By the end of the first 2 weeks in November 1942, 13 psychiatrists had been assigned to replacement training centers. In March 1943, there were 16 consultation services in the 33 training centers when Colonel Halloran recommended to Brigadier General Hillman that such units be established in all replacement training centers, including those of the Army Service Forces. By the middle of May 22 replacement training centers had neuropsychiatrists assigned and by the end of summer, all Army Ground Forces and Army Service Forces replacement training centers had consultation services.[47] This condition did not persist, however, because the Army Service Forces had not yet published a directive making mandatory the establishment of mental hygiene consultation services in all Army Service Forces Training Centers. In this the Army Service Forces was more than 2 years later than the Army Ground Forces.

---

[45] Palmer, R. R.: The procurement of enlisted personnel: the problem of quality. *In* U. S. Army in World War II. The Army Ground Forces. The Procurement and Training of Ground Combat Troops. Washington, Government Printing Office, 1948, pp. 1–86.

[46] Farrell, M. J.: Psychiatric lessons learned in the Army. Rhode Island M. J. 30: 582–586, Aug. 1947.

[47] Semimonthly Rpts, Med Practice Div SGO, 1942 and 1943. HD: 024.

With the assignment of psychiatrists to replacement training centers, new problems came into relief which had not been previously encountered. Where the development of such a facility had proceeded spontaneously, it indicated a receptive attitude on the part of the command or medical officers. The papers of Lieutenant Freedman,[48] Captain Cruvant,[49] Major Cohen,[50] and Captain Schreiber[51] indicate the importance of this factor. It is doubtful if such development could have proceeded without the wise leadership and support of responsible local commanders and senior medical officers. Such support, however, was not to be uniformly experienced by all psychiatrists in establishing new consultation services.

Other difficulties arose, even when command support was satisfactory. Perhaps the first of these was because of a lack of clear understanding by both commanders (including medical) and the psychiatrist as to the psychiatrist's place in the training situation, what his duties were to be, and how he was to implement them.

The usual assignment procedure for the psychiatrist on orders to open a new consultation service was for him to report to the training center after spending a week of temporary duty at one of the established consultation services. Some were also briefly seen in the Neuropsychiatry Branch of the Surgeon General's Office by Colonel Halloran. With an orientation thus acquired and armed with the only directive pertaining to his new assignment, the psychiatrist reported to the training center.

The psychiatrist assigned to the Infantry Replacement Training Center, Camp Wolters, Texas, arrived on 27 November 1942 after having spent a week at the Engineer Replacement Training Center, Fort Belvoir, Virginia. He had conferred with Colonel Halloran and Colonel Farrell and was advised that his task was to organize and develop a mental hygiene consultation service for prevention, treatment, and disposition of maladjusted soldiers. Upon arrival he was first assigned to the special training unit several miles from the main camp. However, within the same day he was reassigned to the Infantry Replacement Training Center as Acting Assistant Classification Officer, with functions as an integral part of the Classification Section.[52] At Camp Roberts, California, the psychiatrist arrived 6 December 1942 following 1 week of temporary duty at Camp Callan, California, Antiaircraft Replacement Training Center. He was immediately assigned to S–1 (Personnel) at Headquarters Field Artillery Replacement Training Center and given a desk in the Classification and Assignment Section. During a period of orientation to the organ-

[48] Freedman, H. L.: The services of the military mental hygiene unit. Am. J. Psychiat. 100: 34–40, Jul 1943.

[49] See footnote 23, p. 180.

[50] See footnote 27 (1), p. 181.

[51] See footnote 26, p. 181.

[52] Hunt, R. C.: History of the consultation service, Camp Wolters, Texas. HD: 730 Neuropsychiatry.

ization, procedures, and training of the replacement training center, he studied the official guide for the setting up of the program: The Adjutant General's letter of 30 October 1942, subject: "Assignment of Neuropsychiatrists to Replacement Training Centers."[53] The psychiatrists who were assigned to establish consultation services at North Camp Hood, Texas,[54] and Camp Abbot, Oregon,[55] also reported lack of clarity as to responsibilities and relationships. The psychiatrist at the latter camp thought some advantage resulted from this in that it allowed for local development according to the requirements and response of the group being served. However, he thought acceptance of the services may have been delayed by the absence of definite regulations.

A difficulty frequently encountered was a lack of sufficient personnel to accomplish more than a modest amount of the program prescribed. At several camps, little or no stenographic help was available for a time. At North Camp Hood social histories were taken by line officers except during a brief period in 1943 when an American Red Cross social worker was assigned. These line officers were individuals of varying skills who were unassigned for one reason or another. Since they were rotated every 1 to 3 months, this resulted in unreliable case histories and demanded continuous effort in training new officers by the psychiatrist. In the 31 months of performance no enlisted social worker or clinical psychologist was available.[56] Psychiatrists at other posts fared better. The psychiatrist at Camp Abbot, and later Fort Lewis, was able to meet the problem of finding qualified enlisted men for interviewers by accepting "near-qualified" personnel with good educational backgrounds and interest in the work. He then put them through a concentrated and personalized training program supervised by the staff. A comprehensive manual of procedures was devised for reference.[57]

This kind of success depended upon factors not always amenable to the psychiatrist's efforts at solving his own personnel problem. As it was expressed by one psychiatrist who had experienced considerable difficulty in this matter: "Those consultation services which have been able to build up to a satisfactory size have done so due to the special help and understanding on the part of the local commands by taking personnel away from other sections in the camp."[58] Confirmation of this observation came from another source: "Throughout its operation the MHCS [Mental Hygiene Consultation Service] has had to con-

[53] Houloose, J.: History and statistical summary—psychiatric service, Field Artillery Replacement Training Center, Camp Roberts, California, 1943–1944. HD: 730 Neuropsychiatry.

[54] Kraines, S. H.: A brief history of psychiatry at the Tank Destroyer Replacement Training Center, Camp Hood, Texas, December 1942 to July 1945. HD: 730 Neuropsychiatry.

[55] Eisendorfer, A., and Fowler, D. D.: History of the Fort Lewis consultation service—an outpatient psychiatric clinic. HD: 730 Neuropsychiatry.

[56] See footnote 54.

[57] See footnote 55.

[58] Ltr, Maj G. S. Goldman, MC, Consultation Serv IRTC, Camp Wheeler, Ga., to Maj M. S. Guttmacher, MC, SGO, 19 Oct 44. HD: 730 Neuropsychiatry.

sistently borrow men from other units because insufficient personnel is allowed under the present table of distribution." [59]

Lack of space to establish a clinic was a handicap which some were able to convert to an advantage. Maj. James Houloose, MC, while at the Field Artillery Replacement Training Center, Camp Roberts, never formally established a separate clinic, but maintained a desk in the classification section. He utilized willingly the various orderly rooms for his examinations and interviews. This allowed him to keep in continuous contact with battery headquarters and to develop a working acquaintance with commanders, noncommissioned officers, and trainees of the units. While he gathered information of use in his function as psychiatrist, he explained his role and taught psychiatric concepts. This was a practical and effective manner of continuously orienting battery cadre.[60] Maj. Robert C. Hunt, MC, at the Infantry Replacement Training Center, Camp Wolters, Texas, was similarly assigned desk space in the classification office, but "conducted a traveling clinic; interviewing soldiers in six area dispensaries." He saw the noncommissioned officers and officers in their orderly rooms to discuss individual problems with a mutually valuable exchange of information and resultant education. He had appreciated at the beginning of his assignment that he "had much to learn about the Army and that the Army had much to learn about psychiatry." [61] This was an effective approach in the conciliation of varying views on problems of common interest to command and psychiatry.

Of the functions outlined by the authorizing directive, the most familiar one to most psychiatrists from civilian experience was that of consultation. It was also the function that was inevitably first in demand. Being both most in demand and most familiar to the psychiatrist from his clinical practice in civil life, it was often the first function to receive attention. The accomplishment of the consultation function entailed various operations:

1. Referrals: These came from the unit commander, dispensary surgeon, personnel officer, classification and assignment officer, school director, chaplain, judge advocate, provost marshal, information and education officer, special services officer, and American Red Cross representative.

2. Evaluation: This was the process of utilizing the professional techniques appropriate to the presenting problem and the individual referred.

3. Reports and recommendations: These were made either to the individual himself or to the interested staff officer after psychiatric evaluation had indicated the advisability or desirability for certain action to be considered or taken.

4. Followup: This was the establishment and maintenance of an effective program to appraise the effectiveness of the recommendations and the progress being made by the soldier after return to duty.

---

[59] Brewer, F. W.: History of mental hygiene consultation service, Infantry Advanced Replacement Training Center, Camp Livingston, Louisiana, 29 Aug 45. HD: 730 Neuropsychiatry.

[60] See footnote 53, p. 189.

[61] See footnote 52, p. 188.

The last was frequently undeveloped during the early period because of a lack of personnel commensurate with the magnitude of the consultation requirement. In response to this need, the principal function in the replacement training centers immediately after establishment of a consultation service was that of consultation or of screening.

The variable manifestations of failure in the adjustment process were used as a basis for referral for psychiatric evaluation. Some of these were: complaints for which no physical basis could be found on medical examination, difficulty in concentration and learning, undue anxiety on the rifle range or infiltration course, unusual awkwardness, insubordination, unfriendliness to fellow trainees, depression, tremulousness, insomnia, and frequent petty military offenses. The principal purpose in obtaining an evaluation was selectively to eliminate the potentially maladjusted individuals—hence the frequent use of the term screening when consultation was described.

One of the difficulties in the screening at basic training centers which psychiatrists soon experienced was expressed as follows by an officer at Camp Croft, South Carolina:[62]

> . . . . The greatest hazard in the psychiatric screening of soldiers in the army is that, once given an awareness of the omnipresence of maladjustment, the inexpert observer, in his endeavor to find a case, may make a case. Too often a man will be referred to this service in the early weeks of his cycle when he is displaying a moderate and understandable anxiety which is indicative of nothing more or less than his difficulty in orienting himself away from the home to the army. For the military authorities to show undue concern over this serves only to crystallize a neurotic reaction pattern in men who might otherwise attain an adequate adjustment.

Experience demonstrated that those who appeared hopelessly inadequate on arrival often were able to complete training and were never seen in the consultation service. Major Hunt at Camp Wolters described this type of trainee:[63]

> . . . . The typical example is an eighteen year old, group IV on AGCT. He tells the Classification interviewer that he has always been weak and sickly, that he can't stand crowds or excitement and is afraid of guns. On filling out the questionnaire he indicates that there is a family history of nervous or mental illness, his health is generally poor, he has had to quit jobs because of his health, he is nervous much of the time, does not like to mix with people, cannot work well when watched, is bothered by headaches, dizzy spells, and back trouble, has worrisome problems at home, thinks his induction into the army was a mistake and does not think he can become a good soldier. This is all prognostically bad, of course, yet many of this sort do finish training.

It came to be considered that most personal adjustment problems could be and should be dealt with by the platoon or company commander. Such officers

[62] Frankfurth, V. L.: A brief history of the development and functions of the consultation service, IRTC, Camp Croft, S. C., 9 Dec 44. HD: 730 Neuropsychiatry.

[63] Ltr, Maj R. C. Hunt, MC, Hq IRTC, Camp Wolters, Tex., to Maj J. W. Appel, MC, SGO, 9 Nov 45. HD: 730 Neuropsychiatry.

were assisted by conferences with the psychiatrist on problem cases. Often such a conference between the company officer and a member of the clinic staff resulted in the desired improvement without the need for the soldier to be formally referred to the clinic for evaluation. However, if initial efforts failed to provide the necessary solution, the soldier was referred to the mental hygiene consultation service.

Among the soldiers referred were individuals who lacked the intellectual, cultural, or emotional requirements for prompt adjustment to military service. In addition to the slow learners, there were individuals who gave the appearance of being mentally deficient, but who responded to appropriate training with a performance which indicated that the basic problem was not one of low innate intelligence, but rather one of insufficient previous opportunity. Another group of soldiers referred were men who had not mastered the English language. All of these individuals were placed in the special training units at various training centers. Where such units were in operation, the mental hygiene consultation service was presented with a problem predominantly related to the maladjustment of trainees with defective intelligence.

For some time following its establishment at Camp Croft, the consultation service functioned mainly as a psychological screening service for the special training unit. During this period, the emphasis in function was on psychometric evaluation and recommendations for discharge under appropriate administrative regulations. So long as the special training unit was active, the main body of referrals came from it and defective intelligence was seen as a frequent basis for the maladjustment. The experience of the psychiatrist at the Fort Bragg Field Artillery Replacement Training Center was similar:[64]

> As in any new medical setup where the most pressing and striking cases take precedence initially, the severe mental defectives were the first to claim attention and most of the psychiatrist's time was taken up in the organization of a psychometric program and the actual giving of intelligence tests. Since it was keenly felt that casual estimation of mental age was futile and misleading, the Replacement Training Center provided test materials for the Stanford-Binet Scale, Form L, 1937, and the psychiatrist proceeded to weed out most of the severe intellectual defect problems and bring them to the attention of the Center Reclassification-Disposition Board for discharge. The value of psychometry in the weeding-out process soon proved so great that the test-battery was expanded to include the 1937 Stanford-Binet, Form M, the Kent Emergency and the Porteus Mazes. An attempt to have laymen (platoon officers and noncommissioned officers of the Special Training Battery) learn and administer the E–G–Y was unsatisfactory, and the introduction of an enlisted psychologist finally solved the psychometry problem and enabled the psychiatrist to devote more of his time to strict neuropsychiatry.

With his full-time assignment to the replacement training center, the psychiatrist at Fort Bragg was able to extend his resources beyond diagnosis and disposition. This led him into activities of a preventive nature:[65]

---

[64] Abrams, A. L.: Structure and functions of a neuropsychiatric service in a replacement training center, Jul 1943. HD: 730 Neuropsychiatry (Fort Bragg).

[65] Ibid.

> . . . . We felt ourselves responsible for a "preventive psychiatry" which would prevent those unfit from getting to theaters of operations.
>
> Accepting as its primary purpose the elimination of the mentally unfit from the Replacement Training Center situation so that they are never given a chance to burden and endanger the overseas combat units. . . . Our secondary purpose has been to salvage as many cases as possible.

The prevention was still one of screening, however.

Various methods were devised to screen the new arrivals. The screening process at the Fort Bragg Field Artillery Replacement Training Center utilized officer and enlisted cadres who had been educated to the problem of the emotionally unstable by a series of lectures. This indoctrination worked satisfactorily and helped the cadres to deal at first hand with many problems in which the psychiatrist participated as an adviser only. Referral was accomplished by telephone; forms and questionnaires having been discarded as unnecessary. At Camp Croft the basic trainee was seen soon after arrival on the post by personnel of the classification section. This was primarily to conduct a vocational interview, but the interview was utilized additionally for the screening of men with mental disorders. The interviewers, who were enlisted men, had been instructed to refer any trainee about whom there were doubts concerning his ability to adjust. Trainees so referred were then evaluated by the senior psychiatric caseworker who scheduled appointments at the consultation service for those who were most in need of further evaluation. Generally, these were men who were depressed, acted eccentrically, admitted enuresis or other undesirable habits, appeared extremely effeminate, or who claimed to be conscientious objectors.

An interesting observation was made at Camp Wolters, Texas, when a system of spotting potential casualties was begun at a later time:

> . . . . Early in our work with the method we were able to demonstrate statistically that one third of the interviewers were doing most of the spotting, and some were doing practically none. These data were given to the section chief, and I never asked just how he handled it, but from then on the interviewers all spotted approximately the same numbers, and the coverage was more complete.[66]

During the training cycle, any member of the training command staff could refer cases to the clinic for examination. At Camp Croft the referral method found to be most satisfactory included the following points:[67]

1. Responsibility for referral rested with line officers.

2. The telephone was used to make the referral because it was considered a most ready and convenient means of communication and was conducive to a more lucid statement of the problem than the written method of referral.

3. Recording of the problem, as it was received, was accomplished on a 3 by 5 card and entered upon a daily schedule sheet.

---

[66] See footnote 52, p. 188.

[67] See footnote 62, p. 191.

The company commander of the trainee was notified in every instance when a referral had not originated with him. In some instances, a soldier came to the clinic as a self-referral. However, the primary sources for referrals were company commanders, dispensary surgeons, staff judge advocates, chaplains, and the Red Cross. Cases referred from the dispensaries were to have had a recent physical examination prior to referral. If a report of such an examination was not available, the psychiatrist was responsible for the determination of physical status.

Sometimes an elaborate operating procedure was prescribed for the referral procedure. An example of this is the first memorandum at the Replacement Training Center at Camp Crowder, Missouri. This publication announced that a neuropsychiatric consultation service for the replacement training center had been established on 10 June 1943. It was stated that full advantage of the service had not been taken. This memorandum established procedure as follows:[68]

1. Platoon officers were to interview each trainee prior to completion of the first 2 weeks in the replacement training center (both basic and specialist trainees).

2. Trainees having difficulty adjusting were to be reported to the company commander and a checklist was provided as a guide for determining those who required referral to the neuropsychiatric consultation service.

3. The company commander was to interview the men considered maladjusted or of dubious value to the military service and submit a report to the director of personnel.

4. The report to the director of personnel was to state that all men assigned within the past 21 days had been interviewed and none required referral, or a list of those requiring referral was to be appended.

5. In the latter instance, a memo was to be appended for each soldier requiring referral stating (a) the problem, (b) a specific example of the difficulties, and (c) an estimate of his potential value. If the report were made on a soldier in specialist training, information was also to be included concerning the progress he was making in the specialist course.

Problems which were considered a matter of misassignment were handled by the classification branch, but those which had some degree of personal maladjustment as well were referred to the neuropsychiatric consultation service. This memorandum specified the channels through which consultations were to be sent, requiring an indorsement, with pertinent information, including recommendations as to possible disposition, and provided that when "neuropsychiatric examination reveals that reclassification or reassignment will enable the enlisted man to make a more satisfactory adjustment, this will be done."

---

[68] Hq ASFTC, Camp Crowder, Mo. Personnel Memo 23, 7 Oct 43. HD: 730 Neuropsychiatry.

The cumbersome referral system was changed approximately a year later by a directive which provided for referral directly to the Chief, Neuropsychiatric Consultation Service, Personnel Division.[69] The referring organization was made responsible for the soldier's appearing, with all his medical records, from post installations.

Intake procedure varied between consultation services, depending upon the available staff. At Camp Roberts, California, in the Field Artillery Replacement Training Center, the procedure in accomplishing consultations was geared to the psychiatrist as the only member of the staff. Requests for consultation came through the post personnel office from the battery commander or other individuals. The trainee was initially interviewed at the orderly room of his organization, where care was exercised to make the situation as private as possible. Then the progress record of the trainee was reviewed and consultation was held with the trainee's noncommissioned officer and platoon leader. Other sources utilized for information which might be an aid in making a diagnosis or in planning for the adjustment of the trainee were: unit dispensary, station hospital, and civilian social agency educational or employment records.[70]

By way of contrast, the intake procedure at Camp Wolters was more elaborate. The clerk first entered information from the enlisted man's personnel records (Form 20) on the consultation service face sheet; the chief social worker then scheduled an appointment. At the time of the appointment the social worker saw the patient first for a history; then the psychiatrist saw the patient. If the personnel records disclosed an Army General Classification Test of under 75, the enlisted man was routinely sent to the personnel consultant for a psychological evaluation before being scheduled in the mental hygiene consultation service.[71]

At Camp Croft, the soldier was scheduled for an hour and was seen initially by the psychiatric social worker who prepared a history. Depending upon the nature of the problem and the amount of time available, the personality development was carefully traced, exploring the most pertinent areas thoroughly. These workers used the Wechsler Individual Mental Abilities Scale if mental deficiency was to be evaluated. A questionnaire with 20 neurotic trends was used as a key to further history taking. The psychiatrist reviewed the history before seeing the patient and was able to get to the problem with minimum time spent in investigation. The problem had been pointed up by this process and it left further development of the case to him. His was the responsibility for diagnosis, treatment, or recommendations for disposition. In cases which required supplemental information, the American Red Cross was requested to

[69] Hq ASFTC, Camp Crowder, Mo., Personnel Memo 3, 22 Aug 44. HD: 730 Neuropsychiatry.
[70] See *footnote* 53, p. 189.
[71] See footnote 52, p. 188.

provide social histories. Followups in the individual units were conducted by the enlisted psychiatric social worker.[72]

At North Camp Hood, Texas, all emergency cases were seen immediately by the psychiatrist. The procedure with routine cases was spread over a 3-day period, incorporating one feature of the adviser system. On the first day the social worker took an essential background history and returned the soldier to his unit with three request forms. One was for a report on his medical status; another was to obtain a report from his commanding officer; and the third was a request for the adviser or platoon sergeant to report to the clinic on the second day. On the second day the adviser furnished the social worker or the psychiatrist with a complete social case study of the soldier's activities in camp. This information was most valuable since it was the result of a day-to-day observation of the patient's activities, attitudes, and abilities. On the third day the referred soldier was examined by the psychiatrist with social history, medical report, commanding officer's report, and the adviser's observations.[73]

Yet, in spite of the familiarity of the psychiatrist with the clinical procedures involved in consultation and with well-planned screening, referral, and intake procedures, he still found that military psychiatry required a somewhat different evaluation than his previous civilian experience permitted him to anticipate. The symptom complexes presented by the soldiers seemed to be familiar insofar as diagnosis was concerned. *The difficulty was in translating diagnosis into an evaluation of the man's fitness to perform in the military service so that proper recommendations could be made.* The advantages of illness—secondary gains—were comparatively greater than had been present in ordinary civilian practice. Therefore, although the presenting symbols were familiar, the setting was not, and it took a while for the psychiatrist to appraise the problems in terms of the new situation. Maj. S. H. Kraines, MC,[74] refers to this as the "military orientation of the psychiatrist" and Maj. (later Lt. Col.) George S. Goldman, MC,[75] writes of the emotional adjustment required before an effective consultation function could be accomplished. As the psychiatrist shifted his sights to new aims, these of necessity were concerned with what would be best for the group being served. He became familiar with matters of motivation, incentive, morale, factors of stresses and supports in groups as well as individuals. As he did so he became better equipped to recommend consistently and meaningfully to staff officers in individual cases and for groups.

However, formulation of recommendations was difficult because policy with regard to many matters in the utilization of manpower fluctuated con-

---

[72] See footnote 62, p. 191

[73] See footnote 54, p. 189.

[74] Kraines, S. H.: Psychiatric orientation of military nonmedical personnel. *In* Manual of Military Neuropsychiatry. Philadelphia, W. B. Saunders, 1944, pp. 481–505.

[75] Goldman, G. S.: The psychiatrist's job in war and peace. Psychiatry 9: 263–276, Aug 1946.

siderably. This had its unsettling effects upon the training center psychiatrists whose recommendations were required to reflect the perspective of each new directive. Recommendations were not always easily effected as a result of changes in policy. When emphasis was placed upon the training of individual combat replacements, transfers to a specialist training unit or to other branches of the service were nearly impossible. There was continuous uncertainty about which individuals would be considered as unfit. Early in the war conservation by utilization of reclassification procedures was directed:[76]

> During the emergency, it is essential that manpower be conserved. Therefore, releases from active service will be granted only when in the interest of the Government or when the necessity therefor is extreme. . . . No man will be separated from active service because of disability, inaptness or undesirable habits or traits of character, unless the Government can obtain no useful service from him. Full use will be made of reclassification procedure and additional training in special training battalions.

This policy was to undergo many changes during this period when psychiatrists' services were being extended to all training centers. The Surgeon General summarized this evolution for the Assistant Chief of Staff, G–1, as follows:[77]

> . . . . In the early days of the war there was no classification limited service. Men with psychoneuroses were marked full duty or were discharged. Limited service was authorized in the summer of 1942, permitting the retention of men with borderline or mild psychoneurosis. In March 1943 (Memorandum No. W600–30–43, Adjutant General's Office, March 25, 1943), attention was called to the need for preventing men with neuropsychiatric disorders from being sent overseas, and increasing numbers were retained on duty in this country. In April 1943 (Memorandum No. W600–39–43, Adjutant General's Office, April 26, 1943), it was directed that individuals with any neuropsychiatric disorder who could not be expected to render full military duty were to be discharged. In July 1943 (W. D. Circular No. 161, 14 July 1943, as amended by W. D. Radiogram, 29 July 1943), the classification limited service was discontinued and anyone who did not meet the minimum standards for induction was discharged except when his commanding officer specifically requested his retention for a specific assignment. Large numbers of men with mild psychoneuroses were discharged from the service by CDD [Certificate of Disability for Discharge], since anyone with a psychoneurosis of any degree was automatically below minimum standards for induction. In November 1943 (W. D. Circular 293, 11 November 1943), it was directed that no individual would be discharged from the service regardless of diagnosis if he was capable of performing effective duty. This resulted in the retention of many men with psychoneuroses in the service, but only those with mild transitory psychoneuroses could be sent overseas. As an amplification of this policy, S. G. O. Circular Letter No. 194, 3 December 1943, directed that separations from the service would not be recommended merely because a man has, or has had, a psychoneurosis or similar disorder.

One of the effects of changing policy on disposition may have assisted the psychiatrist to seek better means than disposition to satisfy his own require-

---

[76] WD Cir 270, 27 Dec 41.

[77] Memo, Maj Gen N. T. Kirk for ACofS, G–1, 7 Dec 44, sub: Psychoneuroses. HD: 730 Neuropsychiatry.

ments as a physician to individual soldiers. As Major Goldman at Camp Wheeler, Georgia, stated: [78]

> . . . . We have not, of course, been able to maintain a constant policy as regards dispositions such as discharge, or as concerns therapy. We were better able to orient ourselves toward therapy during the time when discharge was extremely difficult to effect, although at the same time we saw a great deal of unnecessary and useless suffering. While our attempts at individual therapy have necessarily been somewhat limited, we have from the beginning tried to do as much as possible by educating the officers and cadre.

Particularly important to the effectiveness of the consultation service was its relationship to the reclassification-disposition board. This was facilitated at Camp Croft by the personnel consultant of the consultation service acting as classification officer of the board. The personnel consultant also served as recorder of the boards convened under provisions of section VIII, AR 615–360. At Camp Wolters a cumbersome board procedure was modified for increased effectiveness. For example, as much as a half day might be used to take detailed testimony from six witnesses to dispose of a single case of enuresis. This was shortened by having only one witness testify who usually was a noncommissioned officer knowing the man well. Additional documentary evidence such as certificates by psychiatrist, psychologist, and commanding officer were introduced. The psychiatrist was a member of the Section VIII board at this camp after June 1943. This practice was subsequently discouraged because, in effect, the psychiatrist might act as both witness and judge in some cases. The psychiatrist frequently had to familiarize board members with the intent of the provisions of the regulation under which the board was convened. When the turnover of officers detailed to such duty was rapid, there were delays and misunderstandings until interpretations could be made.

Although most of the psychiatrist's time at the outset was spent with the consultation and screening activities, circumstances were combining in 1943 to favor an increasing attention to the function of treatment. At Camp Wolters, Texas, after running a "discharge mill" for the first few months, the backlog of inapt soldiers had been processed by March; special training units were opened at reception centers in July 1943, materially reducing the large numbers of mental defectives which formerly had composed 75 percent of the problem cases. The staff was enlarged by the addition of a full-time stenographer and a social worker. Doubtless, similar circumstances were in process elsewhere.

As a clinically oriented physician, it was inevitable that the psychiatrist should select for treatment cases which he believed were likely to result in improved adjustment following treatment. Thus, one of the functions of the mental hygiene consultation service came to be the careful selection of candidates for treatment in an outpatient capacity. This was an important adjunct

---

[78] See footnote 58, p. 189.

in assisting the adjustment of the individual soldier who, because of lack of motivation, defective attitudes, mental, emotional, or personality factors, had encountered problems in adjusting to military service.

Major Kraines [79] believed that not only was diagnosis more effective while the man was still in his organization than after he was admitted to the hospital, but also psychotherapy was more effective in the training setting. He had observed the frequency with which symptoms recurred following the return of the soldier from the hospital to the stress of military life. On the other hand, adjustment during training by means of social and psychiatric measures resulted in more effective performance and fewer exacerbations of symptoms. As one psychiatrist stated it, psychotherapy was ". . . aimed at retaining the soldier in duty status, in the environment of his unit. It prevented many men from being hospitalized and removed from an ostensibly threatening environment to which they had not become acclimated." [80] This was analogous to the method of treating combat casualties as soon as possible in the setting of the breakdown.

Treatment took many forms in application. Measures which the psychiatrist in civilian practice perhaps would not have rated high were successfully utilized. Intensive, or deep, therapeutic techniques were eliminated by press of circumstance prohibiting long-term relationships. Used as psychotherapy at North Camp Hood were explanation, reassurance, persuasion, and occasionally, authoritarian measures. When emotional disturbances secondary to environmental pressures were present, advice was given, help procured through the American Red Cross, and emergency furloughs obtained. Indirect therapy was provided through the company commander or adviser by acquainting them with the understanding of the soldier necessary to his good management. Reclassification and reassignment were considered therapeutics and for some, separation from the service was "treatment."

Therapy, at Camp Roberts Field Artillery Replacement Training Center, consisted of the establishment of rapport, explanation of the soldier's problems in terms of reality principles, and reassuring him of his ability to overcome the difficulty.

The training center psychiatrist was called upon to advise many individuals who manifested symptoms during the transitional period of adjustment to military service. Some of these individuals, abruptly severed from the supports and security upon which they had depended in civilian life, developed depression, anxiety, and in severe cases, panic. Maj. Arnold Eisendorfer, MC, in the training center at Camp Abbot and later at Fort Lewis, studied a group of these individuals and described them as the "passive personality

[79] Ltr, Maj S. H. Kraines to Maj M. S. Guttmacher, SGO, 2 Oct 44. HD: 730 Neuropsychiatry (Camp Hood).

[80] See footnote 55, p. 189.

reaction type."[81] These individuals were characterized as being intensely dependent upon a parent or parent-substitute with what had appeared to be an adequate social adjustment in civil life. The loss of the source of his security and satisfaction (job, sweetheart, family, avocation) was produced by entry upon military service. This was followed by the development of a syndrome, which Major Eisendorfer referred to as "acute nostalgic state." The importance of early treatment in these cases was emphasized and the results were gratifying. Treatment was based upon an understanding by the psychiatrist of the psychodynamics of dependence. The individual was given support by the psychiatrist until such time as his characteristic pattern of dependence could be transferred to the unit of which he gradually came to consider himself a part. While no claim was made that this type of therapy effected a cure, it was considered that one of the possible outcomes of successful management might bring the man to the threshold of newly found self-esteem and emancipation. This method of supportive treatment has been summarized by Major Eisendorfer as follows:[82]

> . . . . When he comes to the neuropsychiatric service, he finds the psychiatrist receptive; immediately he unconsciously attempts to reestablish that emotional pattern he had had with his previous paren al figure. This is called the transference situation. It is a rapport made with an individual in the immediate environment based on emotional ties which had been stimulated by a previous object of security. After a few interviews a considerable amount of the intense anxiety is eliminated. Once the initial panic is diminished, the practical part of the therapy is begun. The vital reasons for his being here are discussed in a language the patient can understand. The enormity of his disadvantage in this conflict because of his nervousness and dependency is constantly brought to his attention. Meanwhile, the soldier is beginning to make progress in training. The sense of accomplishment which accompanies such progress also helps to alleviate the initial anxiety; as he continues to make progress in training, he identifies himself more and more with the healthy soldiers about him, and the basic dependence on the ever-protecting parent is shifted to the powerful organization of which he now feels himself a more integral part. It is interesting to watch these men, as they gain confidence in themselves and their leaders, develop into soldiers who take pride in the role they have to play in the Army. The powerful Army and the cause for which it is fighting become a substitute for the benevolent protector, which was so necessary for their stability in civilian life. By this therapy we are not so naive as to believe that we bring about a cure. We simply attempt to substitute one type of dependency for another; we initiate a process of emotional conditioning which if continued leads to a satisfactory adjustment in the Army.

The aims and objectives of the treatment program at Camp Lee Army Service Forces Training Center were reported by Lt. Col. Samuel A. Sandler, MC. Out of the therapeutic relationship some interesting studies were made at this

[81] Eisendorfer, A.: Some salient dynamic factors of the passive personality reaction type. Ment. Hyg. 30: 226-234, Apr 1946.

[82] Eisendorfer, A.: Clinical significance of extramural psychiatry in the Army. War Med. 5: 146-149, Mar 1944.

mental hygiene consultation service on camptocormia and somnambulism concerning the psychodynamics of these two symptoms.[83]

An interesting development during 1943 was the adviser system which was initiated in February at North Camp Hood, Texas, in the Tank Destroyer Replacement Training Center by Major Kraines.[84] The object of this system was to assist trainees with personal problems by providing specially qualified and psychiatrically oriented noncommissioned officers in each company to whom trainees would turn for advice. It was considered that morale would be enhanced by bringing good counsel to the unit level in a form readily available and easily acceptable. These advisers were to be selected by the company commander and to be responsible to him and work through him, calling to his attention morale problems of which he should be made aware. Advisers were initially planned to be the platoon sergeants; however, they were found to be too often engaged in punitive measures or too busy with administration to effect the desired relationship. Failing in this, the company commanders were then asked to select two qualified men for these duties. They were to be responsible to the company commander. Meetings with the advisers of each battalion were held by the psychiatrist every 2 weeks. General instructions were given them on the importance of understanding men, with specific instructions relative to cases referred from their units. To assist in the indoctrination of the advisers, a weekly publication called the *Advisor Bulletin* was produced. The specific duties of the advisers were:[85]

1. To be available to answer questions concerning problems of the trainees.
2. To seek out maladjusted men and endeavor to assist them.
3. To provide social case histories on men referred to the mental hygiene consultation services.
4. To assist in adjusting men seen by the psychiatrist, especially in the field of social contacts.
5. To conduct group meetings with trainees in their barracks, discuss trainee problems, answer their questions, explain the reasons for Army procedures.

Later another function spontaneously developed: to inform the psychiatrist of serious morale problems which had been relayed to the commanding officer, but upon which no action had been taken. The purpose of this effort was an attempt to find a method of supplying psychiatric understanding to many more individuals than the psychiatrist could himself reach.

---

[83] (1) Sandler, S. A.: The Army and the maladjusted soldier. Mil. Surgeon 96: 89–93, Jan 1945. (2) Sandler, S. A., and Rotman, S. R.: Adjusting the emotionally unstable soldier. Bull. U. S. Army M. Dept. No. 85, Feb 1945, pp. 103–107. (3) Sandler, S. A.: Camptocormia: a functional condition of the back in neurotic soldiers. War Med. 8: 36–45, Jul 1945. (4) Sandler, S. A.: Somnambulism in the Armed Forces. Ment. Hyg. 29: 236–247, Apr 1945.

[84] Kraines, S. H.: The advisor system—prophylactic psychiatry on a mass scale. Ment. Hyg. 27: 592–607, Oct 1943.

[85] Kraines, S. H.: Managing Men: Preventive Psychiatry. Denver, Hirschfeld Press, 1946.

Another type of applied psychiatry to groups commanded the attention of the Neuropsychiatry Branch, Office of The Surgeon General. There was active interest in Major Cohen's project in mental conditioning of new troops at the Ordnance Replacement Training Center, Aberdeen Proving Ground, Maryland. Members of the Surgeon General's Office worked in an advisory capacity and in close cooperation with the experiment being conducted to deliver talks on mental hygiene to new troops. Results seemed to be encouraging. The Training Division of the Services of Supply was contacted and was favorably impressed by the project. As a result of this, the experiments were enlarged to include the Quartermaster Replacement Training Center at Camp Lee, Virginia.

The activities of the Neuropsychiatry Branch were of such scope during the latter half of 1943 that consideration was given to its reorganization into a separate division under the Chief of Professional Service. Prior to the arrival of Lt. Col. (later Brig. Gen.) William C. Menninger, MC, as successor to Colonel Halloran in the capacity of Chief of Neuropsychiatry Branch, Office of The Surgeon General, it was proposed that a division of neuropsychiatry be organized. It is of interest that in this proposal the psychiatric activities in replacement training centers were considered to be a concern of the Psychiatry Branch rather than of the proposed preventive psychiatry branch, which would be interested in the broad application of educational mental hygiene activities by means of publications and other media, maintaining the necessary liaison with other staff agencies of the Army Service Forces. It is of further interest that the latter branch under the reorganization on 1 January 1944 was designated Mental Hygiene Branch. Captain Appel, who had been assigned 24 March 1943 as liaison officer between the Neuropsychiatry Branch and Special Services Division of the Army, became Chief of the Mental Hygiene Branch.

In summarizing the efforts in 1943, to encourage a truly preventive application of psychiatry in training centers, Captain Appel observed:[86]

> An attempt to emphasize the preventive aspect of the training center psychiatrist's duties was made in the Summer of 1943 when a letter was [sent] out over the Surgeon General's signature to each of [the] training center psychiatrists, drawing their attention to the existence of the Information and Education Division—then known as the Special Services Division, informing them of the liaison with this Division which had been made by the Neuropsychiatric Branch of the Surgeon General's Office and instructing the psychiatrists to effect a similar liaison with the Information and Education organization in their own training centers. Then in the Fall of 1943 eight of the training center psychiatrists who had been most active in pursuing preventive measures were called into Washington by the Chief of the Mental Hygiene Branch for conference. Ways and means of pursuing preventive psychiatry were discussed . . . and representatives of the Information and Education Division were brought in to describe their facilities and activities concerning morale and motivation through their orientation and information program. Although this conference stimulated interest and clarified methods to some extent it was evident that the training center psychiatrists were so overburdened with

[86] See footnote 42, p. 186.

the load of screening and disposal that not a great deal of headway in prevention could be expected.

Notwithstanding the high priority given the screening and consultation functions, with necessary concentration on matters of referral, intake, evaluation, and recommendation procedures, the need for methods directed at larger groups had continued to find expression. Major Kraines' adviser system was one of these manifestations. The effort in the various experiments in attitude conditioning at the replacement training centers near Washington was another. At Camp Abbot, late in 1943, still another was started. Weekly meetings were held by each squad leader with his squad. Current events provided the themes, but free discussion was the principal objective. This was considered to be an effective method of bolstering morale because ". . . in the mind of the newly inducted trainee who had suddenly, as it seems to him, had all his freedom restricted, there occurs an unconscious inhibition of thinking and expression which results in the harboring of intense resentment which is directed against the authorities. This program provided a means of ventilating this resentment and prevented dissension or impaired morale." [87]

Psychiatric experience during this period had resulted in the emergence of a new orientation. Although he was still concerned with the individual patient, the psychiatrist had found that he was unable to fulfill the larger mission if he confined himself to working with soldiers as individual problems of diagnosis and treatment. There was a pressing need for the application of his knowledge to the problems which faced the individual, but the major effort would have to be directed toward groups. This function could not be performed except in terms of the requirements of the group, with the understanding and support of its key members. To obtain that support and understanding would be a major task during the following months.

On 3 February 1944, official cognizance was given to the importance of attitude conditioning activities which had been initiated independently at the replacement training centers at Aberdeen Proving Ground, Camp Callan, and North Camp Hood. In a publication [88] issued to stress the importance of informing both enlisted men and officers on matters of sanitation, personal adjustment, and first aid, it was asserted that prevention and control of neuropsychiatric cases was of equal importance to the maintenance of physical health. Training courses were to insure that individuals would have ". . . a knowledge of personal adjustment problems in the Army; relation between emotions, feelings, and body functions; and a healthy viewpoint toward being a soldier." Toward this end the subject and scope of a series of lectures on personal adjustment for enlisted men, and for officers and noncommissioned officers, were outlined. The 1-hour lectures, of 3 and 6 total hours, respectively,

[87] See footnote 55, p. 189.
[88] WD Cir 48, 3 Feb 44.

were to be based upon technical medical bulletins which were then in preparation and were to be given by medical officers, preferably psychiatrists. The complete outlines appeared subsequently as War Department technical bulletins, TB MED 12, 22 February 1944, and TB MED 21, 15 March 1944.

Mental Hygiene Phase

The first of the lecture outlines, published as TB MED 12, included six subjects that were considered to be of importance to noncommissioned and commissioned officers. The subjects were:

Principles: modern conception of personnel adjustment and its importance to the Army officer
Personalities and the adjustment process
Motivation
Specific factors of stress in the Army affecting adjustment
Signs and symptoms, types of breakdowns, and
Measures to maintain mental health of command.

At about the same time, the other series of lecture outlines were subjected to field tests at Army Service Forces Training Centers, Aberdeen Proving Ground, and Fort Belvoir. These lectures were approved early in March for publication and appeared as TB MED 21, with subjects listed as:

Personal adjustment problems in the Army
Emotions and feelings and how to handle them, and
A healthy viewpoint toward being in the service.

Early in the phase of development now under consideration, a meeting was held at North Camp Hood, Texas, by the training center psychiatrists of Army Ground Forces replacement training centers. The purpose of this meeting was for the evaluation of the adviser system which Major Kraines had put into effect a year earlier. The consensus of opinion of the visiting psychiatrists was reached on 17 March 1944 and expressed by one recorder as follows:[89]

> As practiced at TD RTC, North Camp Hood, and as demonstrated and described by Major S. H. Kraines and his staff, the Advisor System delegates mental hygiene and psychiatric responsibilities to selected cadre-men in each company. In actual practice, these men are called on to meet psychiatric situations beyond their capacity and experience. The advisors are essentially untrained individuals who can presumably decide when and what kind of specialized medical care should be made available to the maladjusted trainee. The trainee is encouraged to bring all his problems, psychiatric, social, personal, physical, to his advisor. There is real danger in delegating such serious responsibilities to men of such limited experience and training. Dangerous possibilities lie below the surface of many cases of maladjustment; suicide or other unpredictable complications may arise. Only the psychiatrically minded or trained physician, or a trained allied professional under his supervision, should be burdened with such responsi-

[89] Rpt, Maj O. B. Markey, MC, sub: Conference on advisor system, as observed and studied at North Camp Hood, TDRTC, March 15–18, 1944. SG: 337 (Camp Hood) C.

bility. The proper supervision of a large number of advisors is professionally impossible for a psychiatrist charged with the mental health of a large command, ranging from 7,000 to 50,000 trainees, aside from cadre.

The system highlights and emphasizes facilities for the care of early maladjustments. There is the reasonable possibility that an aggressive method of seeking out the individual who may need help tends to weaken, rather than strengthen him. On the other hand, the soldier who must be resourceful enough to seek and find available psychiatric help, more readily develops self-dependence in the military situation. In that sense, psychiatry should be accessible and available, but not predominant in a training camp.

The system threatens to set up a separate channel of authority in the military family. The advisors are appointed by the company commander, but they are professionally responsible to the psychiatrist. Their reports necessarily bring in problems involving disciplinary relationships with the normal chain of command, from corporal to company commander. The latter, whose interest in the total health and adjustment of every member of his company is a command function, may be displaced by the psychiatrist, though this may not be the intention.

The aims of such a system are the same as those followed in the mental hygiene services offered in other RTC's. The method is different. Advantages accruing to the Advisor System, such as increasing attention to the help that trainees can be given; lectures to officer, cadre and trainees on military mental hygiene; cooperation with allied agencies (ARC, Orientation Officer, Hospital and Infirmary Surgeons) are indigenous to every adequate program of prophylactic psychiatry. No one "system" is necessary, for every local system has localized needs and every properly trained psychiatrist should be encouraged to use his own methods. In that case, he will be able to favorably exploit many of the sound practices offered by the Advisor System in operation at North Camp Hood, TD RTC.

Of the comments made, there were two which were considered of most serious character: the effect of placing too much professional responsibility in the hands of individuals ill-prepared to assume it, and the setting up of a hierarchy of a professional-type functionally separate from the traditional command structure of the Army. The valuable features of the program were recognized to be: the improved dissemination of information to cadre which would be of assistance in the exercise of leadership and training functions, the generalized awareness of the wisdom and usefulness of early attention to adjustment problems, and effective cooperative effort with other staff agencies of command.

Major Kraines later attempted, unsuccessfully, to modify his system at North Camp Hood to conform to the usual command channels by using the platoon sergeants as advisers. However, at other camps modifications of the adviser systems were adopted with success.

Although the conference at North Camp Hood had failed to win complete acceptance of the entire adviser system, it had stimulated interest in the problem of prevention. The value of the psychiatrist's advisory function to command was more clearly seen in this perspective. Major Hunt reported increased interest:[90] "Previous to this time reports had been prepared at in-

[90] See footnote 52, p. 188.

tervals of several months when there was a slack period. In May, this was changed to regular monthly reports . . . to bring to the attention of the commanding general situations which are affecting the morale and mental health of the command and which can sometimes be corrected."

Recognition of the mental hygiene consultation service as an important source of information was extended when training center psychiatrists were requested during April 1944 to formulate opinions regarding the factors contributing to the incidence of psychiatric disorders in basic training camps. Colonel Menninger directed letters of inquiry to psychiatrists in 14 Army Ground Forces and 7 Army Service Forces training camps. The replies were extracted and consolidated in a report to Mr. Harvey H. Bundy, Special Assistant to the Secretary of War, in June 1944.[91] Comments were made summarizing the psychiatrists' views in matters pertaining to: leadership, psychiatric understanding required by officers and cadre, instructors, comments on training methods, infiltration courses and rifle training, relation of training to the development of psychoneurosis, classification and assignment, orientation problems of labor battalions, adviser system, and miscellaneous suggestions.

In this report the matter of leadership as it affected morale and the importance of a well-informed company commander were emphasized. To the psychiatrist the company structure resembled the family unit in the manner perceived by soldiers:[92]

> There is frequent reference to the importance of the commissioned officer as he is related to morale and to the successful training of the soldier, with a direct relationship between these and the neuropsychiatric casualties. There is wide recognition by the psychiatrists of the similarity of the company, and a family and the soldier's response depends on the father-substitute: the unit commander. . . .
>
> One of the psychiatrists strongly recommended the preparation of a training bulletin on the subject of leadership, to be issued and placed in the hands of all officers. He summarized the contents as follows:
>
> "A concise bulletin describing the psychiatric aspects of group leadership should be prepared. A few important concepts, such as the following, should be considered (in a language understandable to everyone):
>
> "*a*. The officer-soldier relationship as a duplication of the parent-child relationship.
>
> "*b*. The affectional interest of the parent person must be balanced against the authoritative and disciplinary aspect.
>
> "*c*. The magical power of the leader in affording protection and inspiring a feeling of confidence.
>
> "*d*. The need for inspiring troops with enthusiasm and motivation in getting the job done."

The newly authorized mental hygiene lectures might have been expected to begin to correct some of the deficiencies in the area of leadership. However, there was considerable variation between commands in the utilization of the

---

[91] Memo, Col W. C. Menninger to Mr. Harvey H. Bundy, 7 Jun 44, sub: Comments and suggestions regarding psychiatric problems occurring in basic training camps. HD: 730 Neuropsychiatry.
[92] Ibid.

lectures. In some instances, both series were being given; in others, no lecture was given. It was the consensus that too many officers failed to realize their importance—the necessity for stressing their personal and paternal relationship to their men.

In addition to the factors inherent in the exercise of leadership in training (amount of the commander's understanding of the individual soldier; degree of emphasis on the use of fear of being killed, fear of punishment, or competitiveness as motivating forces), there were other factors which were considered to produce psychoneurotic symptoms:

1. Difference in the mental capacities of the trainees who are all subjected to the same course at the same speed;

2. Difference in the physical condition among trainees of different ages;

3. Insufficient consideration that training is the trainee's first military experience, requiring much readjustment, all to be accomplished in a unit of temporary structure; and

4. A lack of flexibility in arranging special opportunities for training and disposition.

Colonel Menninger went on to comment that: [93]

> . . . . In addition, although not mentioned by the reports, an important psychological hurdle in training is inherent in the program: to learn to kill and avoid being killed. This ideology must be closely linked with motivation and tied into the mental hygiene presentations and the orientation lectures.
>
> It is the consensus of opinion of most of the psychiatrists that it is the total pressure of garrison life which acts as the precipitating factor of emotional instability rather than any specific feature of basic training, as such. There is the unanimous opinion, or nearly so, that "we do increase the already existing psychoneurotic tendencies in certain individuals." That we do produce psychoneurotic responses seems certain, although it is probable that the great majority of these occur in predisposed individuals.

The year 1944 saw articles published by various members of the staff of the Neuropsychiatry Division, Office of The Surgeon General, reflecting a strong trend toward prevention as the main aim of military psychiatry. Colonel Farrell [94] in a paper presented before the Iowa State Medical Society in April, indicated the importance of the training period as demonstrating the need for the development of preventive methods. Observing that the incidence of neuroses among trainees in training centers is highest during the third or fourth week of training, he pointed to the recent progress in providing for the mental hygiene lecture series. In a paper read in May at the Centenary Meeting of the American Psychiatric Association in Philadelphia, Col. M. J. Farrell, MC, and Major Appel [95] indicated that preventive measures were being pursued by

---

[93] See footnote 91, p. 206.

[94] Farrell, M. J.: Developments in military neuropsychiatry. J. Iowa M. Soc. 34: 387–391, Sep 1944.

[95] Farrell, M. J., and Appel, J. W.: Current trends in military neuropsychiatry. Am. J. Psychiat. 101: 12–19, Jul 1944.

psychiatrists in three different areas: education, motivation, and environment as an adviser to commanders with regard to environmental factors of significance to mental health. These three areas for preventive activity were defined in a subsequent paper by Major Appel and Capt. (later Maj.) D. W. Hilger, MC.[96] As used by these authors, education meant ". . . what is usually thought of as mental hygiene and actually amounts to the attempt to teach military personnel what has been learned about human nature from the study of mental disease. The premise is that this knowledge can be used by individuals for the maintenance of their own mental health and by commanders in their problems of leadership and morale."

Although the mental hygiene lectures were the foremost example of the educational endeavor, other measures were being used including the informal personal orientation of commanders by psychiatrists and the use of various printed media in acquainting the military with psychiatric principles. In the field of motivation, the psychiatrist collaborated with the information and education officer who was charged with responsibility in this operational area. It was both as a collaborator and adviser that the psychiatrist was active in the modification of environmental factors. Here the psychiatrist's viewpoint was added to that of the personnel officer, training officer, legal officer, chaplain, recreation officer, and others who were concerned with the morale of troops. Final responsibility for the factors crucial to mental health was inevitably that of command. As an adviser, the psychiatrist could influence these factors indirectly by contributing toward the commander's understanding of significant environmental stresses. The role and function of the psychiatrist as an officer of prevention was becoming clearer and better defined in the training situation.

There was a new activity of certain replacement training center psychiatrists which was briefly referred to by Colonel Menninger in an address before the American Psychoanalytic Association in May 1944.[97] This was referred to as the salvage of psychoneurotic patients, either for further Army service or for return to effective civilian life. In the frame of reference that considers a complete preventive program to include rehabilitation and disability limitation, this salvage of men was patently a comprehensive part of a developing preventive psychiatry. Colonel Farrell[98] reported later in the year that the developmental training units, as they were termed, had been successful in the rehabilitation of neurotic patients outside of the hospital with a substantial number performing satisfactory duty after such training.

On 22 January 1944, Colonel Menninger had accompanied Generals Kirk and Hillman to a preliminary meeting concerning the proposed retraining of

[96] Appel, J. W., and Hilger, D. W.: Morale and preventive psychiatry. Bull. Menninger Clin. 8: 150–152, Sep 1944.

[97] Menninger, W. C.: Psychiatry and the Army. Psychiatry 7: 175–181, May 1944.

[98] Farrell, M. J.: Psychiatry in training centers. Bull. Menninger Clin. 8: 133–135, Sep 1944.

salvable psychoneurotic soldiers. This meeting was attended by representatives of the Military Personnel Division, Office of The Adjutant General; the Training Division, Army Service Forces; and the Office of The Surgeon General. At successive sessions, plans were formulated for the development of three pilot retraining centers at the Engineer Replacement Training Center, Fort Belvoir (Va.), the Quartermaster Replacement Training Center, Camp Lee (Va.), and the Ordnance Replacement Training Center, Aberdeen Proving Ground (Md.). It was decided that Camp Lee would be the reception center for all incoming specially selected salvable troops to be retrained from the Second, Third, Fourth, and Fifth Service Commands. It was further decided that the initial distribution of these troops would be carried out by a special group of officers made up of 1 commanding officer, 2 classification officers, 2 neuropsychiatrists, 2 personnel consultant officers, and a special cadre of enlisted men to assist them in the examination and special assignment of these troops. It was anticipated that this initial classification and allocation would take about 2 weeks. The entire retraining program was to be set up within the existing organization of the replacement training centers selected, to which additional medical-officer and other personnel were added. The initial training program was to extend over a period of 2 months. Those soldiers benefiting by this training were to be assigned to specified duties within the Army; those failing were to be separated from the service.

In March 1944 it was considered that the experimental program regarding the retraining of selected psychoneurotic soldiers was progressing in a very satisfactory manner. On 15 February, Maj. (later Lt. Col.) William H. Everts, MC, visited the three replacement training centers where the special retraining and vocational centers had been established. A battalion of 440 men had been set up at each center, under the command of selected personnel. Specially assigned neuropsychiatrists, under the supervision of the replacement training center neuropsychiatrist, had been assigned to oversee the neuropsychiatric aspects. Men assigned to these training battalions, including officers and enlisted men, were enthusiastic and the commanding generals of the replacement training centers, being personally interested in the experiment, rendered every cooperation. In each instance, the commanding officer of the training battalion was directly responsible to the commanding general.[99]

After the war, General Menninger [100] stated that of the entire experimental group, 70 percent were made available for limited assignment. An account of the experiment at Fort Belvoir was reported by Capt. (later Maj.) Stanley L. Olinick, MC, and 1st Lt. (later Capt.) Maurice R. Friend, MC, who referred to

[99] Semimonthly Rpts, Neuropsychiatry Consultants Div SGO, 1 Jan–31 Jan 1944; 16 Feb–29 Feb 1944. HD.

[100] See footnote 2, p. 171.

the entire process as indirect group therapy. Of those who benefited under the regimen at Fort Belvoir, Captain Olinick and Lieutenant Friend concluded:[101]

> The soldiers who benefited in this process need not have developed insight into their problems in order to derive that benefit. Nor are they to be considered as literally having "toughed it out . . . learned to live with their symptoms." Rather, what happened was that the unresolved emotional drives responsible for the previous maladjustments were tested against a firm but tolerant and individualized reality; the drives were then reintegrated, sublimated, remobilized on a higher level.
>
> It must be emphasized also, that this reintegration did not take place spontaneously, in response to simple environmental manipulations. Those who have worked with the men are confident that suitable work assignments, even in conjunction with placement close to their homes would not alone have been sufficient, except in a very few instances. What was essential to the reintegrative process was the experience of planned group living.

Colonel Cruvant[102] who suggested that this treatment program might well be called "milieu therapy," stated that it appeared in 1941 that such a program would be effective with "situationally conditioned, emotionally maladjusted or physically sub-standard soldiers" as a result of his own experiences with the special training units. The results of the work done in these "Developmental Training Units (Experimental)" seemed to confirm such hopeful anticipation.[103] However, the application of these units was never approved for general use because of the difficulty in making special assignments after training and the cost in terms of trainer personnel.

A brief résumé of the administrative efforts to increase the effectiveness of military psychiatry up to and including this period was published in 1944 by Colonel Menninger.[104] Efforts were being increased to potentiate the effectiveness of psychiatry by the assignment and utilization of clinical psychologists and psychiatric social workers. During the latter part of April 1944, a directive was submitted for publication outlining the duties of clinical psychologists.[105] At about the same time, Machine Records Division, Office of The Adjutant General, was requested to determine the number of psychiatric social workers in the Army. A directive pertaining to the use of these professional workers, then in preparation, appeared as War Department Circular 295, 31 July 1944, which outlined the functions of psychiatric social workers and designated them as critically needed specialists.

This amplified the previous authoritative description of the duties of psychiatric social workers (Specification Serial Number 263) which had been

---

[101] Olinick, S. L., and Friend, M. R.: Indirect group therapy of psychoneurotic soldiers. Psychiatry 8: 147-153, May 1945.

[102] Cruvant, B. A.: Pragmatic psychotherapy in military training centers. Am. J. Psychiat. 103: 622-629, Mar 1947.

[103] Senerchia, F. F., Jr.: Experimental unit for the retraining of psychoneurotic soldiers. A. Research Nerv. & Ment. Dis., Proc. (1944) 25: 87-93, 1946.

[104] Menninger, W. C.: Administrative aspects of neuropsychiatry in the Army. Bull. Menninger Clin. 8: 129-132, Sep 1944.

[105] This was published as WD Cir 270, 1 Jul 44.

issued in 1943. It also underlined the importance of these workers to the psychiatric program. The rapidity of expansion of psychiatric facilities had not allowed for the social worker requirements to be met, notwithstanding the efforts which had been made to obtain the necessary numbers by means of classification procedures and the recruiting of women for the positions of psychiatric social worker and psychiatric assistant. All of these developments had been aided by the active interest and advice of Mrs. Elizabeth H. Ross, the secretary of the War Office of Psychiatric Social Work, a joint undertaking of the American Association of Psychiatric Social Workers and the National Committee for Mental Hygiene.

Increased demands were made upon the profession of psychiatric social work by the rehabilitation program for psychiatric patients at Army hospitals during the last half of 1944. As a result of a conference between the Chief, Neuropsychiatry Division, Office of The Surgeon General, and American Red Cross representatives, a large number of Red Cross social work personnel were approved for assignment to convalescent hospitals for the needs of psychiatric patients.

At a time when social workers from this source were already at a premium, a new, heavy request was thus made for such personnel.[106] It was plain that renewed effort would be necessary to staff psychiatric social workers from military resources. To facilitate the development of this program, Mrs. Ross was appointed as consultant to the Neuropsychiatry Division on 21 December 1944. A similar development in clinical psychology had been earlier established on 8 June when Lt. Col. Morton Seidenfeld, MSC, Office of The Adjutant General, was appointed as liaison between the Classification Branch, Office of The Adjutant General, and the Neuropsychiatry Division, Office of The Surgeon General, for the purpose of selection, appointment, and supervision of clinical psychologists.[107]

More effort was yet to be expended in bringing the clinical psychologist and military social workers to the mental hygiene consultation service. A conference to this end was held on 10 November by Colonel Menninger and Major Guttmacher with representatives of the Classification Branch, Office of The Adjutant General, on the problems relating to utilization of clinical psychologists in mental hygiene consultation services. The need for clinical psychologists and psychiatric social workers was expressed by many psychiatrists at the time of the conference held at Aberdeen Proving Ground early in 1945.

The problem of evaluating the effectiveness of the lecture program as an instrument of the mental hygiene approach to problems of morale was a difficult one and objective means were never satisfactorily developed. A for-

[106] O'Keefe, D. E.: Development of military psychiatric social work. HD: 700.7.
[107] Semimonthly Rpt, Neuropsychiatry Consultants Div SGO, 14–31 Dec 1944. HD: 024.

mal examination following the lecture series was not considered to be an appropriate method. It was pointed out that the value of the lectures was expected to be reflected in the mental health, morale, and operational effectiveness of units. However, statistical analysis of certain data might be of help in approaching the problem objectively. It was suggested that various rates might be reported as was customary with other medical statistics; i. e., rates based upon monthly recordings expressed in terms of the annual rate per 1,000 strength. It was believed that unit AWOL, sick call, company punishment, court-martial, venereal disease, discharges under the provisions of section VIII, AR 615–360, neuropsychiatric, and hospital admission rates might each provide useful indexes of the mental health of the unit. Interest in exploring this possibility further was expressed by the Neuropsychiatry Division: "If it seems advisable to adopt a simple workable reporting system of these data this office would be very interested in lending any assistance desired in devising the reporting forms and setting up criteria of evaluation so that the data might be correlated with other existing data related to mental health." [108] No general reporting system for such data was developed and the utilization of these indexes was to be a matter of independent action in the field.

Certain objections to the lecture series were voiced soon after publication at staff level in Headquarters, Army Service Forces. It was considered that the lectures were in an area believed to be the responsibility of the morale services division and the orientation officer. A part of the difficulty, aside from the acknowledged overlapping of interest with morale services, was in understanding the ambiguous phrases personal adjustment and personnel adjustment. These had been selected after objections had been raised to the use of mental hygiene. It was agreed that although the subject material was presented in layman terms, the objective of mental health made it a technical subject which was properly the interest of the psychiatrist. Other objections were raised regarding: the inclusion of some "strictly orientation material," "the statement as to the inadvisability of the indoctrination of hate," and the sequence of the lectures as presented.[109]

Presenting the lecture series, even where the training program had been modified to include them, was not without difficulty. At Camp Roberts, California, Field Artillery Replacement Training Center, the personnel adjustment lectures were given as 2-hour lectures twice weekly to new groups every 2 weeks, although it had been suggested that a minimum of 6 hours be used for the lectures. Variations in educational background (6th grade to college graduate), in age, and in Army experience and ratings made presentation difficult.

[108] Memo, Lt Col W. C. Menninger, MC, to CG AGF, 29 Feb 44, sub: Index of mental health. SG: 353.–1.

[109] Memo, Col W. C. Menninger, MC, to Chief Prof Serv SGO, 5 Jul 44, sub: Report of conference on consideration of TB Meds 12 and 21. HD: 730 Neuropsychiatry.

The psychiatrist reported: "There was criticism that the instruction was above the level of the group; that some 40 words were used that could not be found in the average desk dictionary." Attempts which were made to simplify the nomenclature and to keep within the educational mean only served to reduce the scope of the material.[110]

The psychiatrist at Camp Wolters observed that although it was too early to evaluate the effectiveness of the lecture program, the first three battalions given the instruction had had comparatively fewer maladjustments. He reported that lectures to trainees had not been instituted until September, although the lectures to the cadre had been started in June. In both instances, the amount of time was less than that prescribed: two 1-hour lectures per series.[111]

The changing character of the trainee population of some camps from inductees to overseas returnees was introducing a new problem: "As you know the number of redeployed troops is increasing progressively. I feel that our material for personal adjustment lectures in keeping with WD [Cir] 48, 1944 is inadequate. TB MED 21 of 1944 gives us some help but does not seem to get the job done as far as redeployed troops are concerned." [112]

On 15 September 1944, Major Guttmacher reported for duty in the Office of The Surgeon General. His projected primary duties were to be the supervision and coordination of the work done by the psychiatrists in the mental hygiene consultation services of the training camps, numbering about 40.[113] One of his immediate duties was the assumption of responsibility for the preparations which had been under way for a few months for a meeting which would bring together all training center psychiatrists for an exchange of experiences gained in the nearly 3 years since the initial effort at Fort Monmouth. This meeting was considered necessary to take account of the demands being made upon psychiatry, the measures instituted to meet the needs of military service, the changing perspectives of psychiatric practice in the Army, and the requirements of the training center psychiatrists to accomplish their part of the military mission.

To obtain some advance information on these matters, Major Guttmacher addressed a questionnaire to the chiefs of mental hygiene consultation services, receiving replies early in December.[114] Of 21 camps reported, the largest from the standpoint of numbers of trainees served was Camp Blanding, Florida, with approximately 44,000. The smallest was at North Camp Hood with less than 3,000. Eight psychiatrists served training commands with under 10,000

[110] See footnote 52, p. 189.

[111] See footnote 52, p. 188.

[112] Ltr, Capt C. J. Kurth, ASFTC, Camp Crowder, Mo., to Maj M. S. Guttmacher, SGO, 2 Jun 45. HD: 730 Neuropsychiatry.

[113] Memo, Col W. C. Menninger, MC, to Maj Gen N. T. Kirk, SG, 9 Aug 44, sub: Projects under way in the Division of Neuropsychiatry. HD: 730.

[114] The replies from chiefs of mental hygiene consultation services to questionnaire sent by Major Guttmacher are filed in HD: 730 Neuropsychiatry.

trainees; there were 7 replacement training centers with between 10,000 and 20,000 trainees; and 5 had 20,000 trainees and above; 1 psychiatrist did not report the trainee strength at his camp. With regard to anticipated gains or losses in the new year, 5 expected the trainee strength to diminish, 5 expected an increase, 8 foresaw no change, 1 reported his replacement training center would be closed, and 2 camps did not report with respect to this question.

In reply to a question "Do you do all the outpatient psychiatry for the trainees?" 19 replied in the affirmative, 2 of these indicating that emergencies were usually seen at the hospital. One shared the work about equally with the hospital outpatient clinic (Camp Plauche) and another considered that 20 percent of the trainee work was done at the hospital outpatient clinic (Camp Croft). The training cadre was also served by consultation services except at the Camp Plauche installation. The cadre varied proportionately with the size of the trainee strength from 600 to 7,250.

Most mental hygiene consultation services served no units or installations other than trainees and cadre, but a few also provided consultation service to service schools, separate battalions, hospitals, and units temporarily assigned to the post.

An average monthly caseload varied with the numbers being served from between 800 and 900 at Camp Blanding, Florida, to about 60 at Camp Roberts, California. All reported seeing old cases except the psychiatrist at Camp Plauche, Louisiana, who saw none. The psychiatrists at Fort Leonard Wood, Missouri; Camp Lee, Virginia; Mississippi Ordnance Plant, Flora, Mississippi; and North Camp Hood, Texas, were the only ones who reported seeing more old cases than new.

Only at Camp Blanding and Fort Lewis had a second psychiatrist been assigned; in addition, a psychiatrist was loaned to the consultation service at Fort Devens, Massachusetts, by the post Army Service Forces Training Center. Seven had no commissioned clinical psychologist or personnel consultant, but two such officers were assigned to Fort Devens and Camp Blanding. Red Cross workers were assigned to only 7 mental hygiene consultation services. Of those which had no Red Cross worker, 6 considered such an addition desirable, but 8 did not. Some of the latter qualified their answers by stating that the addition would be favorably received if the person were a trained psychiatric social worker; others did not consider a full-time assignment necessary because of adequate liaison provided by the Red Cross workers in the hospital or post; and another had a qualified social worker as an enlisted man which met the need in his situation.

Increases in staff were considered immediately desirable by 14 of the psychiatrists. Seven of these believed an additional psychiatrist was needed; 7 thought a commissioned psychologist was required, sometimes in addition to the additional psychiatrist and sometimes in lieu of another medical officer.

Six psychiatrists felt the need for enlisted personnel in psychology and social work.

Criteria for staffing the mental hygiene consultation services had not yet been established, but in his reply Major August (Camp Blanding, Fla.) recommended that there be 1 psychiatrist per 11,000 trainees, 1 commissioned psychologist per 15,000 trainees, and 1 enlisted personnel consultant per 3,000 trainees. He also recommended that an appointment clerk, file clerk, stenographers, and clerk typists be provided.

The mission of the mental hygiene consultation service was formulated in December by 1 psychiatrist as follows: [115]

> The difficulty, and frequently the impossibility, of attaining significant results through individual therapy due to the limitations of time and setting is well recognized. If important therapy is to be accomplished it must be of the prophylactic variety performed on a mass scale. This has been more and more recognized and the psychiatrist has been called upon more and more to supply this need through lectures on personal adjustment in the army given to all trainees, cadre and officers.
>
> If a man appreciates well enough why we fight, and why, specifically, he fights, and if he believes in the rightness of our cause, he is not likely to become a psychiatric casualty at a replacement training center. It is to instill and to develop such an attitude that the consultation service has devoted itself.

Patently, by this time, the mission of the psychiatrist and the mental hygiene consultation service included the promotion of mental health. How this objective was accomplished was described by a training center commander during the same month in the following paragraphs: [116]

> It would be very presumptuous for me to tell you Training Center Commanders how to organize or operate the Consultation Branch of your S–1 Section or the duties you assign to the neuropsychiatrist in that section. Particularly is this true since my organization is based largely on what I learned from observing the operations of these sections in other training centers which I visited. I shall confine myself to covering in a few words some of the good work accomplished by an exceptionally well qualified psychiatric officer.
>
> First, he is never referred to by his formal designation. Doubtless many men do not even know that he is a medical officer. He assumes the role of advisor and helper toward both the patients who may come under his observation and the battery commanders whose problem children they are. He has been able to train the classification personnel who interview incoming trainees so that they are able to spot men who may possibly have personal problems needing the attention of the battery commander and the psychiatric officer; that is, he discovers those who may give trouble *before* trouble arises. Battery commanders are given their names in confidence so they may be carefully observed from the beginning. A check-up over a period of months shows that probably 95% of those who are later before the psychiatric officer were spotted at this first interview by the classification section.
>
> Second, he has gained the complete confidence of the battery and battalion commanders and they seek his advice and help in handling difficult cases. He has also

[115] See footnote 62, p. 191.

[116] Exhibit B to Annual Rpt, Neuropsychiatry Consultants Div SGO, FY 1945. HD.

interested the first sergeants who are usually good judges of men. Incidentally, he learns what noncommissioned officers do not know how to handle men and they are weeded out if proper instruction cannot change them. By comparisons between batteries of the number of men who have been cured of their fancied ills, he has secured a competitive spirit between the battery commanders. In other words, he has built up in these battery commanders a very strong interest in salvaging misfit personnel and building up in them a healthy spirit and frame of mind so that, instead of being sorry for themselves and wishing they were out of the Army, they complete their training with a new pride and self-confidence and with a desire to get out and take their part in winning the war.

Third, he works very closely with the summary court officer and the judge advocate to determine the most appropriate action to be taken in cases where offenses have been committed. I also use him to advise me as to the appropriateness of sentences adjudged by courts. This may take the form of a conference between the JA, psychiatric officer, and myself.

In short, this psychiatric officer has a healthy view toward his duties. He has established very friendly relations with all battery commanders. They believe in and trust his decisions and work together to solve the personal adjustment problems which arise. He had done this with a minimum of overhead or red tape.

Two factors had led to the selection of Aberdeen Proving Ground for the meeting of training center psychiatrists, one of which was its proximity to Washington, D. C. The other reason was "because of the fact that its consultation service is one of the most outstanding in the Army."[117] The 40 psychiatrists which were to be assembled were a small but significant fraction of the fifteen hundred then on duty with the Army. The first general meeting of all training center psychiatrists was held on 8, 9, and 10 January 1945 at the Ordnance Training Center, Aberdeen Proving Ground, Maryland. In addition to representatives of the Neuropsychiatry Consultants Division of the Surgeon General's Office, other interested agencies were represented. These included representatives of the Information and Education Division, Army Service Forces; a representative of the Replacement and School Command, Army Ground Forces; representatives of the Adjutant General's Office; and representatives of the Office of the Director of Military Training, Army Service Forces. The conference provided the first[118] opportunity for all training center psychiatrists to meet as a group, exchange experiences, and receive orientation from staff officials regarding the reaction at headquarters level to the methods being utilized toward solution of problems which were of mutual concern.

Subjects presented for discussion were: the problem of sick call; motivation and orientation; returnees and redeployment; disqualifying neuropsychiatric standards for overseas service; military forensic psychiatry and legal responsibility; the role of the consultation service in training; the educational functions of the consultation service; the Negro trainee; the roles of the personnel consultant, Red Cross social worker, and psychiatric social worker in the con-

[117] Ltr, SG to CG ASFTC, Aberdeen, Md., 13 Dec 44, sub: Meeting of psychiatrists. HD: 730 Neuropsychiatry.

[118] Two earlier conferences of training center psychiatrists had been held, but this was the first meeting at which all mental hygiene consultation services were intended to be represented.

sultation service; relationship of the consultation service to other medical officers; and the use of testing agents. Discussion was freely engaged in and conclusions of a diverse character were reached which were important to psychiatric applications in the military situation.

Of the several subjects discussed, some were of particular interest to the training center psychiatrists alone; others were of general psychiatric interest. Recurrent throughout the discussion was evidence of crystallizing opinion as to the role and function of the training center psychiatrist, his relationship to command, his liaison with other members of the training command staff, his relationship with other medical officers and units, his own contribution to the individual soldier and to groups, and the utilization of psychologists and social workers in joint effort. The significance of the services performed by the training center psychiatrists was expressed by Brig. Gen. Herbert J. Lawes, Commanding General of the Army Service Forces Training Center at Aberdeen Proving Ground; Brig. Gen. Arthur Trudeau, Assistant Director of Military Training, Army Service Forces; and Colonel Menninger. The importance of a focus upon the needs of the group was emphasized at the outset of the meeting. In the same vein, in deciding upon a priority among the various functions of the mental hygiene consultation service, it was considered that prevention should be first and foremost. On these points, Generals Lawes and Trudeau and Colonel Menninger were clear.

In his prepared lecture, Maj. Gen. Ralph M. Pennell, Commanding General, Field Artillery Replacement Training Center, Fort Sill, Oklahoma, made the following pertinent remarks: [119]

> In the *first* place, medical and psychological personnel must be ever conscious of the fact that in the Army it is as important to think of the morale of the men of the total command as it is of the welfare of the particular individual referred because of personal difficulty. This should be remembered when making recommendations for individual men. Perhaps this is suggesting that medical and psychological personnel apply their skills in an unusual way. But as staff officers in the Army, it should be remembered that the primary mission of the Army is the building, training, and deployment of our Armed Forces in such a way as to defeat the national enemies and safeguard the nation. The Army insists that all possible be done for those who stumble or fall by the wayside in the dislocations which accompany rapid mobilization—but not at the expense of the primary mission.
>
> In the *second* place, in dealing with unadjusted personnel, the impression should not be conveyed too readily to them that there is an easy way out of the Army by admitting to personality difficulties. I have seen certain questionnaires used by Consultation Services which make me wonder whether we are trying to cure the soldier or give him an opportunity to put down in writing all of his troubles—real or imagined—and so get out of the Army. The latter is an easy job for him to accomplish if our questionnaires suggest a variety of troubles he might report.
>
> In the *third* place, Consultation Service officers have an opportunity in their various interviews of men to obtain an insight into and an understanding of many general camp

[119] See footnote 116, p. 215.

situations. I am not suggesting that these officers violate any of their professional obligations to specific men by making public, material which is given to them in confidence. I am saying, however, that when matters of sufficient general importance are revealed that affect the total command, they should be brought to the attention of the responsible personnel. In this way, remedial action can be accomplished.

In the *fourth* place, Consultation Service personnel should consider the continuous education and training of commissioned and noncommissioned training officers as a part of their mission. It is sometimes possible through such training to prevent occurrence of maladjustment among the men. In a command, where the officers and noncommissioned officers are untutored, many more problems may be generated than can be handled by the limited number of officers available in the Consultation Service.

In the discussion following General Pennell's paper, the gradual shift in emphasis from the treatment of the individual toward prevention was recapitulated. The experiences of combat psychiatrists had contributed an understanding of the importance of motivation, leadership, and proper assignment to be nearly equivalent with mental stability in the matter of preserving mental health. The psychiatrist had been afforded the opportunity to become effective in prevention through his position as adviser to staff officers. In his report of the conference, Major Guttmacher gave the chief conclusions reached during the conference as follows: [120]

Motivation plays a vital role in determining mental health. Insufficient realization by the average soldier of the degree to which he and his family were threatened by the enemy has been a basic cause for the high incidence of psychiatric disorders among military personnel. Attempts to develop healthy attitudes toward the war have been relatively ineffective. It is the responsibility of the psychiatrist to point out the medical importance of this problem and lend full support to the I. & E. [Information and Education] Division and the command in its solution.

Whereas the treatment and disposition of individuals suffering from psychiatric disorders must be continued, it is evident that the chief military value of a training center psychiatrist can be in the prevention of psychiatric disorders. The factors which determine mental health of military personnel such as motivation, leadership, training, job classification and assignment are functions of command. In these matters the psychiatrist can function only as an advisor to the command. In order to carry out this mission, it would be necessary for him to act as a staff officer. At the present time, limitation of assisting personnel barely permits the psychiatrist time to handle his heavy case load of treatment and disposition. Assumption of duties in regard to prevention must be gradual and depend upon the feasibility of adding further trained personnel to the consultation staff.

These two main points had been expressed by Major Kraines [121] shortly after the meeting, at which time he stated his belief that half of the training center psychiatrists' time should be spent in the field studying the attitudes of officers and men; informally educating officers and noncommissioned officers; discussing with officers the development of group spirit and the fostering of an

[120] Rpt, Maj M. S. Guttmacher, sub: Meeting of consultation service psychiatrists held at Aberdeen Proving Grounds, January 8–10, 1945. SG: 337 (Aberdeen Pvg Gd)N, 1945.

[121] Ltr, Maj S. H. Kraines, MC, to Maj M. S. Guttmacher, SGO, 16 Jan 45. HD: 730 Neuropsychiatry.

aggressive attitude; advising officers in the handling of incorrigibles in their units; and seeing sick call reporters at the unit dispensaries. From this activity, then, a basis would be laid for recommending remedial measures. The role of the psychiatrist in the prevention of psychiatric disorders was published in War Department Circular 81, 13 March 1945. The scope of his field of activity was stated in a paragraph on utilization and prevention. After clearly stating that the responsibility for preventive psychiatry was one for command; and, further, that the majority of factors which determine the mental health of personnel were responsive to command action, the text of the circular continued:

> . . . . The psychiatrist acts as adviser to the command. In training centers or in Army divisions as a member of the division surgeon's staff, he is to be regarded as having a staff function in advising the command on policies and procedures which affect mental health and morale. In certain divisions and in some commands there appear to be excellent morale and splendid accomplishment which are in part due to an ideal relationship between the psychiatrist, the surgeon, and the responsible officers of the commander. It is the responsibility of the psychiatrist to be alert to the situational factors which are precipitating psychiatric disorders and to recommend the measures necessary to alleviate or remove these factors. He should survey the training program from a psychiatric viewpoint, advise concerning schedules, the method of conditioning troops to battle situations, and adjustment to extremes in climate. He should pay close attention to such matters as the furlough policy and the handling of AWOL cases. Through collaboration with the personnel classification officer he should be able to prevent many psychiatric disorders by bringing a medical viewpoint to bear in the job assignment problems. He should be alert to evidence that troops are approaching the limit of their endurance and in need of rest. Equally, he should be alert to untoward effect of boredom from excessive idleness. He should advise other agencies which are important to the morale and mental health of the troops: the information and education officer, the chaplain, the Red Cross, and the special services officer.

Preventive Psychiatry Phase

The continuing demands of military circumstances had forced adoption of new policies with regard to utilization of manpower. As new policies were instituted, new methods were developed; as the new methods were applied, new problems were faced and solutions sought; as new solutions were proffered, new military roles were defined. Commanders, confronted with the difficult problems attendant on the requirements of a tremendous mobilization of military manpower, learned how to utilize effectively the skills of these three professions in a manner and to a degree never before realized in military psychiatry. As commanders found new significance and meaning in their relationship to psychiatry, psychiatrists also found new responsibility and perspective of considerable importance as a result of the wartime experience.

One of the important developments in military psychiatry came about as a result of an increased awareness that the needs of the group were of as great a concern for the military psychiatrist as were the needs of the individual patient. Preventive psychiatry had come to be the designation for that branch

of military psychiatry which was concerned with the evaluation of the attitudes of men and the effects of environmental stresses and supports at play upon them. It was concerned with providing counsel and advice on measures required in the preventive effort, together with the reasons why particular measures were indicated. This was military psychiatry on a firm, positive basis. It made its contribution to the military community in constructive terms. It helped individuals to find a measure of success and satisfaction in an occupation that was for many soldiers reluctantly assumed and difficult. It helped commanders and staff officers in the appraisal of men, the selection of leaders, and the training of individuals of widely differing qualities and experience. It assisted in the maintenance of morale and promotion of mental health and treated individuals before serious reaction patterns were firmly established. It was a social psychiatry far removed from the earlier practice of rigidly excluding and eliminating any who might potentially have an emotional disorder. It was a psychiatry which took serious note of its responsibilities to the individual patient and to the community of which both the military psychiatrist and the individual soldier were members. This was a departure from the traditional role of the civilian psychiatrist; it was a definite advance from the traditional application of psychiatry in the military service. To indicate this broad scope, the term preventive psychiatry seemed most appropriate to many of those who were engaged in these activities.

Publication in June 1945 of the technical bulletin, TB MED 156, on the consultation service, provided an official reference to the function, organization, and procedure in training center mental hygiene clinics. These units, which prior to World War II had no military counterpart, were now firmly established as important resources to command. In internal organization, they were similar to civilian community mental hygiene clinics; in external relationships they were operated as the local mental hygiene unit for a circumscribed community of military personnel. Thus had been overcome a principal obstacle in the development of preventive psychiatry: the lack of a functional unit for bringing psychiatrists into intimate relationship with the problems of trainees and training cadre. Now psychiatry in World War II had produced in the training setting an organization which would facilitate the broader application of psychiatric theory and practice. Apropos of this, Lemkau [122] has recently stated that improvement of health follows when "theory matures into operating procedure, when plans become people at work." These steps had been taken by training center psychiatry.

The chief aim of the psychiatrist, clinical psychologist, and psychiatric social worker as a team was declared to be prevention of mental disorder as a contribution toward the ultimate objective of maximum conservation of man-

[122] Lemkau, P. V.: Local mental health services. Ann. Am. Acad. Polit. & Social Sc. 286: 116-125, Mar 1953.

power. The relatively high incidence of psychiatric disorders during training had made prevention in this setting a problem of primary importance. In the accomplishment of the preventive program, the staff of the mental hygiene consultation service utilized psychiatric doctrine and methods to assist in the solution of problems which are the responsibility of command: morale, leadership, and motivation; basic loyalty and group identification; discipline and justice; training and satisfying occupational experience. From the foregoing list, it is apparent that psychiatrists and the ancillary professional personnel were not, and could not be, sole advisers in any of these areas. Actually, to be most effective in the prevention of psychiatric disorders, the staff of the mental hygiene consultation service had to work as an integral unit of the training command and maintain a close working liaison between mental hygiene consultation service personnel and other concerned officers of the training staff.

It is clear from the foregoing that the scope of the military psychiatrist's job goes far beyond the usual kind of civilian practice in which one may have become expert by long clinical experience. The way in which the psychiatrist became proficient in this was outlined by General Menninger: [123]

> The psychiatrist . . . had to know the Army and its mission; he had to be able to identify himself closely with the Army; he had to reorient from his interest in treating one person to the prevention of mental ill health in groups; he had to attempt to apply the best of his psychiatric knowledge to the social situation in which he worked. . . .
> . . . . His work specifically required him to know the structure of the Army and the methods that were used in the Army. He had to know the point of view of the men in the Army, what they were experiencing, what they were expected to do, how they felt about it, and the prevalent emotional stresses as well as the available emotional supports. Furthermore, he had to identify with the Army to the extent of believing in it, wanting to contribute constructively to it, and feeling of sense of pride in being a part of it.

The forging of effective relationships with other staff officers was essential for the psychiatrist's professional growth in military psychiatry. Therefore, perhaps the first important step to be taken was for the psychiatrist to realize that other staff officers were also concerned with the same basic problems as confronted him. The approaches of other staff officers to problems of motivation, utilization, morale, and leadership were from backgrounds which were at considerable variance with that of the psychiatrist. For the psychiatrist, then, to make a significant contribution he had to be clearly understood, both in terms of his evaluation of a given problem and his recommendations toward its solution. Because of difficulties in common understanding, resulting from varying backgrounds, it was necessary for the psychiatrist to be able to explain his concepts in terms which were readily understood by people unfamiliar with psychiatric terminology. The education of staff officers was facilitated by use of expressions which were readily understood by them. The reserve which was encountered in the application of psychiatric principles was often dissipated

[123] See footnote 2, p. 171.

when it became clear that the problems were mutual ones and that they were more profitably approached as joint ventures with the psychiatrists contributing a fair share.

As in civilian life, psychiatrists encountered resistance to psychiatry among military personnel because of fear of, aversion for, or misconceptions regarding individuals who required psychiatric assistance. Such reactions were best dealt with by the continual familiarization of key personnel with the nature of emotional illness. The tendency to ostracize the psychiatric patient by means of punitive dispositions had to be handled by a consistently interpretative approach. In this the psychiatrist who could welcome constructive criticism of his own services was more effective than the psychiatrist who could not. For if he reacted to criticism with hypersensitivity, he tended to isolate himself from the military community, distinctly diminishing his effectiveness as the leader of the mental hygiene consultation service. Such isolation failed to promote the mutual understanding which was absolutely necessary for the military psychiatrist to serve effectively the organization to which he was assigned. The ability to provide satisfactory professional services to other members of the training staff was commensurate with mutual understanding of each other's role.

Of all the training cadre, the psychiatrist's relationship to the company commander was of primary importance. His was the direct responsibility for the individual soldier. How well he exercised his command was a potent factor in maintaining morale and promoting mental health. To assist him with difficult individual problems, conferences were held at which psychiatrist and company commander could discuss possible solutions. Colonel Cruvant characterized the intelligent line officer as a "bulwark" in the "early recognition, prophylaxis, prevention and prompt elimination of the psychiatrically unfit." [124] In relation to the company commander, it was important that no confusion arise between medical function and command responsibility in the disposition of the administratively unfit soldier. In his relationship to the company commander, the psychiatrist was active at the basic level of prevention by promoting mental health. His advice to the company commander was for general application to help prevent a decline in morale and increase in neuropsychiatric disability. The lecture program to cadre and trainees was also directed at the promotion of mental health.

In addition to the level of prevention represented by promotion of mental health, other functions in prevention at other levels were practiced: specific preventive measures based on etiology; early diagnosis and treatment; limitation of disability; and rehabilitation.

Specific preventive measures within the strict sense of the term are not generally considered to be applicable to most psychiatric disorders—the etiology

[124] See footnote 102, p. 210.

of many conditions being so characteristically multiple factor in type. However, in the military service, psychiatric disability had a distinct relationship to morale and the latter to leadership. Therefore, when the environment of the soldier was affected by policies set forth by command, these became factors that were considered as supports or stresses for the mental health of the individual soldier and, in a sense, factors of etiologic significance in the matter of psychiatric disability. Policies which were not cognizant of certain needs of the individual often acted as stresses which tended to estrange the soldier from his group. On the other hand, policies which were important to the preservation of mental health and the maintenance of morale were those which provided incentive, stimulated motivation, inculcated responsibility, and developed a sense of duty. Clearly, the psychiatrist in training centers had to be sensitive to policies, procedures, and environmental factors which acted adversely on morale and precipitated psychiatric disorders. When warranted, he recommended measures necessary to alleviate or remove stress factors. To function adequately in this capacity, the psychiatrist had to evaluate the total man-environment complex in light of the main objective: to make the soldier well-trained, properly informed, mission-oriented, and group-identified so that he would be more apt to be effective and to take satisfaction in his military life. Valuable policies and practices were those which enhanced the individual's self-esteem and considered him as a person when important matters concerning him were at issue. Insofar as these policies were modified in response to psychiatric evaluation and recommendation, the measures were, indeed, specific preventive ones.

When promotion of mental health and specific preventive measures of the order indicated above were insufficient, the trainee experienced symptoms which brought him to medical attention. Nearly always when this occurred, some degree of psychiatric disability was present. In such cases the aim of the preventive program shifted toward early diagnosis and treatment. Here, the dispensary surgeon was important in the preventive approach.

A good working liaison between the psychiatrist and dispensary surgeon was essential in the proper management of trainees in whom early symptoms of maladjustment were often referrable to various organic systems of the body. Apprehension in response to such symptoms often led the trainee to believe that he had heart disease, gastrointestinal disease, or other physical disorders. The proper management of the trainee required a point of view by the medical officer and psychiatrist of considerable importance to process of adjustment by the trainee. Every individual who presented a diagnosable symptom complex or personality disorder was not necessarily to be recommended for separation from the service; nor was hospitalization to be recommended for all who presented diagnosable conditions. Rather, maximum efforts were to be made to help the individual make a satisfactory adjustment in the training situations.

In accomplishing this, it was important for an appropriate physical examination to be made, including, of course, an examination of the organic system referred to. A perfunctory or careless examination only exaggerated an already present anxiety, making subsequent management more difficult. When a well-conducted examination disclosed no physical disease, it was best for the soldier to be promptly so informed. If his anxiety persisted, the medical officer would interpret the soldier's symptoms as manifestations of a common response to the stress of training. Along with such an interpretation, reassurance was given by the medical officer that notwithstanding certain common difficulties encountered in training, most men were able to make the adjustment. Sometimes trainees were encouraged to discuss their problems and symptoms with friends because it was reassuring for some to learn that others had experienced similar disturbances or were carrying on effectively in spite of symptoms. Emphasis was placed upon exerting maximum effort in spite of defects as contrasted to the focusing of attention upon defects. This approach had the salutary effect of diminishing the tendency of the trainee to utilize symptoms or defects for purposes of primary or secondary gain. It was found that such management during the early period of adjustment of training allowed trainees soon to become asymptomatic, no longer requiring the medical officer's reassuring support. Cases of maladjustment which did not respond satisfactorily to the efforts of the company officer or dispensary surgeon were afforded a first echelon type of psychiatric treatment at the mental hygiene consultation service where similarly oriented treatment was offered. Thus, the trainee was seen early in the development of his symptoms, evaluated with regard to the training situation and the individual's potential, and afforded treatment which was appropriate to both.

Yet another level of preventive effort was practiced in the important matter of occupation. When definite disability was present of a type, which by reclassification or reassignment would result in productive service rather than total loss of the individual to the military service, the result was limitation of disability. Efforts at utilizing the mentally retarded and emotionally unstable were clearly directed toward this end. In solution of such problems, good liaison with the classification and assignment section was of most importance. In this area, the psychologist was often of most value as liaison between the mental hygiene consultation service and the personnel division.

Finally, rehabilitation as a measure of a complete preventive program was carried out at several training centers on an experimental basis with the mental hygiene consultation service staff participating. With this type of "milieu therapy" organized effort at all levels of prevention of psychiatric disability was engaged in and all the elements of a comprehensive program of preventive psychiatry were established in the training center. This development had taken place in units which in almost every instance were a part of the training center command.

The mental hygiene consultation service as an integral part of the training division had developed as a result of a recognized need for professional services at this echelon. The advantages of this close relationship were several. For example, it had been found that when similar facilities were provided as part of a hospital outpatient service the effectiveness of the mental hygiene consultation service in support of the training mission was considerably diminished. This was the result of a combination of factors having to do with the reaction of the referred enlisted personnel and the reaction of referring staff officers. An enlisted man tended to react to being sent to the hospital clinic in such a way as to undermine further his already weakened motivation for performing duty. He reacted as though it had been indicated to him that he was too sick to continue on duty. Furthermore, he lost identification with the mission of his organization. At the same time, unit commanders reflected much the same point of view in other ways. It was a common belief that the men should be sent to such a facility only when the commander was convinced that the men were not worth any further effort expended toward making them into soldiers. It was also feared that if members of the hospital staff did not fully understand the nature of referrals from the training organization, an easy exit from the difficulties of the adjustment period might be offered the trainee. It was found that when the mental hygiene consultation service was in the training area, and outpatient care provided in that setting, the suggestion of escape via the hospital was much diminished. Company and battalion commanders as well as other staff officers of the training division came to view the activities of the mental hygiene consultation service as being not in opposition to, but, rather, in concert with their own efforts.

Assignment of the mental hygiene consultation service personnel to the training command was important to establishing the esprit de corps so important to the maximum effectiveness of the team. It provided the mental hygiene consultation service personnel with strong incentive to become identified with the training command and its objectives. Furthermore, personnel of the training command more freely requested the help of the mental hygiene consultation service staff when it was part of the same command than when the services were supplied as part of the hospital service.

As a corollary to these observations, the optimum location of the mental hygiene consultation service was in a building in close proximity to the headquarters of the training center. The numerous necessary staff associations of the mental hygiene consultation service personnel with other staff and command agencies required the physical location of the clinic in the headquarters area. Because of the community of interests with the classification and assignment section in so many of the cases referred to the mental hygiene consultation service, it was most conveniently situated near that unit. The training center psychiatrist also had to maintain a close working relationship with officers in

S–1, S–3, unit dispensaries, various companies, office of the post surgeon, office of the judge advocate, office of information and education, and the office of the chaplain. All of these important associations were best maintained by a central location so that frequent visits between staff officers could be conveniently arranged for collaborative effort.

Inversely, the effectiveness of the mental hygiene consultation service was considered definitely limited by its location in the hospital area or as part of the hospital outpatient service. Thus, at Fort Francis E. Warren, Wyoming, in June 1945, of 501 new cases seen, only 9 were referrals from company commanders and the type of service was narrowly restricted: [125]

> The Consultation Service continues to be burdened with a large dispositional load which limits the time available for an adequate treatment program. Preventive psychiatry is almost nonexistent, the psychiatrist of the Consultation Service having had an opportunity to make only two mental hygiene talks in a period of five months. In discussing this matter, the Post Surgeon and . . . Executive Officer of the ASF Training Center, explained that the MTP schedule is so crowded that to date it has been impossible to find time for such mental hygiene lectures.

Too close a relationship to the hospital tended to minimize the number of valuable contacts made between staff members of the mental hygiene consultation service and the other officers of the training command. The mission of the mental hygiene consultation service in providing psychiatric services was adapted to the training mission of the organization which it served. This frame of reference tended to be obscured both to the medical personnel and training cadre, when the mental hygiene consultation service was physically placed in the hospital or hospital area. When this occurred, the professional services became less frequently sought by the training cadre and less appropriately given.

The Chief of the Mental Hygiene Consultation Service at Camp Crowder was assigned to the station hospital. The post surgeon, who was also the commanding officer of the hospital, believed all medical personnel should be directly responsible to him. The commanding general of the training center, however, thought it desirable for the training center psychiatrist to be assigned to him and this was in accord with the recommendation made from the Surgeon General's Office.

Still another example of difficulties in relation to the hospital staff association is disclosed by the psychiatrist's remarks concerning affairs at Camp Claiborne where acceptance by the training staff had also lagged: [126]

> The situation at this camp is rather difficult. I am assigned to the hospital and operate under the jurisdiction of the neuropsychiatric ward. The functions of a con-

[125] Ltr, Lt Col J. H. Greist, Consultant in Neuropsychiatry, 7th SvC, to Surg 7th SvC, 7 Aug 45, sub: Report of inspection of consultation service, Fort Francis E. Warren, Wyoming . . . 2 and 3 July 45. HD: 730 Neuropsychiatry.

[126] Ltr, Maj S. H. Kraines, Camp Claiborne, La., to Col W. C. Menninger, 12 Aug 1945. HD: 730 Neuropsychiatry.

sultation service are new to the hospital and difficult for them to accept. The training command also is adverse to activities of such a consultation service. . . .

In September 1945, the Eighth Service Command neuropsychiatric consultant visited Camp Claiborne, Louisiana. As a result of his visit, he reported: "This Mental Hygiene Clinic is unique in that its psychiatrist is assigned to the neuropsychiatric section of the Station Hospital. Heretofore such units have been independent of a station hospital. The present arrangement does widen the scope of hospital activities but is of no particular advantage to the Mental Hygiene Clinic." [127] The situation, unsatisfactory as it was at Camp Claiborne, had, nevertheless, improved over the earlier character of service offered at this post. Before establishment of the clinic as subordinate to the hospital service, it had been under the direction of a nonmedical officer. This unit was then entitled the "Personnel and Separation Branch, Military Personnel Division." The name suggests the strong emphasis placed upon the administrative character of the mission assigned by local authority. This is clearly indicated by the post regulation describing the Personnel and Separation Branch. Although the general scope of a mental hygiene consultation service was included in outlining the functions of this unit, far greater emphasis had been placed upon the procedures to facilitate the separation from the service of men who were to be discharged administratively.

In situations in which the mental hygiene consultation service was not overburdened by disposition problems, or too closely identified with the hospital mission, the preventive mission was furthered. Of the effective ways to approach prevention, the modification of attitudes, a traditional technique of mental hygiene, had been best developed in most instances. However, some efforts were made toward a statistical basis for preventive measures. Such studies were of two types: the continuing type of study of a particular problem to establish trends, and the brief studies of special problems when required. The former group included studies in which the mental hygiene consultation service regularly procured data on unit AWOL rates, unit incidence of venereal disease, and unit sick call rates. These rates were believed to indicate the presence of problems related to morale and leadership. When AWOL, venereal disease, and sick call rates were low, it was interpreted that supporting factors were effective or that stress was minimal. When such rates were high, further study was deemed necessary to elucidate the significant factors responsible so that recommendations could be formulated.

The psychiatrist at Camp Wolters attempted to evaluate the morale of the training company, first by measuring the productivity of each company, and later by figuring weekly sick call rates and transfers: [128]

[127] Ltr, Lt Col P. C. Talkington, to CO Sta Hosp, Camp Claiborne, La., 24 Sep 45, sub: Report of neuropsychiatric consultant's visit to station hospital, Camp Claiborne, Louisiana. HD: 730.

[128] Ltr, Maj R. C. Hunt to CG IRTC, Camp Wolters, Tex., 7 May 45, sub: Report of consultation service for the month of April 1945. HD: 730 Neuropsychiatry.

346336 O—55——16

> An effort was made to work up statistics and charts on production efficiency of the company level. No honest statistical basis could be found and the project was abandoned. The men eventually lost have usually been in two or more different organizations before final failure, so that it is impossible to determine which organization should receive the discredit, and the number transferred as training deficients and the numbers pending at the end of cycle are much larger than the losses.

Because this study was a failure, weekly sick call rates and transfers were charted. It was suggested that morale level would be reflected by the degree that men would strive for hospitalization and emergency furloughs.

Questions were raised with respect to the reliability of this type of index to morale: [129]

> . . . . The relationship between morale and sick-call rate is by no means consistent; we have all seen occasional units with low morale and low sick-call, perhaps because artificial and repressive measures are used to hold down sick-calls. This illustrates the necessity of watching all possible morale indicators, including gossip and one's intuitive feelings about a group which shows nothing wrong statistically.

The use of repressive measures to keep indicators of poor morale from reflecting such circumstances was considered by another observer to warrant another index as a validating check against the incorrect morale indices: "It is a pity that the number of courts-martial is not published for each RTC and the average number of years in the sentences. This would give an opportunity for a comparative study on the means with which RTC's try to maintain morale." [130]

Two factors may have adversely affected the development of a statistical-epidemiologic approach to preventive psychiatry in the training centers, although an interest in this methodology was being manifested with regard to combat psychiatry. One of these was the loss of personnel at local installations as a result of personnel surveys. The result of such economy measures was to place greater burden upon the psychiatrist for detailed administrative matters connected with the operation of the consultation service. Another result was that such cuts did not allow assignment of additional required professional personnel to free the psychiatrist from strictly clinical responsibilities so that an effective preventive program could be developed. The effects of such measures were being felt shortly after the Aberdeen conference.

The second major factor in the failure to develop further the epidemiologic approach to preventive psychiatry may have been the beginning of demobilization when numerous training centers were scheduled to close beginning late in 1945 and continuing into 1946. Most training center psychiatrists became concerned with the problems of demobilization rather than the maximum utilization of manpower or the cause and prevention of psychiatric disabilities in

---

[129] See footnote 63, p. 191.

[130] Ltr, Capt K. R. Eissler, IRTC, Camp Fannin, Tex., to Maj M. S. Guttmacher, SGO, 18 Jul 45. HD: 730 Neuropsychiatry.

the training situation. It was an understandable shift in interest which the nation at large shared following cessation of hostilities and promise of peace.

SUMMARY

One may define preventive psychiatry as that particular branch of medicine which studies disorders of intellect, emotions, and behavior in relation to the group as well as to the individual. Not merely concerned with individual ill health, it is also actively interested in the maintenance of the physical, mental, and social well-being of the man-environment complex. In the military service, preventive psychiatry had become concerned with stresses affecting groups of soldiers, and the supports which could be provided for the group. To obtain the kind of information needed for his counseling role in matters of mental health, it had been necessary for the military psychiatrist to utilize methods which were applicable to groups. Thus he studied the incidence and prevalence of a disorder, employing data related to these factors in the evaluation of etiology and construction of a program of prevention.

The evolution of preventive psychiatry was not a goal envisioned at the outset of World War II by most psychiatrists. Indeed, the meaning and use of the word "prevention" in military psychiatry had unudergone great change. It had generally implied that psychiatric casualties were to be prevented by judicious examination at induction stations, applying standards that excluded the potential casualty. This had been current opinion among well-informed military and civilian psychiatrists alike: prevention and screening were considered to be practically synonymous. This view appeared to be consistent with the basic mission of the Army Medical Department in preserving and maintaining the fighting strength. It was based upon the ideal hope that the elimination of potential casualties before exposure to the stresses of military service would constitute a valuable contribution to the forging of a dependable arm for war. It was also foreseen that fewer pensioners for combat-incurred neuropsychiatric disabilities would result during World War II than had been the experience in the previous world conflict.

However hopeful men had been initially of the potential effectiveness of this means, the application of screening technique had left much to be desired. The psychiatric casualty was not eliminated, in spite of generally high rates of rejection at induction stations. Prevention of psychiatric casualties had not been achieved by the application of screening devices and classification practices; on the contrary, large numbers of men had been excluded or eliminated from contributing to the military effort. It can be fairly stated that these failures opened the way to developments which culminated in the establishment of a psychiatric prevention of a vastly different order than foreseen at the beginning of the war. With utilization of manpower a vexingly com-

plicated, as well as supremely important, matter, psychiatry had to develop techniques which were distinct modifications of the diagnostic and prognostic skills that had been so confidently relied upon.

Most military psychiatrists in the training centers were trained to, or acquainted with, the psychodynamic concept of etiology for psychiatric disorders. The psychiatrist, acquainted with dynamic factors in etiology, possessed an attitude of scientific receptiveness which permitted observations to be made regarding the adjustment process among trainees. In this frame of reference, a psychiatric disorder was viewed as the symptomatic expression of a reaction to stressful inner conflict between the forces of an impulse to gain satisfaction and deterring forces against that end. The imposed deterring forces could be internal (conscience) or external (social). In the training circumstances, the latter tended to overshadow the former. The resulting struggle could be completely unconscious, completely conscious, or, perhaps, but vaguely perceived, with manifestations as symptoms or as aberrant behavior. This conflictual state could be affected by environmental factors acting as individual stresses or supports. The dynamically oriented psychiatrist became more and more concerned with environmental factors and found new avenues of approach to the evaluation and treatment of these conditions.

The soldier entered the military service with a whole set of experiences which conditioned his adjustive processes. He might enter into immediate and overt conflict with the new authority or group. On the other hand, a latent conflict might become activated and be expressed symbolically as a behavior disorder or a symptomatic emotional reaction. The internal conflict between forces thus might be a symbolic representation of an actual conflict in external reality. When the internal struggle was severe, symptoms emerged in various ways as a manifestation of the conflict between forces. It was at this point that the psychiatrist was frequently called upon for his services as a clinician because of the effects of these manifestations. Because the first requirement of the psychiatrist was for his clinical services, much effort was bent in the direction of extending such services to the individual. However, it was soon perceived that although individual factors were of significance, the perspective was often changed by an understanding of group factors. The entire man-environment complex had to be considered so that individual biologic and cultural factors could be evaluated in terms of the soldier and his group. Treatment was based upon such an evaluation and preventive techniques were directed with focus upon the group.

The clinician's role in the study of the individual patient is the traditional one from which epidemiologic studies have originated and was the foundation upon which a design for prevention was based. In his role as the physician to the ill individual, questions emerged which had significance for the group to which the patient belonged. In the mental hygiene consultation service the

psychiatrist was in the advantageous position of being both psychiatrist to the individual soldier and adviser to the commander on matters affecting the mental health of the group. In the first instance he was afforded the opportunity of studying individual cases, drawing conclusions and formulating plans. In the second instance, he was in a position to present his observations, formulations, and conclusions to the commander directly for consideration and action.

This dual role forced a clarification of the differences between the preventive and clinical roles in military psychiatry. The aim of both is to interfere with symptom formation; however, one of the principal differences between the clinical psychiatrist and the preventive psychiatrist is in the unit of study. The former is concerned with the individual who seeks help for himself or has been referred for assistance; the latter is concerned with essentially the same phenomena as they affect the group.

Symptoms could be alleviated by methods directed toward modification of stress or support factors. If the stress to be diminished was an inner dynamic factor, or, if the support to be augmented was an individual resource, the methods used were a modified form of psychotherapy. On the other hand, if the modifiable stress or support was a quality of the individual's surroundings, the methods were those of environmental manipulation. Preventive psychiatry aimed both at the early amelioration of symptoms in the individual by the modification of individual etiologic factors, as well as at the prevention of the development of the same disorders by group studies and group measures.

From the foregoing, it will be seen that steps in the historical development of mental hygiene were rapidly retraced in the establishment of a preventive psychiatry in the military service. This psychiatrist, armed with a holistic approach to the patient's problems, came to see these in terms of disorders arising in the unit analogous to the family, and subject to modification by measures focused at the group. The use of an individual prophylactic guide for each soldier was issued in the form of lectures and pamphlets applied in groups. The broad implications for the group, in addition to the individual soldier's adjustment problem, had been acknowledged and was being met by appropriate preventive measures.

The close of the war found training center psychiatrists engaged in a preventive program which was largely carried on by means of attitude conditioning and staff advisory functions. The increased utilization of psychiatric social workers and clinical psychologists had contributed significantly to this program. Preventive psychiatry based upon a statistical epidemiology appeared to be on the threshold of development. Since psychiatric disorders had important sociologic, psychologic, and somatic components, they were potentially amenable to study by epidemiologic methods. Epidemiologic methods, applied to the problems of psychiatry, might have provided a basis for recommending preventive measures and establishment of a body of preventive psy-

chiatric principles. Although not trained to be an epidemiologist, the psychiatrist was familiar with manifestations of contending dynamic forces within the individual; therefore, the epidemiologic concept of mass disease as a manifestation of contending forces between host and environment would not have been an unfamiliar frame of reference. Similarly, multiple causation of disease as an epidemiologic principle would be familiar to psychiatrists trained to consider multiple factors in the determination of symptom formation. As modern epidemiology utilizes the contributions of various allied disciplines, so also did military psychiatry, in that the psychiatric team studied the soldier in relation to his fellows and environment, employing the professional viewpoints of the psychologist and the social worker. Although the way appeared to be opening for the development of an epidemiologic approach, the efforts in this area were preliminary in nature.

CHAPTER VII

Accidental Trauma

Major Edgar L. Cook, MC, USA
and
*John E. Gordon, M. D.**

NONBATTLE INJURY

The Wartime Problem

During World War II every 5th notification of the death of a member of the United States Army sent to American families was caused by nonbattle trauma, and every 20th was due to disease. In the past the problem of disease was more important than that of nonbattle trauma, but due to modern advances in prevention and treatment of infections there has been a relative change in position especially when mortality is used as the index. The effect of epidemics of infectious disease which rendered whole armies ineffective has been well documented in history. The relative importance of mortality from disease and nonbattle trauma in wars in which the United States has participated, and for which data are available, is presented in Chart 1.

In the Mexican War, 1846 to 1848, there were 28 deaths due to disease for each death due to nonbattle trauma. In the Civil War (Union Troops), the ratio was 9 to 1; Spanish-American War, 16 to 1; World War I, 12 to 1. In World War II the ratio was reversed for the first time with nonbattle injury deaths exceeding disease deaths. During this war there were 4 deaths from nonbattle injury to every death from disease. There were 61,640 deaths due to nonbattle injury, a rate of 2.40 per thousand per annum for the period December 1941 through 1945. For the same period, there were 15,779 deaths due to disease, a rate of 0.61 per thousand per annum. Thus, with death as the measure, one of the important mass health problems of a modern army is nonbattle injury.

The Peacetime Situation

Nonbattle injury, as well as disease, is present during periods of peace as well as war, and therefore is not a problem peculiar to war, although many times modified by operations in the field. Battle trauma, on the other hand, is

*Professor of Preventive Medicine and Epidemiology, Harvard University School of Public Health, Boston, Massachusetts. Formerly Colonel, MC, AUS.

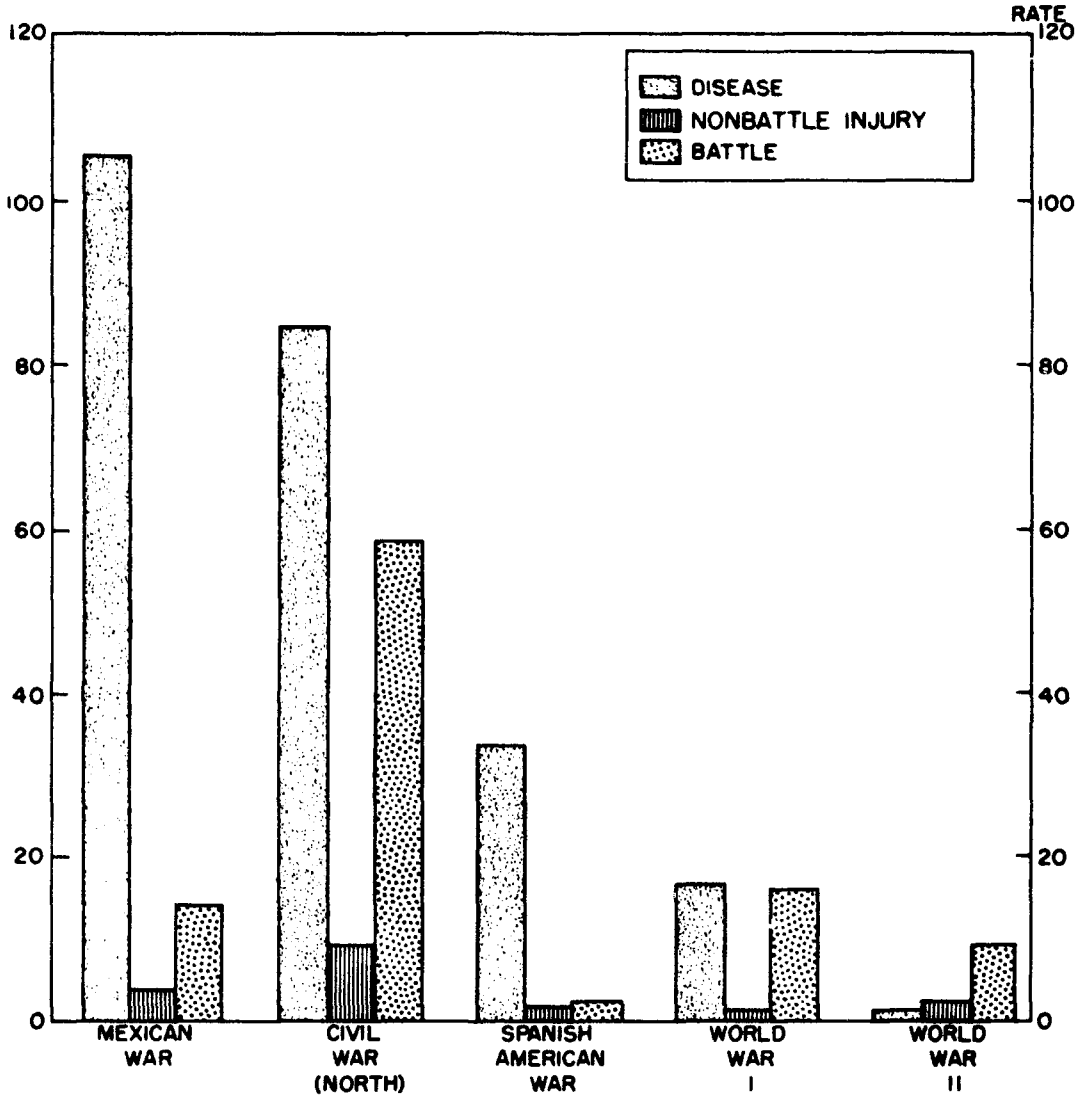


Chart 1. United States Army death rates in various wars. (Death rate per 1,000 per annum.) Considerable uncertainty surrounds the exact number of deaths from broad-cause groups during some of the early wars. This chart does not purport to be official as to the precise values, but does represent the general level of relative magnitudes of these values.

like a point or common source epidemic, being limited by definition to the period of conflict. A comparison of death rates for the years 1900 through 1945 is presented in Table 10. For many years, deaths from disease exceeded those for injury: after World War I the differences were never great. In 1922 the rates were even, and in 1925, 1932, 1936, and 1938 the nonbattle injury rates were higher. Beginning in 1940, the trends changed sharply, with nonbattle injury regularly exceeding deaths from disease, and by a considerable margin.

TABLE 10. DEATH RATES PER 1,000 PER ANNUM, DISEASE AND NONBATTLE INJURY, TOTAL UNITED STATES ARMY, 1900–45

Year	Disease	Nonbattle injury	Year	Disease	Nonbattle injury
1900	15. 79	6. 95	1923	2. 01	1. 90
1901	9. 58	4. 36	1924	1. 94	1. 89
1902	12. 78	2. 71	1925	1. 77	1. 99
1903	7. 02	2. 28	1926	2. 27	1. 67
1904	4. 05	3. 73	1927	2. 35	1. 65
1905	3. 73	2. 86	1928	2. 30	1. 80
1906	3. 77	2. 76	1929	2. 29	2. 05
1907	3. 57	2. 14	1930	2. 08	1. 81
1908	3. 63	2. 59	1931	2. 47	2. 13
1909	3. 28	1. 81	1932	2. 11	2. 15
1910	2. 50	1. 86	1933	2. 11	2. 10
1911	2. 70	2. 05	1934	2. 04	1. 99
1912	2. 47	2. 30	1935	2. 09	1. 75
1913	2. 60	2. 55	1936	2. 00	2. 03
1914	2. 35	2. 05	1937	1. 87	1. 61
1915	2. 53	1. 92	1938	1. 54	1. 71
1916	2. 71	2. 48	1939	1. 55	1. 50
1917	4. 91	1. 22	1940	1. 04	1. 76
1918	18. 81	1. 39	1941	. 60	1. 58
1919	7. 61	1. 34	1942	. 68	2. 08
1920	4. 67	2. 24	1943	. 58	2. 26
1921	2. 24	2. 02	1944	. 55	2. 45
1922	2. 28	2. 28	1945	. 62	2. 47

Source: Annual reports of The Surgeon General and "Army Battle Casualties and Nonbattle Deaths in World War II," Final Report, 7 December 41—31 December 46, AGO.

Civilian Accidental Trauma

The problem of accidental trauma has also shown increasing magnitude in the civilian population of the United States. In 1910, accidents ranked sixth as a cause of death,[1] and in 1945, this cause of death was fourth.[2] Considering

[1] Mortality Statistics 1910. Washington, Government Printing Office, 1913.
[2] Vital Statistics. Special Reports 26, No. 1, USPHS, FSA, 4 Apr 47.

age and sex distributions of the two populations, accidental trauma has even more significance under civilian conditions than for the Army. In 1945, the leading cause of civilian deaths for the age group 1 to 24 years was accidents, and accidents ranked second for ages 25 to 45 years. The Metropolitan Life Insurance data for insured populations reveal a greater incidence of accidents in the male population.[3] These facts are important, because the majority of the Army population is male and of these age groups.

Classification of Army Casualties

ARMY REGULATIONS

An understanding of the classification of military casualties is essential to evaluation of accidental trauma. The definitions of terms that follow are from Army Regulations (AR) 40–1080, 28 August 1945:

> A battle casualty is a traumatism (wound or injury) which is incurred as a direct result of enemy action during combat or otherwise, or is sustained while immediately engaged in, going to, or returning from a combat mission. It does not include traumatisms occurring on purely training flights or missions. Psychiatric cases occurring in combat will not be reported as battle casualties.
>
> The term "injury" will include traumatisms other than those defined as "battle casualty." (The term "traumatism" refers to morbid conditions due to external causes. It includes acute poisoning except food poisoning, the results of exposure to heat, cold, and light as well as various types of wounds.)
>
> All cases other than those due to injury or battle casualty will be classed as "disease." Included among the disease cases will be patients suffering from reactions to medication other than acute poisoning, patients admitted for the sequela of an injury incurred prior to entering service, and patients readmitted for the results of a traumatism (battle or nonbattle) incurred during service.

The classification in most instances is obvious but in others is arbitrary. Trenchfoot, although sustained in battle, is classified as a nonbattle injury. Also, when an individual is admitted with both a disease and an injury, the classification is according to the more serious condition at time of initial admission. When an individual with battle wound and disease or injury is admitted, he is classed as a battle casualty. The three major groups are well defined by regulations, but the subdivisions of nonbattle injury are not well distinguished.

A CLASSIFICATION OF NONBATTLE INJURY

Since Army regulations make no provision for the separation of the various kinds of trauma included under nonbattle injury, and since this study is primarily concerned with accidental trauma, an arbitrary division has been made, recognizing three broad subgroups. Chart 2 shows this in schematic arrange-

[3] Fatal accidents and the venturesome male. Statist. Bull. Metrop. Life Insur. Co. 30: 6–7, Mar 1949.

ment. Nonbattle injuries are divided into: accidental trauma, intentional trauma, and climatic trauma. Climatic trauma includes cold injury of all gradations from chilblains to frostbite, trenchfoot, and immersion foot. The class also includes trauma due to heat, a result evidenced in heat exhaustion or heat stroke. Intentional trauma includes homicide, suicide, and self-inflicted wounds. This leaves the group of accidental traumatic conditions resulting from automobile and aircraft accidents, burns, drowning, and other sources. The purpose of this arrangement is to make possible a specific and separate analysis of accidental trauma. In some instances, a particular case is found difficult to classify according to this scheme.

NONBATTLE INJURY

THERMAL (CLIMATE)	ACCIDENTAL	INTENTIONAL
• HOT	• VEHICULAR	• SUICIDE
• COLD	• AIRCRAFT	• HOMICIDE
	• DROWNING	• SELF-INFLICTED
	• FIREARMS and EXPLOSIVES	• ETC.
	• BURNS	
	• ATHLETICS	
	• FALLS	
	• ETC.	

Chart 2. Schematic arrangement of classification of nonbattle injury.

HISTORY OF ACCIDENTS AND ACCIDENT PREVENTION IN MILITARY PRACTICE

American Revolutionary War

Accidents have been a factor in military operations of the United States Army since earliest days. The first Army regulations drafted by Major General von Steuben in 1780 stated that surgeons would remain with their regiments on the march as well as in camp so that in case of sudden accidents they would be at hand to apply the proper remedy. There are no officially recorded statistics on nonbattle injury during the Revolutionary War, but James Thacher, a

surgeon, gives a stimulating account of medical problems in his Military Journal during the American Revolutionary War from 1775 to 1783.[4] An entry under date of September 1776 states that "a soldier had the imprudence to seize a rattlesnake by its tail; the reptile threw its head back and struck its fangs into the man's hand." On 10 March 1782 he added, "A singular incident occurred in the Sixth Regiment to-day. Two soldiers were eating soup together, and one forbid the other eating any more; as he did not desist, his comrade gave him a blow with his fist on the side of his head, on which he fell to the ground and instantly expired. On close examination, I could discover no bruise or injury which could enable me to account satisfactorily for his death." This author also intermingles pertinent medical observations among his many vivid accounts of duels, brawls, and scalpings.

Nineteenth Century and the Twentieth Century to 1930

During the 19th century, accidental trauma continued to take its toll. It was commonly interpreted as being caused by events beyond control, that happened despite all foresight and expectation. Since accidents were considered inevitable, little attention was given to the question of prevention. The strongest efforts were made in attempting to solve the mysteries of unknown fevers and consumptive disease. The perfection of the microscope and Pasteur's work at the end of the century brought the infectious diseases into clearer focus.

During the first part of the 20th century, until World War I, there was scarcely mention of accidental trauma in the annual reports of The Surgeon General, although during that time a gradual narrowing of the gap between the death rates for disease and nonbattle injury was under way, as seen in Table 10. There is nothing to indicate that the problem of accidents was given much attention in World War I; again in all probability because of the relatively greater importance of disease control.

During the years of the 1920's the recognition of the importance of nonbattle injury became evident. In the Report of The Surgeon General, U. S. Army, 1932, there is a paragraph on the increase in relative importance of injuries as a cause of death, stating:

> It is apparent . . . that external or violent causes were by far the most important cause of death in the Army in 1931. Thus they caused 46 percent of all fatalities. . . . During the early period [1852–1861], deaths from external causes were only 11 percent of the total ones as compared with 50 percent during the last 10 years [1922–1931]. . . . Fatalities from automobiles, airplanes, etc., are largely responsible for the greater relative increase in deaths from violent causes.

---

[4] Thacher, James: A Military Journal during the American Revolutionary War from 1775 to 1783. Boston, 1823.

Accident Activities of the Medical Department, 1930 to World War II

In the late 1930's a need for more detailed evaluation of the problems was generally appreciated. A reporting system was developed which was designed to evaluate death, defect, and disability from accidental injury. It included information on disability discharges, days lost, an analysis of the place of the accident, and whether it occurred on duty or leave. It also had an analysis of fault and of influence of alcohol. The collection of information was started in 1938. Data for 1939 were tabulated in the next annual report and it was stated that the 1938 figures were similar. Death, defect, and disability attributed to leading causes of accidental trauma were as presented in Table 11. With the onset of mobilization in 1940, the strength of the Army increased materially. The special reporting system for accidents was no longer considered feasible. The 1941 Annual Report of The Surgeon General did not present the detailed figures for the year of 1940.

TABLE 11. ACCIDENTAL INJURY* IN THE TOTAL UNITED STATES ARMY, BY CAUSATIVE AGENT, 1939

Causative agent	Admissions		Deaths		Disability discharge		Days lost		Average days per admission
	Number	Percent of total	Number	Percent of total	Number	Percent of total	Number	Percent of total	
Total	20, 215	100. 0	214	100. 0	124	100. 0	389. 084	100. 0	19
Motor vehicles	1, 845	9. 1	97	45. 3	48	38. 7	67, 028	17. 2	36
Aircraft	138	. 7	36	16. 8	1	. 8	3, 252	. 8	24
Athletics	4, 621	22. 9	5	2. 3	14	11. 3	82, 250	21. 1	18
Falls	2, 596	12. 8	8	3. 7	14	11. 3	60, 560	15. 6	23
Fighting	1, 091	5. 4	------	0	3	2. 4	20, 368	5. 2	19
Firearms	240	1. 2	6	2. 8	7	5. 6	7, 512	1. 9	31
Drowning	22	. 1	22	10. 3	------	0	--------	0	0
All others	9, 662	47. 8	40	18. 8	37	29. 9	148, 114	38. 2	15

*Excludes cases of homicide and suicide.

Source: Annual Report of The Surgeon General, U. S. Army, 1940.

The 1940 Annual Report of The Surgeon General, at the end of the analysis of data on accidental trauma made the following statement:

> These tables give rather detailed information as to the causative agent, show wherein the fault lay in many cases, and serve as sources of data to indicate the most fruitful fields of accident prevention. However, it should be remembered that there is no evidence here as to the particular combination of circumstances which brought about the causation of the injuries. It is emphasized that this information can be obtained only by a detailed study of each case, and that such studies by unit commanders and medical officers can do much in the prevention of injuries.

Col. Samuel Adams Cohen, MC, made the following statement in an article in The Military Surgeon, November 1940:[5] "In view of the numerical increase of its personnel and the broadening of the Army's mechanization, the problem of accidents therefore promises to assume increasing magnitude." He advocated a safety officer at every large post who would know the existing conditions at the particular post and be responsible for reducing the incidence of accidents. He outlined the role of the medical officer in the accident prevention program as follows:

> It cannot be overemphasized, however, that the problem of accidents and accident prevention should be the direct concern of the medical officer. Since he is the guardian of the health of the personnel, he should be the predominant influence in the prophylaxis of accidents.
>
> The medical officer should explore all factors that may lead to accidents and make appropriate recommendations for eliminating them or decreasing their frequency. The gratifying experiences of the medical officer's successful efforts to stamp out many diseases and reduce the incidence of other diseases should be an added incentive for him to do likewise with accidents.

Another contribution was made just before the beginning of hostilities, by Maj. M. H. Fineberg, MC, who made a survey of the serious accidents resulting from the maneuvers by the First United States Army in October and November 1941 with the object of suggesting methods for their prevention. On the basis of 1,820 cases studied, Major Fineberg made the following recommendations to lessen the number of accidents occurring during maneuvers:[6]

> 1. Unit commanders and all officers having charge of troops should familiarize themselves with the most common causes of accidents and make definite plans for their prevention.
>
> 2. Soldiers should be given careful instruction in getting on and off trucks. Greater caution should also be exercised to keep men from falling out of moving vehicles.
>
> 3. More careful and more thorough training of drivers should be attempted. Also, more frequent changing of drivers who are exhausted or who are on the point of falling asleep should be effected.
>
> 4. Soldiers should be instructed to walk on the proper side of the road, and to rest and sleep in places where a vehicle is not likely to strike them.
>
> 5. Drivers should not suddenly start vehicles which have been standing for a long time without first looking around and underneath the vehicle.
>
> 6. Irregularities of the terrain in the camp site and objects over which they might stumble in the dark should be pointed out to the soldiers.
>
> 7. An attempt should be made to guard against branches striking the eyes.
>
> 8. Soldiers should be instructed in the proper method of lighting and caring for gasoline stoves and in the proper method of handling gasoline.
>
> 9. Soldiers should be cautioned against letting ammunition, even supposedly blank ammunition, get close to the fire.

---

[5] Cohen, S. A.: Accidents in the Army and their prevention. Mil. Surgeon 87: 434–443, Nov 1940.

[6] Fineberg, M. H.: A survey of the accidents resulting from Army maneuvers with recommendations for their prevention. Mil. Surgeon 91: 75–81, Jul 1942.

10. Players participating in sports should be more adequately protected and more carefully supervised.

11. More care should be taken to prevent objects from falling on soldiers.

12. Fights and brawls might be lessened by better discipline with specific reference to drinking and gambling.

13. Soldiers should be instructed in the proper method of lifting heavy objects.

14. Inexperienced soldiers should be given pointers on how to use an axe.

15. Rings should not be worn by soldiers on maneuvers.

ACCIDENT PREVENTION DURING WORLD WAR II

General Policy

Prior to the mobilization for war, safety activities were carried on with varying emphasis by several of the supply services as a part of plant protection. The Ordnance Department had a special safety section for problems related to explosives, and cooperation was maintained with the Corps of Engineers in building new powder and loading plants. This was an important move in the direction of prevention. The major emphasis in plant protection was devoted to fire, espionage, and sabotage. However, after 7 December 1941 accident prevention was stressed more strongly and considerable attention was given to the conservation of manpower. At that time the problem of concentration of effort was considered. Procurement of war material was considered of prime importance and safety efforts were turned in that direction rather than on troop activities.

In March 1942, the Plant Protection Division, Office of Under Secretary of War, was transferred to the Provost Marshal General's Office, and combined with the Emergency Operations Division to form the Internal Security Division. This placed the policy making responsibilities in the hands of The Provost Marshal General.

Reorganization of the Army (War Department General Orders 35, 1942), resulted in changing corps areas to service commands and transferred administrative functions from the procurement services to the service commands. Internal security and accident prevention were included in this transfer, and technical services were given certain responsibilities. The Chemical Warfare Service and Ordnance Department were given the responsibilities for continuing protection of field installations and facilities and manufacturing, storing, and processing explosives and allied substances. Since the Chief Signal Officer, Quartermaster General, and Surgeon General procured only inert items, they were assigned no responsibility for continuing protection.

Army Service Forces Safety Program

The Services of Supply Safety Program (later the Army Service Forces Safety Program) was established on 31 August 1942.[7] The policies and pro-

[7] SOS Cir 55, 31 Aug 42.

cedures which had governed accident prevention in the Internal Security Program were greatly expanded. The loss of valuable manpower, and the resulting costly delays in war production, were cogent reasons for a comprehensive and aggressive accident prevention program in all plants and facilities vital to the war effort. Coordination between numerous governmental and private agencies engaged in various phases of accident prevention was stressed. Primary responsibility was given to the commanding officer of a Government-operated plant or facility and to the owner and operator of a privately operated plant or facility. The Provost Marshal General was charged with the preparation of general policies; supervision over accident prevention activities within the Services of Supply; and coordination in Washington with the Department of Labor, Bureau of Mines, War Production Board, Office of Civilian Defense, War Manpower Commission, the Navy Department, and numerous voluntary organizations including the National Safety Council, National Conservation Bureau, and National Bureau for Industrial Protection. The responsibilities of the Chief of Ordnance, Chief of Chemical Warfare Service, Chief of Transportation, and Chief of Engineers were outlined, but no mention of The Surgeon General was made.

In December 1942, the War Department Safety Council was organized.[8] It consisted of representatives of the technical services and staff divisions of the Army Service Forces, the Army Air Forces, and the Navy. The officer in charge of occupational medicine matters in the Preventive Medicine Service, Office of The Surgeon General, United States Army, was designated to represent the Medical Department on that council. This council met once a month for discussion of War Department safety problems. In addition, annual meetings were held and were attended by representatives of civilian safety organizations.

Because of high admission rates for nonbattle injury in the United States, the scope of the safety program turned from production workers to military personnel. The first accident frequency reports had been tabulated in January 1943 and covered private plants. Reporting injuries of military personnel was established late in 1944 by adapting the morbidity reports program of The Surgeon General.[9] The accident rate of soldiers on furlough, leave, or pass was considered high, and in June 1944 War Department Pamphlet 21–10 "Private Droop has Missed the War" was published for distribution. In the fall of 1944 a War Department general safety manual, TM 2–350, was published. There is no mention that the Medical Department had any part in the preparation of this manual. Also in the fall of 1944, a bimonthly publication, "Safety Information," was started. Five issues were published before it was discontinued.

---

[8] Memo, Chief of Staff, US Army, for PMG, 5 Dec 42, sub: War Department Safety Council. HD: 322.

[9] WD Cir 438, 14 Nov 44.

In February 1944, an advisory board on fire and accident prevention was established in the Office of the Under Secretary of War.[10] Membership included the Assistant Provost Marshal General as chairman; the Director, Control Division, Army Service Forces; and the Air Provost Marshal. There were 2 additional members to serve in matters concerning fire prevention and 2 additional members on matters concerning safety measures. The Director of the Occupational Health Division, Preventive Medicine Service, Office of The Surgeon General, was 1 of the members representing safety. One of the functions of the board was to report quarterly to the Under Secretary of War providing factual data as to important trends of fire and accidents, both in actual number and as related to exposure, making necessary recommendations where other agencies of the War Department had previously refused or neglected to take action.

In September 1945, a revision of the accident reporting system and a restatement of policy was published.[11] The Provost Marshal General was given the responsibility for the collection and analysis of accident statistics for Army Service and Ground Forces, the coordinated safety activities with appropriate governmental and private agencies, and with The Surgeon General, Director of Military Training, and Director of Personnel. The Surgeon General was given the responsibility of: (1) assisting The Provost Marshal General and Director of Military Training in determination of doctrine and in preparation of texts, manuals, and other aids for safety training of military personnel, and (2) coordinating with the Army Safety Program, his program for control and reduction of occupational diseases.

The new reporting system went into effect 1 November 1945 so that direct responsibility for collecting information on accidents now rested with The Provost Marshal General. One new "Report of Injury" form for use in recording accidental injuries to all types of personnel, and three new forms for summarizing accident frequency, causal data at posts and service commands, and technical services were provided. All accident data were to be routed through safety personnel of each echelon to The Provost Marshal General. In October 1945, the War Department Safety Council was abolished, as was the Fire and Accident Advisory Board.[12] The Army Safety Program participated in National Safety Congresses of 1942, 1943, and 1944. Among the speakers at these conferences was The Surgeon General of the Army.

Occupational Health Division, Preventive Medicine Service

The Occupational Health Division of the Preventive Medicine Service of the Surgeon General's Office developed the occupational health program which

[10] WD Memo W850–44, 8 Feb 44.
[11] ASF Cir 360, 25 Sep 45.
[12] WD Cir 305, 5 Oct 45.

was carried throughout the war. In January 1944, the director of the Occupational Health Division recommended that a program of accident prevention be established for military personnel because of the high admission rate in Army hospitals for nonbattle injuries. He cited the value of such a program in industry and suggested to the Chief, Preventive Medicine Service, that an accident prevention division be established. This was not approved by The Surgeon General because accident prevention was not considered as a primary function of the Surgeon General's Office although its importance was recognized, and cooperation with other agencies continued. The Occupational Health Division assisted in the preparation of War Department Circular 252, 20 June 1944, sponsored by the Office of The Surgeon General. This circular gave directions by which medical officers in the field would prepare reports in all cases of accidental injury to military personnel, to be used by accident prevention officers.

The activities of the Occupational Health Division, Preventive Medicine Service, Office of The Surgeon General, endeavored to promote high standards of industrial medicine. The replacement examinations contributed to the accident prevention program by listing the number of individuals being placed on jobs beyond their physical capacities. A worker with defective vision, if placed on a job requiring perfect vision, would be likely to have accidents. The control of environmental factors such as toxic dusts, noise, and illumination may also be contributing factors in accidents. A worker may be partially overcome by some toxic fumes and perform his activities in such an abnormal manner as to receive an accidental injury. Such contributions are difficult to evaluate from statistics because of the many variables involved, but should be considered as an essential part of the overall program of accident prevention.

Activities Overseas

IMPORTANCE OF THE PROBLEM

A comparison of nonbattle injury death rates and admission rates for troops stationed overseas and in continental United States reveals that both the admission rates and the death rates were much higher overseas (Charts 3 and 4). In many theaters active accident prevention campaigns were developed and in most instances the surgeon provided an analysis of the situation from medical records, as reporting of accidents overseas through the Army Safety Program was not instituted until after the war. There were also many special studies on automobile accidents, poisoning, and burns. Additional studies were made on cold and heat trauma, suicides, and self-inflicted wounds, but under the scheme of Chart 2 these conditions have been separated from accidental trauma and will be covered in other portions of the history.

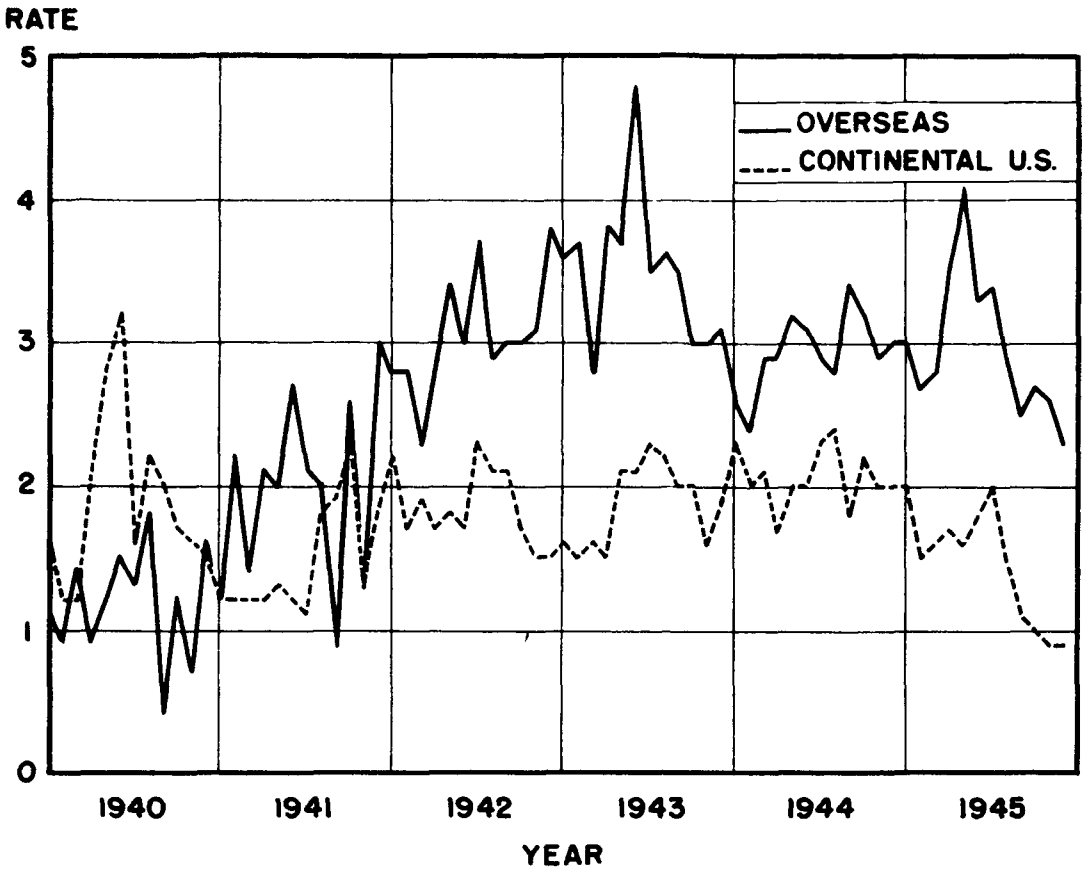


Chart 3. United States nonbattle injury death rates, per 1,000 per annum, continental United States and overseas, 1940–45. These are preliminary data based on statistical health reports.

In the European theater the theater surgeon had the responsibility of collecting statistical information on nonbattle injuries and presenting it to the provost marshal of the theater.[13] The Preventive Medicine Division, Office of The Chief Surgeon, European Theater of Operations, prepared extensive analyses of nonbattle injuries for 1942, 1943, and the first half of 1944, the period immediately preceding continental operations. Because the major problems of trenchfoot and typhus control required the maximum utilization of the staff on the Continent, detailed analyses for the continental period were not made; but general features of accidents and injuries were abstracted and detailed studies made of specific problems. In 1943 a special study of automobile accidents was made.

[13] Gordon, J. E.: A history of preventive medicine in the European Theater of Operations, U. S. Army, 1941–1945. HD: 314.7–1.

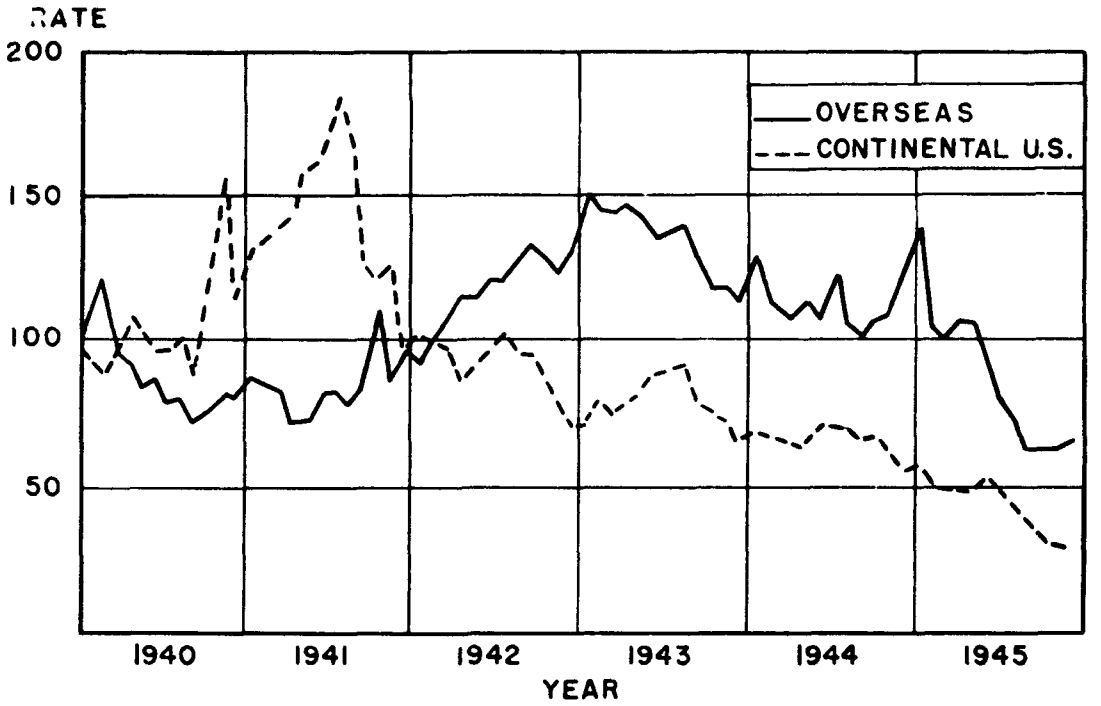


Chart 4. United States Army nonbattle injury admissions to hospital and quarters, per 1,000 per annum, by month, continental United States and overseas. These are preliminary data based on sample tabulations of individual medical records.

Because of the importance of nonbattle injuries as a source of noneffectiveness in the Southwest Pacific in 1944, an investigation was made under the direction of a specially trained Sanitary Corps officer.[14] The Surgeon, Headquarters, Mediterranean Theater of Operations, brought to the attention of the theater staff in 1944 the extent of the manpower loss resulting from injuries, and a safety committee was formed which developed a safety program.[15] The Army Service Forces Monthly Progress Report, Section 7, "Health," dated 31 July 1944 stated:

> Because of the importance of nonbattle injury as a source of noneffectiveness, there has long been evident a need for an adequate and effective control program, both in the Continental U. S. and overseas. During 1943 nonbattle injuries overseas caused a loss of almost four million man-days and battle injuries a loss of perhaps half this amount. The loss of time from nonbattle injuries is in large part preventable by means of a suitable control program.

[14] ETMD, SWPA, Jun 1944. HD: 350.
[15] Final Rpt, Prev Med Off, Off of Surg NATOUSA, 2 Nov 45. HD.

DEATHS

Nonbattle injuries were responsible for 32,914 deaths overseas, a rate of 3.06 per thousand per annum, compared with 27,140 deaths in the United States, a rate of 1.84 per 1,000 per annum for the period 1942–45 (Table 12).

An analysis of deaths in the South Pacific area 1 September 1942 to 31 August 1944 revealed deaths from battle causes as 2,588, nonbattle casualties 765, disease 166, suicides 51, and cause undetermined 12.[16] The survey in the Southwest Pacific revealed during the year of 1943 :[17]

Killed in action	930
Nonbattle casualty	574
Disease	152
Died of wounds	94

During the period October 1944 to June 1945, inclusive, there were more deaths in the European theater due to a single agent, alcohol poisoning (178), than to acute communicable disease (162).[18]

[16] ETMD, SOPAC Base Comd, 16 Nov 44. HD : 350.05.
[17] See footnote 14, p. 246.
[18] See footnote 13, p. 245.

TABLE 12. DEATHS DUE TO NONBATTLE INJURIES IN THE UNITED STATES ARMY, BY THEATER OF ADMISSION AND YEAR OF DEATH, 1942–45

Preliminary Data Based on Tabulations of Individual Medical Records

Theater	Total 1942–45	1942	1943	1944	1945
	Number				
Total Army	60, 054	6, 751	15, 561	19, 053	18, 689
United States	27, 140	4, 850	9, 764	8, 211	4, 315
Overseas [1]	32, 914	1, 901	5, 797	10, 842	14, 374
North America [2]	1, 493	359	622	297	215
Latin America	1, 587	385	509	487	206
Europe	12, 484	199	779	4, 058	7, 448
Mediterranean [3]	5, 644	149	1, 915	2, 277	1, 303
Middle East	538	22	174	256	86
China, Burma, India	2, 525	73	285	1, 021	1, 146
Pacific Ocean Areas [4]	8, 557	348	866	2, 431	3, 943
Southwest Pacific [4]		340	629		

See footnotes at end of table.

TABLE 12. DEATHS DUE TO NONBATTLE INJURIES IN THE UNITED STATES ARMY, BY THEATER OF ADMISSION AND YEAR OF DEATH, 1942–45—Continued

Theater	Total 1942–45	1942	1943	1944	1945
	Annual rate per 100,000 mean strength [5]				
Total Army	235.70	208.19	226.49	244.55	246.72
United States	184.09	182.54	188.40	206.73	147.19
Overseas [1]	306.57	324.53	343.44	283.88	309.56
North America [2]	303.21	356.80	319.83	229.81	315.85
Latin America	416.10	377.74	421.24	567.61	282.81
Europe	283.78	239.74	291.97	241.96	313.96
Mediterranean [3]	380.57	649.92	419.30	350.54	368.24
Middle East	368.00	363.88	328.03	553.91	210.32
China, Burma, India	575.85	834.67	719.37	605.19	517.60
Pacific Ocean Areas [4]	276.62	230.53	297.02	248.58	279.28
Southwest Pacific [4]		477.37	331.21		

[1] Includes admissions on transports.
[2] Includes Alaska and Iceland.
[3] Includes North Africa.
[4] Not available separately in 1944 and 1945.
[5] The strengths on which these rates were based are mean strengths and will vary therefore from the official strength reports of The Adjutant General.

ADMISSIONS

The admission rates to hospital and quarters for nonbattle trauma in overseas theaters were variable. In some areas, mainly the European theater, Mediterranean theater, and Alaska, the cold injury which is a component of nonbattle trauma was a large factor during the seasons of cold weather. In the Southwest Pacific area, a survey of 16,486 completed cases tabulated from the April 1944 admissions showed that 2,676 or 16 percent were admitted for nonbattle injury.[19]

NONEFFECTIVENESS

Much of the military significance of the admission rate derives from the length of time the patients remain noneffective. A study was made of the average days lost per admission for troops overseas to hospital or quarters for the year ending 30 June 1944.[20] The average number of days lost per admission was 48 for wounded, 13 for disease, and 19 for nonbattle injury. This excludes time lost subsequent to evacuation to the United States. There is a presumption, therefore, that these data are somewhat understated in terms of the true noneffective time. The report of this study further states, "The fact that the aver-

[19] ASF Monthly Progress Rpt, Sec. 7, Health, 31 Jul 44.
[20] ASF Monthly Progress Rpt, Sec. 7, Health, 31 Jan 45.

age patient suffering from an accidental injury loses 40 percent more time than the average disease patient helps to explain the tremendous drain on manpower which accidents cause overseas as well as at home."

A study of surgical dispositions was made for March through June 1944 in the South Pacific.[21] Of 14,738 dispositions there were 3,877 injury patients with an average stay of 28 days; 3,604 were returned to duty; 243 were evacuated to the Zone of Interior; and 30 died. A detailed distribution of events is given in Table 13. The type of injury and days lost were tabulated. Accidental discharge of guns and ammunition caused 11 percent of the days lost, had the highest average of days lost, and the lowest percentage of return to duty (Table 14). The dispositions were also divided into specialty fields, with 47.5 percent orthopedic and 44.9 percent general (Table 15). During the 4 months, accidental injuries cost 92,869 man-days lost, or an equivalent of an entire division for a week.

DISABILITY

Disability in an overseas theater cannot be measured by discharges from service, but can be by evacuations to the Zone of Interior, as these represent a loss to the theater. This varied in different theaters depending on the individual evacuation policy. An analysis was made of the cause of evacuation of nonbattle injuries to the Zone of Interior from the European theater of command for 1943. Of the 24,919 men admitted to hospital for nonbattle injury, 1.1 percent were evacuated to the Zone of Interior (3.2 percent died).[22] In the Southwest Pacific during 1943 there were 751 nonbattle injuries evacuated to the United States, compared with 551 battle casualties.[23] The South Pacific Base Command

TABLE 13. SURGICAL DISPOSITIONS, SOUTH PACIFIC BASE COMMAND, UNITED STATES ARMY, MARCH–JUNE 1944

Type of cases	To duty		To Zone of Interior		Deaths		Total	
	Patients	Average hospital days	Patients	Average hospital days	Patients	Average hospital days	Patients	Average hospital days
Surgical disease	8, 639	21	564	57	9	8	9, 212	23
Injury	3, 604	25	243	72	30	4	3, 877	28
Battle casualty	873	29	286	55	23	9	1, 182	35
No disease	466	12	1	62	0	0	467	12
Total	13, 582	22	1, 094	60	62	6	14, 738	25

Source: ASF Monthly Progress Rpt., Sec. 7, Health, 31 Jan 45.

[21] See footnote 20, p. 248.
[22] See footnote 13, p. 245.
[23] See footnote 14, p. 246.

TABLE 14. CAUSES OF NONBATTLE INJURY, UNITED STATES ARMY, SOUTH PACIFIC BASE COMMAND, MARCH–JUNE 1944

Cause of injury	Number of patients	Hospital days		Percent returned to duty
		Total	Average	
Falls and jumps	706	21, 420	30	96. 9
Moving objects	474	11, 149	24	95. 4
Organized athletics	385	8, 550	22	96. 6
Moving vehicles	368	10, 775	29	88. 9
Burns	354	9, 377	26	95. 5
Accidental discharge of guns and ammunition	235	10, 018	43	78. 7
Sharp objects	171	3, 659	22	96. 5
Lifting	135	2, 393	18	99. 3
Assault	135	3, 090	23	95. 6
Unspecified	467	12, 438	27	93. 4
Total*	3, 430	92, 869	27	93. 9

*These represent cases among the 3,877 shown in Table 13 which were considered to be acute.

Source: ASF Monthly Progress Rpt., Sec. 7, Health, 31 Jan 45.

TABLE 15. CLASSIFICATION OF INJURY DISPOSITIONS BY SURGICAL SPECIAL FIELDS, UNITED STATES ARMY, SOUTH PACIFIC BASE COMMAND, MARCH–JUNE 1944

Special field	Percent of patients	Percent of hospital days	Average stay in days	Percent returned to duty
Orthopedic	47. 5	56. 3	33	92. 9
General	44. 9	37. 1	23	94. 9
Neurosurgery	3. 4	4. 1	33	71. 5
Eye	2. 5	1. 6	17	85. 7
Ear, nose, throat	1. 2	. 6	14	95. 8
Urology	. 5	. 4	21	95. 0
Total	100. 0	100. 0	28	93. 0

Source: ASF Monthly Progress Rpt, Sec. 7, Health, 31 Jan 45.

evacuated 243 out of 3,877 injury dispositions, or 6.3 percent during the 4-month period from March through June 1944.[24]

OVERSEAS ACCIDENTS AS AN ECOLOGIC PROBLEM

In the study of mass disease the causes of origin and course are multiple. They reside in influences sometimes associated with an agent of disease, a

[24] See footnote 20, p. 248.

particular inciting cause; sometimes in innate or acquired characteristics of the host or population that suffers the disease or injury; and almost invariably in the many features of the environment in which both agent and host find themselves. An ecologic approach to causality is helpful in formulating a control program, for intelligent action depends upon a direct attempt to eliminate or modify identified causes. In any specific situation, causative factors are expected from all three general sources. Commonly one may exert dominant action, but rarely to the exclusion of all others. The complex of causation is an association of multiple factors.

Agents Acting in Accidents

In current considerations of accidental trauma, much variability exists in the use of the several terms of agent, agency, mechanism, and action. Many reports follow a common classification. Others employ an entirely different arrangement, sometimes unique and sometimes a mixture of many different classifications. This makes comparison difficult, and in some instances impossible.

One feature becomes strongly evident, namely an appreciable difference in death and admission rates for accidents, when these are arranged according to the various agents involved. This is clearly visible in the 1939 figures in Table 11. Aircraft injuries have a high mortality, but a low admission rate. During the first year of World War II, 1942, for which preliminary tabulations of individual medical records have been made, deaths due to aircraft accidents account for 44 percent of the total deaths from nonbattle injury in the Army, but only 1.8 percent of admissions for this class. The numbers of aircraft used in various areas influenced the death rates from accidental injury in that area. In Table 16 a comparison of death rates from nonbattle injury in continental United States and overseas for the year 1942 reveals a much higher death rate overseas for aircraft, firearms and ammunition, and for athletics and sports, while death rates from injury due to motor vehicles, fire, and heat were about equal. In three specific studies overseas, aircraft, automotive, drowning, and firearms-explosive accidents accounted for 72.5 to 85.2 percent of the total deaths from nonbattle injury in those areas (Table 17).

In the Southwest Pacific area in 1943, 54.5 percent of accidental deaths were associated with air transportation. Since that group was judged to constitute a special problem of control, accidental deaths related to aircraft, along with suicides and homicides, were excluded from nonbattle injury deaths by cause. Under that modification, automobiles were then responsible for 24.8 percent of all accidental deaths, firearms for 23.5 percent, and drowning 19 percent.[25]

[25] ASF Monthly Progress Rpt, Sec. 7, Health, 31 Jul 44.

TABLE 16. DEATHS DUE TO NONBATTLE INJURIES IN THE UNITED STATES ARMY, BY AREA OF ADMISSION AND CAUSATIVE AGENT, 1942.

Preliminary Data Based on Tabulations of Individual Medical Records

Causative agent	Total Army	Continental United States	Overseas
	Number		
Total	6, 751	4, 850	1, 901
Aircraft accidents	2, 986	2, 122	864
Vehicle accidents	1, 489	1, 222	267
Firearms and ammunition	963	555	408
Falls, jumps	106	77	29
Athletics and sports	124	88	36
Ill-fitting clothing			
Fire or heat	60	49	11
Tools, instruments	64	57	7
Chemicals	128	98	30
Excessive heat	29	26	3
Excessive cold	3	1	2
Other agents	799	555	244
	Annual rate per 100,000 mean strength		
Total	208. 19	182. 54	324. 53
Aircraft accidents	92. 09	79. 86	147. 50
Vehicle accidents	45. 92	45. 99	45. 58
Firearms and ammunition	29. 70	20. 89	69. 65
Falls, jumps	3. 27	2. 90	4. 95
Athletics and sports	3. 82	3. 31	6. 15
Ill-fitting clothing	0	0	0
Fire or heat	1. 85	1. 84	1. 88
Tools, instruments	1. 97	2. 15	1. 20
Chemicals	3. 95	3. 69	5. 12
Excessive heat	. 89	. 98	. 51
Excessive cold	. 09	. 04	. 34
Other agents	24. 64	20. 89	41. 65

Other variations in agent pattern included snakes and other reptiles as a biologic contribution to the more common physical agents of disease. In no theater did they play a prominent role in accidental trauma.

Among chemical agents in accidental injury, methyl alcohol was a considerable factor during the continental phase of operations in the European theater. An interesting variable of agents active overseas was the cited instance during 1 month in a Pacific island area when 50 percent of the nonbattle injury deaths were due to falling trees, weakened by preinvasion naval gunfire.[26]

[26] ETMD, SPA, 2 Dec 43. HD: 350.05.

TABLE 17. PRINCIPAL CAUSES OF ACCIDENTAL DEATH, SELECTED THEATERS OF OPERATION, WORLD WAR II, UNITED STATES ARMY, BY PERCENT OF ALL ACCIDENTAL DEATHS

Theater and year	Aircraft	Motor vehicle	Drowning	Firearms, explosives
European: 1943 [1]	54. 5	13. 0	2. 5	8. 5
Southwest Pacific: 1943 [2]	54. 5	11. 3	8. 7	10. 7
North African: January–May 1944 [3]	30. 3	21. 8	5. 1	18. 5
South Pacific: September 1942–August 1944 [4]	30. 6	12. 0	21. 7	20. 2

[1] Gordon, J. E.: History of preventive medicine in European Theater of Operations, 1941–1945. HD: 314.7-2.
[2] ETMD, SWPA, Jun 1944. HD: 350.05.
[3] ASF Monthly Progress Rpt, Health, 30 Sep 44.
[4] ETMD, SOPAC Base Comd, Nov 1944. HD: 350.05.

Host or Population Factors in Causation

Many factors, such as anatomic structure, physiologic state, psychical constitution, and intrinsic characters contribute to accidents just as to disease.

The initial physical examination upon entrance into the service eliminates many physically handicapped individuals. However, there are special assignments in various branches of the services which make greater demands on physical qualification than are called for by entrance requirements to service. Complicated mechanized army equipment should be designed with consideration of the physical limitations of individuals operating the equipment. Considerable research initiated by the Preventive Medicine Service, Office of The Surgeon General, was conducted at the Armored Medical Research Laboratory at Fort Knox, Kentucky, on anthropometric measurements especially in relation to the design of tanks. Studies were also made on the physiologic and psychologic requirements of tank crews. This material was turned over to the Ordnance Department for use in the design of tanks.

Fatigue. Fatigue is another important factor. A fatigued individual often reacts sluggishly to stimuli at a time when precision and accuracy are essential and thus the liability to accidents is increased. In an overseas theater this factor is of no small consequence, because of the many circumstances calling for extreme effort.

Alcohol. Increased blood alcohol levels are capable of altering the reaction of individuals and may be a factor in the production of accidents. In the 1939 Army survey,[27] in 636 out of 19,707 injuries, or 3.2 percent, alcohol was considered a contributing factor. In one Australian mainland base, surveyed over a 3-month period in 1943, in patients with nonbattle injuries entering general hospitals of the base, the influence of alcohol was assessed as follows:[28]

[27] Annual Report of The Surgeon General, U. S. Army, 1940. Washington, Government Printing Office, 1941.
[28] See footnote 25, p. 251.

> . . . . Sixty percent of the days lost were attributable to traffic accidents, in 6 percent of which alcohol was a contributing factor. Twenty-seven percent of the days lost were allocated to burns, and 13 percent to personal assaults and injuries. In 49 percent of the latter group alcohol was a contributing factor.

In overseas areas during active operations, the availability of alcohol varies greatly. When beer and whiskey are not available, substitutes in the form of methyl alcohol, canned heat, and antifreeze have been used, all with serious toxic hazards.

Accident Proneness. Another inherent factor on causalty of accidents is the concept of accident proneness. The characteristic is otherwise referred to as that of accident repeaters or the accident habit. Such a concept raises the question of possible differences among individuals in liability to accidents, and if such differences exist, how they can be detected. A considerable amount of literature on accident proneness had been published before the onset of World War II but these studies had brought no definite tests for identification of such individuals. Flanders Dunbar [29] reported the results of psychosomatic studies among industrial workers and members of the Armed Forces. In a psychosomatic study of cardiovascular and diabetic patients a control group had been selected, composed of patients with fractures admitted to the same hospital. On the basis of observations on these patients with fractures the author felt that the accident-prone person belonged to a personality type which could be described with fair accuracy. Such individuals give a history of a large number of previous accidents, and a lack of colds, indigestion, or other "vegetative disturbances." They did not finish educational courses which they undertook, whether grammar school, high school, or college. They had an unstable work record and changed jobs frequently. There was a tendency to focus on immediate values rather than on long-range goals, to appear casual about feelings and personal problems, and to avoid responsibility—to live from day to day. Dunbar concluded by stating:

> I would suggest that those persons in charge of selective service or industrial activity be on the lookout for persons of the types here delineated and that such persons be given special attention in placement and treatment. It has been suggested, for example, that a person who is accident prone would probably do better in a commando or a paratroop unit or in some other more or less individualized and adventurous assignment, just as persons who are potential sufferers from cardiovascular disease, if they follow the coronary or anginal pattern, will do better and maintain health longer if given recognition and authority.
>
> Whether better suggestions than these could be made will remain for those in charge of Army personnel to discover. The aim in this article was merely to call attention to the possibility of excluding from service persons with a well confirmed accident habit who may prove to be a liability to themselves and others or of placing them in such a way that their liabilities may prove if not an asset at least a minimal danger.

* * * * * * *

[29] Dunbar, F.: Medical aspects of accidents and mistakes in the industrial army and in the Armed Forces. War Med. 4: 161–175, Aug 1943.

In considering whether such persons should be rejected, carefully placed or treated, the material given here may be useful. Because of the limited time and personnel available for medical and psychiatric examination, it seems obvious that the greatest possible use should be made of social workers and public welfare agencies in supplying the specific details of past history here indicated as having a bearing on the problem.

The fact cannot be too much emphasized that persons whose histories suggest accident proneness are of most vital interest. Such persons can make the kind of mistake that sinks a ship, loses a battle or explodes a munitions plant. And apart from its consequences, the mistake will appear to be just the kind of unfortunate mistake that any one might make. But, nevertheless, there is evidence that only certain types of people make such mistakes.

Personality Changes. Menninger,[30] after the war, brought attention to the personality factor in accidents by stating, "A small minority of combat soldiers were unable immediately to rechannel their aggressive behavior into socially approved activity. Following VE and VJ days in the various theaters, although no figures are available, it was apparent that automotive and traffic accidents increased."

Brigadier General Bliss [31] in a letter to the Army Assistant Chief of Staff G–4, 23 August 1945, stated: "Early termination of hostilities in the Pacific will result in an immediate increase in anticipated evacuations from that area rather than the reverse. However, most of these evacuees will represent disease and non-battle injury patients rather than battle casualties."

The intrinsic characteristics of age, sex, and race were not analyzed in respect to accidents during the war experience of 1941–45. Alterations in age composition for the Army as a whole were recognized, primarily as a reflection of changes in the draft policy bringing a lower age at induction. A correlation with frequency of accidents is not known.

Environment

Physical aspects of the environment of man, such as weather, climate, season, soil, and terrain, were factors exerting a measurable influence on the incidence of accidents in different areas. In the United States a definite seasonal variation in incidence of admissions was observed for nonbattle injury. (See Chart 4.) Speculation could be offered as to the precise influence arising from these physical factors of environment as such, but data are insufficient for true evaluation.

The consideration of population pressures, crowding, density, and extent of movement are given considerable attention in evaluating causal factors in mass disease. An excellent illustration that these social factors of the environment contribute to accidents, along with others relating to host and to agents,

---

[30] Menninger, William C.: Psychiatry in a Troubled World. New York, Macmillan, 1948, see p. 150.

[31] Ltr, Brig Gen R. W. Bliss, Asst SG, to ACofS G–4, thru CG ASF, 23 Aug 45, sub: Zone of Interior hospitalization. SG: 322 Hospitals.

is seen in the 1945 annual report of the 8th Evacuation Hospital in the Mediterranean Theater of Operations. The report states:[32]

> The surrender of the German Army created the problem of handling thousands of German troops. . . . The overturning of one 10-ton trailer killed several and put the remainder of the 50 Germans in the hospital. During May, the roads were filled with a great variety of German vehicles, many of them in rather bad repair, manned by German drivers and transporting Germans to P. O. W. stockades at Modena, Florence and points south. . . .
>
> With the end of the war, a great deal of confusion arose. Added to the stream of German Prisoners of War were thousands of Italian civilians who suddenly decided to go somewhere other than where they were located. Roads were crowded with civilians, men, women, children and infants in arms, on foot, bicycles, carts, wagons, old cars and dilapidated trucks. Displaced persons and repatriated individuals trying to get home added to the confusion.
>
> Military personnel seemed also affected by the rush and confusion and continued to operate vehicles at high speed and in a reckless fashion. Accidents were frequent and tragic. A truck load of Russians, formerly German prisoners and labor troops, returning to Russia, overturned, killing one woman and sending 15 other individuals to the hospital. Italian civilians scrambling into an abandoned German ammunition dump for wooden boxes, precipitated an explosion that killed many and put 18 civilians in the hospital.
>
> A regiment of Czechoslovakian troops sent numerous patients to the hospital. German Prisoners of War continued to be admitted for illness and injury until the Prisoner of War hospital at Mantova began to function. During May, 592 patients out of a total of 2,183 admissions were due to accidents of various kinds, including accidental gunshot injuries. With the break-up and surrender of the German Army, unfamiliar weapons fell into the hands of the Allies as captured material and souvenirs. During the month of May, 42 soldiers shot themselves, and 31 more were shot by their buddies, while handling enemy guns, usually pistols.

In the European theater following V-E Day, the Commanding General, Third United States Army, undertook special measures, such as intensifying the activities of Military Police patrols on main highways, in order to curb motor accidents involving military personnel and resulting from speeding and reckless driving. It is an ironical fact that several months thereafter he himself died as the result of a motor accident.

A separation of accidents by rank and service was made in the Southwest Pacific theater in April 1944 (Table 18) representing in all some 2,676 cases. Although personnel of the Corps of Engineers suffered 17 percent of the injuries, no statement of strengths was provided by which to determine rates.[33]

The Fifth United States Army conducted a study of battle casualties and nonbattle casualties from the standpoint of military occupational specifications (Table 19).[34] The observations were based on the experience of the 3d, 34th, 36th and 45th Infantry Divisions while in combat between 9 September 1943

---

[32] Annual Rpt, 8th Evac Hosp MTO, 1945. HD.

[33] See footnote 14, p. 246.

[34] Monthly Progress Rpt, Sec. 7, Health, Sep 1944.

and 4 April 1944. The experience was thus heavily weighted by winter operations. During this period the rates were 3.7 for battle casualties and 4.7 for nonbattle casualties. For the Fifth United States Army during the period December through March the average rates were 1.2 for battle casualties and 3.3 for nonbattle casualties. For the Mediterranean theater as a whole, from 1 October 1943 to 1 April 1944, the rates were 0.4 for battle casualties and 3.0 for nonbattle casualties. By a wide margin the occupation of rifleman was the most dangerous. Both battle and nonbattle casualty rates were about twice as high as those for artillerymen (gunners), the next highest group. Before reasonable conclusions can be made about accidents, the material must be considered in terms of Chart 2. In the analysis under consideration, nonbattle casualty included both disease and cold injury. Cold injury has a high incidence among riflemen. The analysis states:[35] "Combat may be said to increase exposure to a wide variety of diseases and injuries, to hinder the precautionary measures usual under non-combat conditions and to impair physical and psychological reserves to a degree which renders the individual more susceptible to disease and injury."

A study of parachute injuries was made for the first and second years of parachute training at Fort Benning, Georgia.[36] From a total of 89,551 training jumps 1,386 injuries were noted, of which 272 were fractures and 2 died. During the first year of operations the total injury rate was 2.69 percent and the fracture rate 0.55 percent. During the second year the total rate was 1.48 percent and the fracture rate 0.29 percent. The injury rate was considered low in view of recognized hazards of parachute jumping. The possibility of effecting further reduction in accident losses through preventive measures was an outgrowth of this study.

SPECIAL STUDIES OVERSEAS

The following special studies are included because they represent important contributions to the prevention of accidental trauma overseas. They also represent examples of what can be done with a specific problem.

Low Back Injury

A survey of low back injury in the Persian Gulf Command[37] was made for the 20 months between 1 March 1943 and 31 October 1944. The command was composed of supply troops of all branches. A review of case records revealed that 466 individuals were hospitalized for one or another type of low back

---

[35] See footnote 34, p. 256.

[36] Tobin, W. J.; Ciccone, R.; Vandover, J. T., and Wohl, C. S.: Parachute injuries. Army M. Bull. 66: 202-221, Apr 1943.

[37] ETMD, Persian Gulf Comd, Oct 1944. HD: 350.05.

TABLE 18. SOUTHWEST PACIFIC AREA, UNITED STATES ARMY NONBATTLE INJURIES, APRIL 1944, BY TYPE AND ARM OR BRANCH OF SERVICE (2,676 COMPLETED CASES)

Arm or branch of service	Total nonbattle injuries	Lacerations	Abrasions and contusions	Other wounds	Strains and sprains	Fractures	Burns			Old injuries	Dislocations	Eye injuries	All others
							Gasoline	Chemical	Others				
Total Southwest Pacific Area	2,676	441	385	129	777	421	176	19	102	89	33	29	75
Officers		22	20	4	34	18	2	1	5	6	5	1	
Enlisted men		419	365	125	743	403	174	18	97	83	28	28	75
Engineers	442	81	73	25	108	79	23	1	16	15	3	4	14
Officers	10		3	1	3	2			1				
Enlisted men	432	81	70	24	105	77	23	1	15	15	3	4	14
Air Corps	423	58	51	26	142	60	32	1	20	13	2	9	9
Officers	46	12	4	2	12	6	2		3	3	1	1	
Enlisted men	377	46	47	24	130	54	30	1	17	10	1	8	9
Infantry	335	55	48	9	110	53	20	1	8	17	3	1	10
Officers	6		1		2	1		1		1			
Enlisted men	329	55	47	9	108	52	20		8	16	3	1	10
Quartermaster	253	45	40	4	84	38	15		10	6	4		7
Officers	5	1	1		2	1							
Enlisted men	248	44	39	4	82	37	15		10	6	4		7
Medical Corps	179	31	27	5	48	30	11	2	8	6	2	2	7
Officers	8		2		4	1					1		
Enlisted men	171	31	25	5	44	29	11	2	8	6	1	2	7
Ordnance	168	29	25	9	43	20	18	1	10	4		4	5
Officers	5	3			1	1							
Enlisted men	163	26	25	9	42	19	18	1	10	4		4	5
Field Artillery	119	24	14	8	31	18	5	5	4	5	1	2	2
Officers	3		1	1	1								
Enlisted men	116	24	13	7	30	18	5	5	4	5	1	2	2
Coast Artillery	115	18	7	9	28	23	10		5	2	6	1	6

Officers	1										1		
Enlisted men	114	18	7	9	28	23	10		5	2	5	1	6
Signal Corps	112	17	7	3	30	19	13	1	8	6	1	2	5
Officers	2	1				1							
Enlisted men	110	16	7	3	30	18	13	1	8	6	1	2	5
Cavalry	70	18	5	6	19	7	10		1	1	1	1	1
Officers													
Enlisted men	70	18	5	6	19	7	10		1	1	1	1	1
Nurses	15	2	4		5	2				1	1		
Others	445	63	84	25	129	72	19	7	12	13	9	3	9
Officers	17	3	4		4	3			1	1	1		
Enlisted men	428	60	80	25	125	69	19	7	11	12	8	3	9

Source: ETMD, SWPA, Jun 1944. HD: 350.05.

TABLE 19. BATTLE AND NONBATTLE CASUALTIES BY MILITARY OCCUPATION SPECIALTY, FOUR INFANTRY DIVISIONS, FIFTH UNITED STATES ARMY, OCTOBER 1943 THROUGH MARCH 1944

Military occupational specialty		Percent of division casualties			Casualties per 1,000 table of organization strength per division combat day		
Number	Title	Battle	Non-battle	Total	Battle	Non-battle	Total
745	Rifleman	38.1	25.5	30.4	12.2	10.7	22.9
603	Gunner	8.0	5.5	6.4	6.2	5.5	11.7
653	Squad leader	8.1	7.5	7.8	5.2	5.9	11.1
761	Scout	1.1	1.0	1.0	4.9	5.5	10.4
657	Litter bearer	1.2	1.7	1.5	3.4	5.8	9.2
746	Automatic rifleman	3.9	2.9	3.4	4.8	4.3	9.1
652	Section leader	1.4	1.7	1.6	3.7	5.4	9.1
651	Platoon sergeant	1.8	1.8	1.9	3.9	4.7	8.6
504	Ammunition handler	8.3	9.0	8.7	3.6	4.8	8.4
238	Lineman telegraph and telephone.	1.4	2.0	1.8	2.7	4.7	7.4
675	Messenger	2.6	2.5	2.6	2.8	3.3	6.1
610	Antitank gunner	1.0	1.0	1.0	2.4	3.3	5.8
060	Cook	.7	1.9	1.4	1.2	4.5	5.7
531	Cannoneer	1.2	2.7	2.1	1.4	4.2	5.6
245, 345	Truck driver	2.6	7.0	5.3	1.0	3.5	4.5
014	Auto mechanic	.4	1.0	.7	1.0	3.3	4.4
539	Section chief	.2	.5	.4	1.0	3.3	4.3
225	Surgical technician	.5	.7	.6	1.6	2.5	4.0
177	Radio operator	.5	.9	.7	1.1	2.4	3.6
521	Basic	4.0	4.1	4.0	1.4	1.9	3.3
821	Supply NCO	.2	.5	.3	.8	2.6	3.3
695	Orderly	.2	.4	.3	.9	2.1	3.0
405	Clerk typist	.2	.6	.4	.5	2.0	2.5
	Other enlisted men	7.0	13.1	10.9	1.8	3.7	5.5
	Total enlisted men	94.6	95.5	95.2	3.7	4.7	8.4
	Officers	5.4	4.5	4.8	4.0	4.2	8.2
	Total division	100.0	100.0	100.0	3.7	4.7	8.4

Source: ASF Monthly Progress Rpt, Sec. 7, Health, 30 Sep 44.

condition, some having as many as 6 admissions. Distribution according to branch is shown in the following tabulation:

Branch	*Cases*
Quartermaster	104
Engineer	91
Port personnel	73
Ordnance	71
Railway	51
Medical personnel	26
Military police	12
Others	38
Total	466

Of the 466 patients, 138 were truck drivers who were either actually injured while driving or complained of aggravated symptoms while so engaged. Of the 138 patients, 94 were Quartermaster Corps truck drivers, accounting for all but 10 of the total low back injuries sustained by Quartermaster personnel. Many reasons in explanation of the undue incidence were considered such as (1) rough roads, particularly in the early months of the command when 8 to 12 hours were required to negotiate an average run of 150 miles; (2) hard, uncomfortable seats, particularly in the Studebaker 6 by 4 and 6 by 6 trucks, causing every bump to vibrate through the driver's body; (3) lack of drivers' belts as supports (not included in the tables of equipment); (4) long hours of driving with insufficient rest periods during peak tonnage months; (5) continued use of army cots which develop "sags" and do not afford relaxation to tired back muscles; and (6) failure of the drivers to seek proper massage and heat for tired back muscles after a run, and failure to report the conditions until the symptoms were severe. Accidents were more frequent during the early months in the theater and, therefore, more of these injuries were incurred. One hundred patients, approximately 21 percent, were transferred from a station or field hospital to the general hospital serving the command; and 20 were evacuated to the Zone of Interior for further observation and treatment. Specific preventive recommendations were made and are considered in greater detail under Control Measures.

Accidental Eye Injuries

A survey of eye injuries was made at the 21st General Hospital, Eye Center, North African Theater of Operations, for the period 10 May 1944 to 1 August 1944.[38] The types of cases were distributed as follows:

Battle casualties	135	(49.4 percent)
Eye disease	101	(37.0 percent)
Accidental injury	37	(13.6 percent)

[38] ETMD, NATO, Sep 1944. HD: 350.05.

The dispositions made of 212 of these cases are shown in Table 20. Twelve accidents happened near the frontlines, while 25 occurred in rear areas. The causes were extremely varied. Seven mechanics, struck by flying particles while at work, constituted the largest group from a single cause.

TABLE 20. EVENTUAL DISPOSITION OF 212 PATIENTS WITH EYE INJURIES, NORTH AFRICAN THEATER OF OPERATIONS, UNITED STATES ARMY, 1944

Type of casualty	Number	Evacuated to Zone of Interior		Returned to duty class B permanent		Returned to duty A-1		Type of disposition unknown	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	212	68	32.0	26	12.2	110	51.8	8	4.0
Battle casualties	88	53	60.3	8	9.1	25	28.4	2	2.2
Accidental injury	37	6	16.2	8	21.6	22	59.4	1	2.8
Disease	87	9	10.3	10	11.4	63	72.4	5	5.9

Source: ETMD, NATO, Sep 1944. HD. 350.05.

Burns

In the North African Theater of Operations it was stated that:[39]

> The great majority of burns in the theater occur in the Lines of Communications, from accidents and unauthorized use of gasoline. During the month of August, the 73rd Station Hospital, sited in Constantine, records 222 admissions to the surgical service, 94.8% of which were non-battle casualties; 10.35% of admissions were for burns. It is stated that 65% of the burns were caused by accidents with the fire units of field ranges.
>
> The 54th Station Hospital in Tunis reports 53 burns, many severe, among 998 surgical admissions, 108 of which were battle casualties.
>
> Gasoline burns often involve large areas of body surfaces, but tend to be negligible in depth. Only rarely is skin grafting required. This impression is gained from examination of large numbers of these burns and from reports of the surgeons in the Mateur-Bizerte area during the summer months. It is contrary to the impressions received at the 12th General Hospital, where large numbers of burns are treated in Mediterranean Base Section. This, however, was during the cold and damp spring months. It is suggested that, in the hot (95°–110°) dry summer climate of Tunisia, gasoline tends to vaporize more readily and produces a true flash explosion of short duration. Full thickness burn areas are produced by contact with the flaming liquid as it is thrown into the air by the explosion, or spilled from the burning container. It is quite possible, therefore, that during the approaching cool rainy season, the gasoline burns may be more severe. Such variables, always modifying the pattern of trauma, constantly must be kept in mind in judging the relative merits of therapeutic procedures.

Later from this theater the 12th General Hospital made a survey of burns during the first 8 months of its operation, from 26 January to 26 September

[39] ETMD, NATO, Sep 1943. HD: 350.05.

1943.[40] The causes of burns were related to battle casualties in 49 instances (32.5 percent), and to accidental injuries in 102 (67.5 percent), a total of 151. The specific circumstances associated with accidental burns were gasoline fire in 77 cases, and burning plane, car, or motorcycle in 9 cases, to account for 84.3 percent of the total. Seven other cases were related to electricity; 5 to boiling water or steam; 1 each to mustard gas and shell explosion; and 2 were due to acid burns. A startling fact is that 85 percent of the accidental burns were the result of the use of gasoline in the bivouac area. When analyzed further, it was noted that the cause was the abuse of the use of gasoline. Americans in civilian life seldom use gasoline for heating and cooking but overseas it was common practice, with the result that unnecessary accidents were bound to occur unless instructions were given on the precautions to take. Some accidents were the result of explosion while lighting or filling various types of stoves; others were the result of pouring gasoline on an open flame; and still others were from cleaning clothes or equipment in the presence of an open fire. Some few were the result of using gasoline for burning garbage or insects. The final disposition of 102 cases of accidental burns was that 51 (50.0 percent) were sent to the Zone of Interior; 6 (5.9 percent) were classified limited service and 43 (42.1 percent) returned to combat duty. There were 2 (2.0 percent) deaths.

The most important group were the 86 cases of preventable burn resulting from the use or abuse of gasoline. Of this group more than half (44) had to be returned to the Zone of Interior. Many of these gasoline burns were serious, since 53 required skin grafting and the 2 deaths of the total burn cases were included. Deeply burned areas were frequent, because of clothing catching on fire.

Poison Liquor

Accidental poisoning by alcohol or substances thought to be alcoholic is to be expected in areas where the supply of ordinary alcoholic beverages is short. In the European theater 178 deaths were attributed to alcohol poisoning or a rate of 0.12 per 1,000 strength per annum for the period October 1944 to June 1945.[41] During the same period acute communicable disease accounted for 162 deaths, a rate of 0.11.

Prior to the invasion of the Continent, in the United Kingdom, there were few difficulties. Beer was available, and although hard liquor was scarce, it could be obtained in recognized bars.

On the Continent the situation was very different. Beer was limited and wine did not have the potency of whiskey, so that frequent attempts were made to fortify wine with alcohol of undetermined quality. Samples of this liquor

[40] ETMD, NATO, Feb 1944. HD: 350.05.
[41] See footnote 13, p. 245.

were examined by the central laboratory of the theater in Paris. Methyl alcohol was the cause of most deaths, but other substances such as antifreeze and buzz bomb fluid were used accidentally or in the belief that they were potable. The majority of deaths due to methyl alcohol and other toxic agents were among ground combat troops. The Air Corps and troops of the communications zone were less involved, chiefly because their source of liquor supply was better and substitutes were not necessary.

Control Measures

In making a general evaluation of the accident problem in the years before the war, reports of The Surgeon General had stated that effective control measures would come through analysis of the individual local post or area. Colonel Cohen suggested that the medical officer contribute through an epidemiologic analysis of the situation, and that unit safety officers be appointed.[42] Major Fineberg, who made a detailed analysis of accidents during maneuvers, made specific recommendations for control of accidents under such circumstances.[43] In overseas theaters, European, Mediterranean, and Southwest Pacific, reports based on medical records were submitted to commanders for formulation of programs and evaluation of the problem. Special problems such as low back pain, burns, and poison liquor were studied. In the European theater an estimate of the amount of preventable accidents was made and given with other data to the provost marshal, Table 21. Eight principal causes were shown to be responsible for the accidents of about 20 percent of those able to return to duty, 50 percent of those evacuated to Zone of Interior, and 80 percent of the deaths. The approach to prevention was demonstrated. In the Mediterranean theater the extent of the manpower loss was brought to the attention of the Mediterranean theater staff by the theater surgeon and a safety committee was formed and drafted.[44] Theater G–1 (personnel) was given the staff supervision responsibility and the theater provost marshal the operational responsibility.

In the Southwest Pacific the accident prevention program was delegated to the Office of the Assistant Chief of Staff, G–3 (Training) by the commanding general and a suitably trained Sanitary Corps officer was assigned as accident officer.[45] Commanders of all bases and units under their command were instructed to appoint an officer to act as accident prevention officer. Pertinent data relative to the causes of nonbattle injuries, together with corrective measures for their reduction, were prepared by theater headquarters, and sent through channels to all base and unit accident prevention officers. Accidents occurring within each unit were recorded and analyzed by base and unit acci-

[42] See footnote 5, p. 240.
[43] See footnote 6, p. 240.
[44] See footnote 15, p. 246.
[45] ETMD, SWPA, Dec 1944. HD: 350.05.

TABLE 21. SELECTED PREVENTABLE CAUSES OF NONBATTLE INJURIES, EUROPEAN THEATER OF OPERATIONS, UNITED STATES ARMY, FEBRUARY 1942 TO MARCH 1944

Cause of accident	Percentage which specified types of accidents constituted of all nonbattle injuries where the patient was—								
	Returned to duty			Evacuated to the Zone of Interior			Died		
	1942	1943	1944 January–March	1942	1943	1944 January–March	1942	1943	1944 January–March
Motor vehicle accidents	9.4	7.9	6.2	17.2	21.8	19.0	18.2	12.9	17.7
Tank and tractor accidents	.5	.3	.4	2.9	0	0	0	.4	.9
Bicycle accidents	2.9	5.1	2.9	2.3	7.6	6.0	1.6	1.2	.5
Other road accidents	1.0	.8	.3	2.9	2.2	0	0	2.2	2.6
Air transport accidents	2.3	3.5	2.2	.6	5.5	1.0	39.6	54.2	44.0
Firearms	2.9	2.2	1.3	17.8	15.3	13.0	13.0	8.5	21.7
Machinery	1.0	1.6	.9	1.1	5.5	1.0	.5	.6	0
Burns	.6	0	.9	0	0	0	0	0	0
Total	20.6	21.4	15.1	44.8	57.9	40.0	72.9	80.0	87.4

Source: Gordon, J. E.: History of preventive medicine in the European Theater of Operations, 1941–1945. HD: 314.7–2.

dent prevention officers and immediate corrective and/or disciplinary action was taken. The program was publicized by radio broadcasts, lectures, news bulletins, signs, posters, slogan contests, moving pictures, and film strips. Particular emphasis was also placed on measures to be taken for reducing the destruction and loss of vital equipment and supplies through carelessness and accidents. It was also suggested that an instructional and training program, devoted to swimming, be instituted through each Base S–3. The aid of the special service officer and Red Cross representative was utilized to develop such a program for reducing accidents and casualties resulting from swimming and diving, and to prevent drowning. It was estimated that 65 percent to 70 percent of the soldiers were unable to swim and that only 5 percent were proficient swimmers.

In the European theater where the problem of poison liquor was becoming evident, efforts were made to provide sources of safe and relatively mild drinks.[46] A team consisting of a sanitary engineer, a toxicologist, and a beverage expert from Special Services Division, Headquarters, made special surveys of facilities for providing beer and soft drinks for the troops. Most of the breweries, many of which had closed during the war, were found acceptable when operated under American sanitary control. Breweries were reopened, processes were modified, facilities were occasionally provided to local operators,

[46] See footnote 13, p. 245.

and an adequate supply of beer was assured. No instance ever came to the attention of Army authorities of an outbreak of intestinal infection traced to beer.

Suggestions for the reduction of burns were made from the North African theater in March 1944. That headquarters recommended: [47]

> To prevent such unnecessary injuries, it would seem possible that the various types of stoves used for cooking or heating should be made more "foolproof," since explosions resulting from the use of improper type of fuel or failure to clean the jets are too common. The proper method of making, lighting, filling and cleaning the various types of G–I or improvised stoves, should be better demonstrated and unless their use is absolutely necessary the use of such stoves should be discontinued.
>
> The average soldier is not acquainted with the potential dangers of improper use of gasoline. This is demonstrated by the statements overheard on a "burn" ward where other patients see these seriously injured men and are amazed that such injuries can and do result from gasoline.
>
> Gasoline is too vital an item of war to be used for cleaning clothing or burning garbage and some conservation could be accomplished by disciplinary measures.
>
> To summarize, it would seem possible to reduce the incidence of accidental burns by:
>
> 1. Proper instruction in the danger of the indiscriminate use of gasoline.
> 2. Proper instruction in the use of the various stoves that require gasoline for fuel.
> 3. Disciplinary measures where infractions have occurred after the men have been instructed.
>
> It would seem possible to attain all of these aims by the use of a well prepared color movie that could demonstrate to the troops what might be a real cause of disability to themselves and the loss of important equipment by the careless use of gasoline.

In the Persian Gulf Command certain measures for the reduction of low back injuries were suggested: [48]

1. General Measures for Reducing Back Injuries
   a. Don't lift loads too heavy to lift or support normally.
   b. Always face swinging loads and cables.
   c. Don't push heavy loads with body "off balance."
   d. Learn to lift objects correctly (lift with legs and back, not back alone).
   e. Don't stand under heavy loads.
   f. Never be in such a hurry as to be careless.
2. Special Measures for Reducing Truck Driver Low Back Injuries
   a. Have better cushioned seats for drivers (even if it is a supplemental cushion and back rest.)
   b. Have sufficient belts provided so that all deserving cases can wear one.
   c. Provide adequate rest periods for drivers between long hauls.
   d. Provide, preferably, a hard surface bed, one that will not sag.
   e. Advocate massage and heat to backs after a long trip (This should be done preferably by trained personnel, as it relieves fatigue symptoms early).
   f. Avoid sudden jerking motions while shifting or making a curve.
   g. Avoid accidents.

---

[47] See footnote 40, p. 263.
[48] See footnote 37, p. 257.

Conclusion: Low back injuries appear to be one of the outstanding forms of injury among troops, requiring long hospitalization or loss of time from normal duties. As brought out in this report, this is particularly true among truck driver personnel in all branches of the service. If some, or all, of the suggested measures can be taken to afford relief, or prevention of injuries, the noneffective rate among troops can be greatly lowered. Troop commanders have a great responsibility in preventing injuries of this nature. If they will conduct lectures and safety campaigns for instruction of troops and better understand these injuries and their treatment themselves, perhaps, more than anything else, this would prove to be one of the best forms of prophylaxis.

Evaluation

The Medical Department had been pointing out the increasing importance of nonbattle trauma before World War II, and during the war, especially in overseas theaters where admission and death rates were high. The Medical Department tabulated the data which enabled commanders to see the tremendous loss of manpower and thus establish programs of control. In the Mediterranean theater there was a marked drop in the nonbattle injury admission rate in 1945 and the theater surgeon felt this was due to the Accident Prevention Program.[49] In the Southwest Pacific, a comparison was made of accident rates during the 8 months prior to the initiation of the program and the 5 months after it.[50] This analysis revealed the following:

Hospital and quarters cases of non-battle injuries averaged 18.9 days per patient for 1943, 16.3 days for 1944. This represents a reduction of 13.7% in average hospitalization time per patient admitted to hospitals and quarters for non-battle injuries.

The average non-effective rate for non-battle injuries was 8.5 per 1,000 per annum for 1943, 7.0 per 1,000 per annum for 1944. The reduced rate with a strength of 750,000 has resulted in saving of 1.125 man days per day in the SWPA. Because of this reduction in rate, approximately 1,000 more hospital beds are released every day and approximately 125 more men are available for duty every day who would be confined to quarters as a result of non-battle injuries.

Twenty-two more men would have been evacuated to the U. S. and 8 more would have died from non-battle injuries if the same rate for 1943 had prevailed for the first 6 months of 1944.

Admission rates of non-battle injuries to hospitals and quarters for the 6 month period previous to the initiation of the Accident Prevention Program was 174 cases per 1,000 per annum; the 5 months following the initiation of the program shows 146 cases per 1,000 per annum, a reduction of 16%. With a strength of 750,000, this reduction in rate will result in a decrease of 5,700 admissions to sick reports for non-battle injuries per year.

Such an evaluation (see Chart 5) certainly brings out the importance of prevention of nonbattle trauma in the saving of life as well as of medical facilities.

The contributions of the Industrial Hygiene Section, Preventive Medicine Division, Office of The Surgeon General, are more difficult to evaluate. Their

[49] See footnote 15, p. 246.
[50] See footnote 45, p. 264.

effort to promote industrial medicine contributed toward a good working environment and aided effort to place the individual in a job within his physical capabilities. These factors are important in accident prevention. The work on anthropometric, physiologic, and psychologic measurements at the Armored Force Medical Research Laboratory provided data for the design of vehicles and equipment which could be used more effectively and safely by the soldier. The activities of this laboratory are discussed further in the chapter on Occupational Health in another volume in this series.

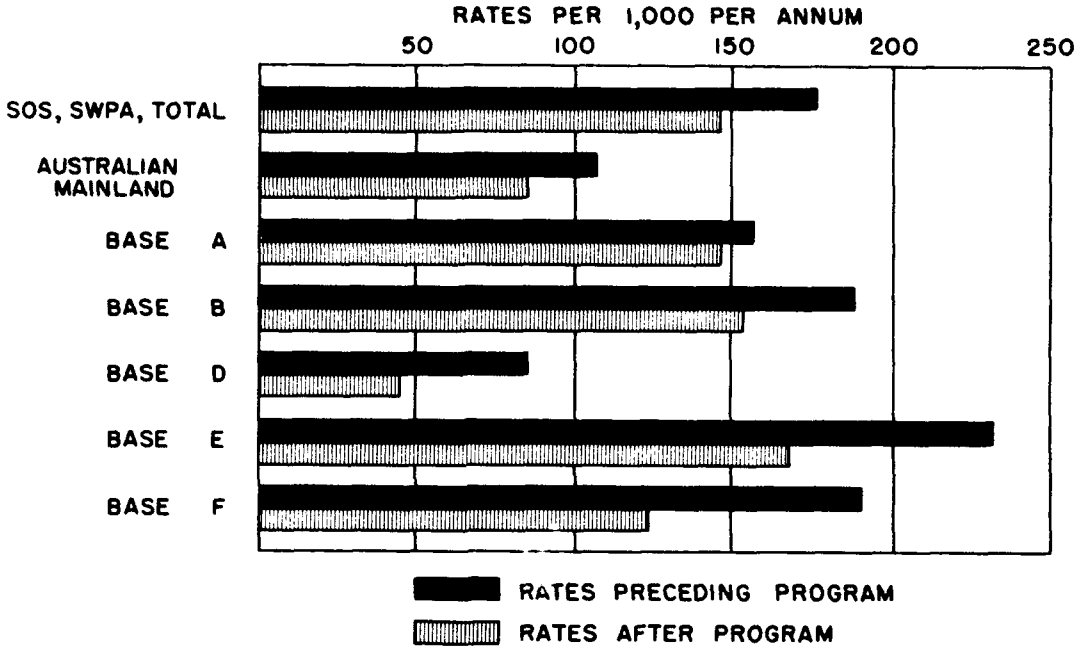


Chart 5. Nonbattle injury rates. A comparison of hospital admission rates for 8 months preceding accident prevention program and for 5 months after institution of program. Source: ETMD, USAFFE, Dec 1944. HD: 350.05.

In future operations the problem of alcoholic beverages and nontoxic beer needs serious consideration. The American soldier will find a substitute which may be poisonous, if a supply is not available.

In addition, the lack of knowledge of the use of gasoline was evident throughout World War II, and instruction in its use should be given serious emphasis early in the training of the soldier.

As the war progressed, need was demonstrated for better classification and reporting of injuries, especially those occurring overseas in theaters of operations. The Army Safety Program system had been developed for analysis of the agency, act, and action of accidental injury. This should be fused with medical records of type of injury, duration of hospitalization, disability, and

discharges in order to define the problem as to time, place, and person, and as to the resulting death, or extent of defect and disability.

There is need for continued study on basic research on anthropometric, physiologic, and psychologic factors which would guide engineers in designing new equipment. The concept of accident proneness requires further testing to establish its validity and to determine whether objective or subjective physiologic or psychologic tests can be developed to detect such persons.

As the war closed, the outstanding demonstration was the need for many professions to combine and work on the problem of accidental trauma, which had become recognized finally as one of the major mass health problems of armies; indeed, a problem that develops even greater significance as armies become increasingly mechanized.

CHAPTER VIII

The Army Immunization Program

Colonel Arthur P. Long, MC, USA

The Army immunization program was a positive, direct, and specific approach to disease prevention and control. This program as it developed just before and during the war period represented a very considerable expansion of the application of immunization procedures in the Army. The pattern for the extended program was set at an informal meeting of representatives of the medical services of the Army, Navy, and the United States Public Health Service. At this meeting, called by Lt. Col. James S. Simmons (later brig. gen.), MC, in the spring of 1940, a general program considered desirable in the event of war was outlined. It was the consensus of the group that tetanus immunization in the Armed Forces should be instituted at the earliest possible date.

The Army immunization program, as it was evolved and applied, required not only the acquisition and application of the best available professional knowledge and techniques but also the rapid development of effective mechanisms to insure adequate administrative control and technical guidance. The general supervision of the Army immunization program was one of the major functions of the Epidemiology Division of the Preventive Medicine Service, Office of The Surgeon General. Many of the technical problems related to this program, as well as the administrative details, were handled by that division. The following is an outline of the activities of the Epidemiology Division in connection with that program:

1. Collection of the necessary information and establishment of policies governing the various immunization procedures.

2. Compilation and publication of general and specific instructions on various administrative and technical matters.

3. Investigation and evaluation of the development and improvement of materials and procedures.

4. Investigation and study of problems arising in connection with the immunization program such as the indications for special immunizations, occurrence of reactions, and efficacy and practicability of various procedures and methods.

5. Provision of technical advice and assistance to the Supply Service, Office of The Surgeon General, with respect to estimates of requirements, procurement, distribution, and storage of prophylactic biologicals.

6. Conduct of miscellaneous correspondence with both civilian and military personnel and agencies and with various governmental and civilian groups concerning the immunization program.

It is the purpose of this chapter to present a review of the entire program, to trace as accurately as possible the important steps in the development, adoption, and use of each of the various immunizing procedures authorized by the Army during the war, and to summarize and evaluate the experiences gained. In the interest of uniformity of presentation and to facilitate reference, discussion of the individual procedures will be presented under the general headings of development and adoption of the immunizing agent, methods and requirements for immunization, and experience with the procedure. While emphasis is given to the developments arising from the demand of mobilization and conduct of the war, those procedures already practiced before the mobilization period are also discussed from the viewpoint of their application during the emergency. In addition to the discussion of the various immunizing agents and their use, an attempt is made to present the salient features of the general administration of the immunization program.

TYPHOID-PARATYPHOID VACCINATION

Development and Adoption

The full history of typhoid vaccination in the Army is a long one[1] and need not be recounted here. It is sufficient to state that the regular administration of typhoid vaccine to all Army personnel had been routine since 1911 so that at the beginning of World War II, this practice was almost an Army tradition.

The Immunizing Agent

For many years, including the period of World War I, the typhoid or typhoid-paratyphoid vaccine used in the Army had been that prepared at the Army Medical School. This was continued throughout World War II. These vaccines had undergone changes as to content from time to time, and intensive research and investigation had been continuous. As a result, the production of typhoid vaccine for the expanding Army and such changes as were required to meet the new situation were not new projects, but represented rather expansion and intensification of previous efforts and existing facilities. In 1928 the paratyphoid B fraction contained in the vaccine during World War I was eliminated; the paratyphoid A fraction was discontinued in 1934. From that time until the World War II emergency period, a monovalent vaccine containing *Salmonella typhosa* organisms only was used.[2]

[1] Siler, Joseph F., and others: Immunization to Typhoid Fever. Baltimore, Johns Hopkins Press, 1941.

[2] Ibid.

In view of the anticipated increase in field service of troops and likelihood of exposure to enteric organisms, in early 1940 it was considered advisable to readopt a triple or typhoid-paratyphoid vaccine. This decision was reached after careful consideration by a committee representing the Army, Navy, and United States Public Health Service. Acting on the advice of this committee, The Surgeon General on 9 July 1940 instructed the Commandant of the Army Medical School to prepare a typhoid-paratyphoid vaccine for distribution to the Army.[3] The triple vaccine was manufactured in September 1940 at which time official announcement of its readoption was made by Circular Letter 67, Office of The Surgeon General, 3 September 1940.

The vaccine contained in each cubic centimeter 1,000 million typhoid bacilli and 250 million each of the paratyphoid A and B components. The *S. typhosa* strain used was the Panama carrier strain 58 (Army Medical School culture collection No. 42–A–58); the Para B (*S. schottmuelleri*) organism (Army Medical School culture strain 41–H–6); and the Para A (*S. paratyphi*), originally Army Medical School strain 41–N–8, but replaced in 1942 by an English strain HA–6 (Army Medical School strain 41–N–22). Since the criteria for the selection of these strains is discussed at length elsewhere,[4] as are their characteristics, these will not be presented here. It is enough to state that they represented the most highly immunogenic strains obtainable and were selected on the basis of their virulence, their biochemic behavior and productivity of agglutinins and protective substances, and their production of cross-immunity against other strains of homologous species. These strains were continued in the manufacture of the triple vaccine throughout the war.

On some occasions questions were raised as to the specificity of this vaccine for protection against infection with strains encountered in overseas areas. For example in 1942 the occurrence of three cases of typhoid fever among American troops in India occasioned the recommendation by the surgeon of that theater that typhoid vaccine produced locally be used there in place of the Army Medical School product.[5] After study of strains isolated from cases in India and of the Indian-produced vaccine, it was determined that the United States Army vaccine was at least equal to the Indian vaccine in protection against the local strain of typhoid bacillus.

Methods and Requirements

At the beginning of the emergency, the vaccine was given in 3 subcutaneous doses administered at intervals of 7 to 10 days, the 1940 regulation reading ". . . intervals of not less than 5 nor more than 14 days between consecutive

---

[3] Ltr, SG to Commandant Army Med School, 9 Jul 40, sub: Change in the composition of typhoid vaccine manufactured for use in the U. S. Army. SG: 444.2–1 (AMS)GG.

[4] Longfellow, D., and Lulppold, G. F.: Immunization to typhoid and paratyphoid fevers. Am. J. Hygiene 38: 139–151, Sep 1943. Also see footnote 1, p. 272.

[5] Ltr, Surg CBI Theater to SG, 12 Dec 42, sub: Typhoid fever. HD: 720.3.

doses; ordinarily the doses will be spaced at intervals ranging from 7 to 10 days. . . ." The dosage was 0.5 cc. for the first dose and 1 cc. each for the 2 subsequent doses. The interval between series was stipulated as 3 years, with only 2 such series being required under ordinary circumstances. A complete series of 3 injections was required within 1 year of departure for theaters of operations, and provisions were made for revaccination in face of a threatened outbreak (individuals over 45 years of age were exempted from typhoid vaccination except under these circumstances). The method for the accomplishment of the first series of typhoid vaccine injections (the basic immunization) remained unchanged throughout the war except for the required time interval between individual injections. It was soon learned that the requirement of an interval "not to exceed 14 days between doses" was undesirable and impractical when applied to large numbers of troops in a rapidly expanding Army. Frequently, when for one reason or another this interval was extended, literal-minded officers (medical and nonmedical, commissioned and noncommissioned) would require the repetition of the entire series. To correct this undesirable practice, Army regulations governing immunization were revised in 1942 [6] and the circular letter implementing these regulations [7] did not state a maximum allowable interval between individual doses, but indicated that the desired interval was 7 to 10 days. If this time were exceeded, the next dose was to be administered as early as possible and the entire series was *not* to be repeated.

The recommendation concerning the interval between individual injections was again changed in 1944.[8] At that time the recommended interval was stated to be from 7 to 28 days. This policy was adopted largely for administrative reasons, chief among which was the desirability of simplifying the immunization schedules for individuals receiving the basic immunizations of typhoid and tetanus at the same time. Under the old system, with typhoid vaccination accomplished at weekly intervals and tetanus toxoid injections spaced every 3 weeks, at least 5 visits to the dispensary or other agency were required. By giving typhoid-paratyphoid vaccine and tetanus toxoid at the same time, a saving of 2 visits could be accomplished. This saving when translated into terms of hundreds of thousands of individuals was an extremely significant one. There was little hesitancy to accept this change of policy, from a technical point of view, since the 1-week interval was originally based on administrative grounds only and it is an accepted principle that in general and within reasonable limits the immunity response tends to increase rather than decrease with longer periods between the administration of individual doses of antigen in series. This hypothesis was borne out in part at least by the result of experimentation at the Army Medical School where it was determined that 3 doses

[6] AR 40–210, 15 Sep 42.
[7] SG Cir Ltr 162, 28 Nov 42, sub: Immunization.
[8] TB Med 114, 9 Nov 44.

of typhoid-paratyphoid vaccine when administered to rabbits at intervals of 3 weeks were just as effective in the production of protective antibodies as were similar amounts of the antigen administered at intervals of 1 week.[9]

The only other changes effected in the typhoid-paratyphoid immunization practices were those in connection with revaccination methods and requirements. Following the demonstration by workers at the Army Medical School and elsewhere [10] of the efficacy of 0.1 cc. of vaccine administered intradermally or of 0.5 cc. given subcutaneously as stimulating doses, serious consideration was given to the adoption of one or the other of these methods as routine practice in the Army. It was considered, however, that such a change in practice during the early phases of mobilization was not justified. This decision was based principally on the fact that prior to September 1940 the vaccine used by the Army for some years had been monovalent in type. Hence those who had received it rather than the triple vaccine had no basic protection against Para A or B, without which the effect of single small stimulating doses was questionable. Accordingly revaccination with the complete series of three injections of the triple vaccine was continued until 30 August 1943, at which time the practice of annual administration of 0.5 cc. of triple vaccine was adopted for reimmunization to the typhoid and paratyphoid fevers.[11] The subcutaneous route rather than the intracutaneous one was chosen since the response was known to be at least as good with the former as with the latter, and it was considered that the intracutaneous technique when applied to large numbers of troops was considerably less certain of proper accomplishment than was the subcutaneous method of injection and would inevitably be more time consuming. At the time of the adoption of this method of reimmunization, the exemption from revaccination of those over 45 years of age was removed, the only exemption remaining being that of the presence of a medical contraindication to the procedure.

To recapitulate, the final policy for the administration of typhoid-paratyphoid vaccine was briefly as follows: [12]

1. Initial immunization: 3 doses of typhoid-paratyphoid vaccine, 0.5 cc., 1 cc., and 1.0 cc. respectively, administered subcutaneously at 7- to 28-day intervals without unnecessary delay after entry into the Federal service.

2. Revaccination: 0.5 cc. typhoid-paratyphoid vaccine administered subcutaneously annually or in the presence of danger from an outbreak of typhoid fever or the paratyphoid fevers, this revaccination procedure to be followed if an initial series as above had been received at any time in the military service.

---

[9] Army Med School, "Comparative effectiveness of 1-week and 3-week intervals between doses of T. A. B. vaccine," 16 Oct 44. HD: 720.3 Typhoid and Paratyphoid.

[10] See footnote 1, p. 272.

[11] AR 40-210, C 6, 30 Aug 43.

[12] (1) AR 40-210, 25 Apr 45. (2) See footnote 9.

3. Initial vaccination or revaccination required within the 12-month period prior to embarkation for overseas duty.

Experience

Effectiveness. The effectiveness of typhoid vaccination as employed in the Army over a period of approximately 35 years has been generally accepted and requires little exposition here. In the historical review, previously referred to, were presented the results obtained from the inception of the procedure in 1909 through the year 1939.[13] These will not be repeated other than to recall that the incidence rates for typhoid and the paratyphoid fevers during World War I in a vaccinated Army were approximately one three-hundredths of those experiences in the Spanish-American War when no immunization was practiced, this difference being stated to be ". . . a result of the routine use of typhoid vaccine as a protective measure and improvement in methods of environmental sanitation."

A continuation of these excellent results is indicated by the fact that the combined average annual rates for these diseases during World War II was approximately 0.05 per thousand which is about one-eighth of the combined rate for World War I which was 0.42. Table 22 shows the cases and rates per thousand per annum for typhoid fever, paratyphoid fever, and the diarrheal diseases as they occurred in the Army during World War II, and Table 23 provides the same type of data as nearly comparable as possible for World War I.

[13] See footnote 1, p. 272.

TABLE 22. TYPHOID, PARATYPHOID, AND DYSENTERY, DIARRHEA, AND ENTERITIS, UNITED STATES ARMY, 1942–45

Rates Per 1,000 Troops Per Year

	Typhoid		Paratyphoid		Dysentery, diarrnea, and enteritis*	
	Cases	Rates	Cases	Rates	Admissions	Rates
Total Army	505	0. 02	839	0. 03	785, 164	30. 82
United States	91	. 01	125	. 01	294, 346	19. 97
Overseas	414	. 04	714	. 07	490, 818	45. 72
Europe only	64	. 01	84	. 02	92, 304	20. 98

*Relates to all dysenteries, enteritis, gastroenteritis, colitis, enterocolitis, and diarrhea (not elsewhere classified). No vaccination is applicable to these groups of diseases.

TABLE 23. TYPHOID, PARATYPHOID, AND DYSENTERY, DIARRHEA, AND ENTERITIS, UNITED STATES ARMY, WORLD WAR I

Rates Per 1,000 Troops Per Year

	Typhoid		Paratyphoid		Dysentery, diarrhea, and enteritis*	
	Cases	Rates	Cases	Rates	Admissions	Rates
Total Army	1, 529	0. 37	212	0. 05	92, 512	22. 4
United States	546	. 24	32	. 01	39, 854	17. 8
Overseas (Europe only)	885	. 53	151	. 09	48, 202	28. 9

*Relates to all dysenteries, enteritis, gastroenteritis, colitis, enterocolitis, and diarrhea (not elsewhere classified). No vaccination is applicable to these groups of diseases.

It will be seen that the rates for typhoid alone in the Army during the last war were only about one-twentieth of those experienced in the former conflict, while that for the paratyphoid fevers was about three-fifths that encountered in the earlier experience. This difference seems to be particularly striking when considered in the light of the rates for the diarrheal diseases which were essentially the same for both periods. This single observation might suggest that the chances of acquiring an enteric infection were approximately the same in both wars, that the nonspecific protective measures were equally effective during the two periods, but that the protection from specific vaccination particularly that against typhoid fever was considerably improved over that afforded in World War I. If such were the case, however, it would be reasonable to have expected the rates for the diarrheal diseases to have increased at least as much as did typhoid under the unfavorable conditions met in overseas theaters of operations. This did not occur since typhoid fever among troops stationed overseas was approximately 4 times higher than for those in this country while the diarrheal disease rates showed an increase of about 2 times. A ratio approximating this held for all the major theaters despite wide variations in the actual incidence of the diseases in question. For example, the European Theater of Operations reported the lowest typhoid and diarrheal disease rates for any major theater and the China-Burma-India theater, the highest. The European theater typhoid rate was essentially twice that in the United States and the diarrheal disease rate about the same. The typhoid rate in the China-Burma-India theater was 30 times greater than that in this country and the diarrheal disease rate showed an increase of about 6 fold.

This situation also obtained in World War I when the rate in Europe for typhoid fever was just over twice as high as in this country and the diarrheal disease rate was slightly over 1½ times that experienced here. The experience with the paratyphoid fevers essentially paralleled that with typhoid in this

regard, the former showing a slightly greater increase in incidence in overseas theaters than did typhoid fever.

This view of the occurrence of typhoid and paratyphoid fevers does not bring forth evidence against the efficacy of vaccination for the prevention of these diseases nor does it gainsay the probability of a considerably improved typhoid vaccine. These observations do, however, emphasize again that the incidence of typhoid fever and the paratyphoid fevers, as well as of the other enteric infections, tends to be in proportion to the opportunities for infection existing in the environment and that specific protection through vaccination does not eliminate the necessity for proper application of sanitary measures for the control of these infections.

Histories were received by the Epidemiology Division, Office of The Surgeon General, of most of the cases of typhoid and paratyphoid fevers reported in the United States during the war. In a number of instances it was apparent from these histories that the diagnosis had been made on insufficient evidence. There were a few individuals in whom the clinical course and laboratory findings were such that a diagnosis of typhoid or paratyphoid fever could be made with reasonable assurance in spite of failure to obtain positive cultures of the organisms from stool, blood, or urine. These cases, however, were not included in the data presented in Table 24. There were 42 cases of typhoid fever in the 4-year period from whom the organism was recovered and on whom clinical and epidemiologic information was received. Eleven cases occurred in each of the years 1942 and 1943, and 10 in the years 1944 and 1945. Twelve cases had had not only a basic series of typhoid vaccine injections but 1 or more stimulating doses in addition. Eighteen had had the basic series but no stimulating doses. In 9, the basic series had been begun but not completed at the time of onset of typhoid, and in 3, no vaccination had been done, the individuals having just been inducted. Among the 12 who had had a basic series and 1 or more stimulating doses, there were 8 who had had 1 stimulating dose, 3 who had had 2, and 1 who had had 4. This last case was a result of a laboratory infection as was 1 other in the series. The intervals which had elapsed between the last dose of vaccine and the onset of typhoid were studied for those individuals who had completed a basic series with or without additional stimulating doses. The interval was less than a week in 2 cases, between 1 week and 1 month in 3, 1 month to 6 months in 9, from 6 months to 1 year in 9, and in excess of a year in 6. It is of interest that in 1942, when men were being inducted at a rapid rate, the majority of cases of typhoid occurred in those who had not received a complete basic series of typhoid vaccine whereas in subsequent years, particularly in 1945, most of the cases had had not only a complete basic series, but 1 or more stimulating doses. In summary, it may be stated that except for the year 1942, most cases of typhoid fever in the United States occurred in fully vaccinated personnel and that such cases as did occur during the war in unvac-

cinated individuals were not due to failure to carry out immunization. It is also apparent that most of the typhoid occurred through failure of immunization to protect against the dosage of the infecting organism received. Whether the important factor here was the strain of the infecting organism, against which standard Army vaccine might not have been adequate to protect, whether it was the number of organisms ingested or whether it was some deficiency in the individual's ability to develop immunity after vaccination cannot be determined.

TABLE 24. IMMUNIZATION STATUS OF 42 CASES OF TYPHOID FEVER AMONG ARMY PERSONNEL IN THE UNITED STATES, 1942–45

CASES PROVEN BY POSITIVE CULTURES, ON WHOM HISTORIES WERE RECEIVED BY EPIDEMIOLOGY DIVISION, OFFICE OF THE SURGEON GENERAL

Immunization Record	1942	1943	1944	1945	Total
Typhoid Vaccine Received					
Basic series completed, stimulating dose(s) given	------	1	5	6	12
Basic series completed, no stimulating doses	4	9	3	2	18
Basic series not completed	6	1	1	1	9
No vaccination	1	------	1	1	3
Total	11	11	10	10	42
Number of stimulating doses given					
1 dose	------	1	5	2	8
2 doses	------	------	------	3	3
3 doses	------	------	------	------	------
4 doses	------	------	------	1	1
Interval From Last Dose to Onset of Disease (For Cases Who Had Completed Basic Series)					
Less than 7 days	------	------	1	1	2
1 week to 1 month	1	------	1	1	3
1 to 6 months	2	4	2	1	9
6 months to 1 year	1	5	1	2	9
More than 1 year*	------	------	3	3	6
Not stated	------	1	------	------	1
Total	4	10	8	8	30

*Of the 6 cases in this group, the interval was 12 to 15 months in 3.

Reactions. As pointed out previously, typhoid-paratyphoid vaccination has for many years been an accepted, almost traditional procedure in the Army. That this procedure is attended by local and systematic reactions has also become more or less generally accepted. Accordingly, the proportion of such reactions

in those receiving the vaccine is not definitely known nor has it been considered to be of enough importance to initiate a study of sufficient magnitude to allow such definition.

During only one brief period of the war were reports received indicating an unusually high occurrence of untoward reactions following the administration of this vaccine. This was during the first half of the year 1942 and the reports indicated reactions to typhoid-paratyphoid vaccine unusual both in number and degree when the vaccine was administered within 5 to 10 days following yellow fever immunization.[14] The occurrence of such reactions, however, was not sufficiently frequent nor were the reactions themselves of such severity as to warrant concern and the matter was automatically rectified with the discontinuance of routine vaccination against yellow fever. The matter was given considerable study, however, and it was considered that the apparent increase in reactions to typhoid-paratyphoid vaccine when this material was administered a short time after the yellow fever antigen were in the nature of a summation of reaction to the two agents (the febrile reaction to yellow fever vaccine having a usual incubation period of 5 to 7 days) rather than a true augmentation of the reaction from typhoid vaccine itself. This formed the basis for the recommendation that administration of typhoid-paratyphoid vaccine within a week following yellow fever immunization should be avoided whenever possible.[15]

Other than that just referred to, the experience with reactions from triple typhoid vaccine during World War II apparently differed little from that of previous years. A fairly high proportion of individuals receiving such vaccine will exhibit reactions, local or systemic or both. As previously indicated, the exact proportion of such reactors is not known. Previously published figures of 10 to 20 percent [16] are probably safely conservative. The most common reaction is that of local redness, heat, and tenderness at the site of injection. The systemic reactions encountered are characterized by general malaise, headache, and elevation of temperature. The second injection of the basic series is the dose most likely to cause reaction but untoward effects from stimulating doses are not uncommon particularly in individuals who have received several "basic series" or stimulating doses in the past.

SMALLPOX VACCINATION

Development and Adoption

Smallpox vaccination may well be classified as one of the most important measures for disease prevention that has been applied in military as well as in civilian populations. It has long been recognized that vaccination is, for

[14] Report of Conference on Yellow Fever, Typhoid Vaccine Reactions, SGO, 14 Mar 42. HD: 720.3.
[15] See footnote 8, p. 274.
[16] See footnote 1, p. 272.

all practical purposes, the only practicable effective procedure for the prevention of variola. The story of the recognition by Jenner of the effectiveness of cowpox inoculation for the prevention of smallpox and the subsequent development, refinement, and general application of this principle is one of the classics of medicine and has been recounted so often that its review here is not warranted.

Smallpox vaccination in the Army antedates the application of any other immunization procedure. The exact date of the adoption of this procedure for routine use in all Army personnel does not appear to be a matter of record. However, its first use is said to have been early in the last century. Its application was expanded somewhat during the Civil War period and its adoption as a routine measure was presumably at or near the turn of the century.[17] Vaccination against smallpox has, of course, been continued since that time as a routine procedure and is applied on entry into the service and at intervals thereafter.

The Immunizing Agent

Glycerinated calf dermovaccine is the agent used in the Army. Army Medical Department specifications applicable to the purchase of this vaccine are quoted in part as follows:

Smallpox Vaccine, U. S. P.

General description.—Vaccine shall conform to the requirements of the National Institutes of Health.

Quantity.—Vaccine shall be supplied in capillary tubes, each tube sufficient for one vaccination. Ten such tubes shall be the unit of quantity, furnished with 10 sterile needles and one rubber bulb.

Packaging and Packing.—The unit of quantity shall be furnished in suitably sized and constructed individual containers. Shipment shall be made in a waterproof bag or envelope, in an insulated container, having enough dry ice to keep the vaccine at the proper temperature until it reaches destination.

Expiration date.—Shall not be less than 2½ months after delivery date.

It will be noted that these specifications in stipulating refrigeration during shipping take cognizance of the fact that this vaccine, containing a living virus, loses its potency rapidly unless kept cold (preferably at freezing temperatures) at all times. This extreme lability and the short expiration date resulting therefrom were obvious obstacles to the maintenance of stocks of fully potent material in Army installations in the various theaters of operations and in this country as well. Continued emphasis was given to the necessity for proper shipment, storage, and care of this agent. In order that proper instructions in this regard might be disseminated to supply depots and other agencies concerned,

[17] The Medical Department of the United States Army in the World War. Washington, Government Printing Office, 1928, vol. IX, pp. 357–386.

a memorandum outlining the proper procedure was forwarded to the Finance and Supply Division, Office of The Surgeon General, from the Epidemiology Branch, on 2 December 1941.[18] In brief, this memorandum presented the following procedures as requirements:

1. Shipment to be made by the most rapid and direct method and route
2. Ordinary shipment by express, etc., or long distanced shipping by air, to be made by packing vaccine in dry ice and insulating the package properly
3. For extended shipment such as by boat, the vaccine to be held at freezing temperatures
4. Upon arrival at destination and thereafter until use, the vaccine to be kept at all times below 5° C., preferably below 0° C.

Essentially this same information was disseminated to all medical installations and medics in Circular Letter 162, Office of The Surgeon General, 28 November 19.. and again in November 1944 in War Department technical bulletin, TB MED 4. In addition, it was recommended in both of these publications that because of its perishable nature and the brevity of the period of expected potency, the amount requisitioned should not be in excess of the anticipated need for approximately 2 months. It was also recommended that for use overseas smallpox vaccine of acceptable quality be purchased locally whenever possible. This procedure was followed quite extensively in the United Kingdom for troops stationed there. Local procurement was also accomplished in India for a time but was discontinued upon the development of a more satisfactory system of air shipment with adequate dry ice refrigeration. Local procurement was also practiced in other areas but as a rule only to meet unusual needs.

The question of specificity of the action of American-made vaccine when used for the prevention of the virulent smallpox of the Far East and other areas was brought up from time to time. In view of the basic nonspecificity of the procedure (vaccinia virus being used for protection against variola virus) and the lack of evidence of noneffectiveness of American-made vaccines in these situations, this matter was not considered to present a problem. It was considered that vaccination properly performed and interpreted, using potent vaccine, would afford adequate protection.

Methods and Requirements

The method recommended for the performance of vaccination was the so-called "multiple pressure" method now generally accepted in this country to be the one of choice.[19] The instructions issued with respect to this procedure em-

---

[18] Memo, Chief Epidemiology Branch SGO for Dir Finance and Supply Div SGO, 2 Dec 41, sub: Shipping and storage of smallpox vaccine. HD: 720.3.

[19] See footnotes 1, p. 272 and 11, p. 275.

phasized adequate care of the vaccine to insure its potency, careful attention to the vaccination procedure itself, and proper interpretation of the results obtained. It was stipulated that the procedure be repeated until a satisfactory result (vaccinia, vaccinoid, or immune reaction) was demonstrated.

Early in 1943 when large numbers of men were passing very rapidly through induction and reception centers, it became apparent that vaccinations performed at these centers could not always be properly interpreted, and hence it was thought that considerable value from the procedure was lost. Accordingly, a memorandum was published by The Adjutant General directing that smallpox vaccination should not be performed unless the personnel concerned were to remain at the center at least 1 week.[20] It was thought that the results incurred by the postponement of this procedure for a short time were more than compensated for by the advantage which would accrue with the opportunity for observation and interpretation of the vaccination result.

Because of the occurrence of a certain number of cases of smallpox in overseas installations, it was found necessary in 1944 to emphasize once more to medical officers in the field the necessity for careful attention to the performance and interpretation of this simple procedure. To this end there was published in the *Army Medical Bulletin*, August 1944, a special article on smallpox vaccination.[21] Unfortunately in some instances a lack of knowledge or failure to appreciate the importance of the development and maintenance of satisfactory immunity to smallpox resulted in failures to vaccinate troops properly. As will be seen, these failures led to a certain number of cases of smallpox, some of which were fatal.

The stated requirements for smallpox vaccination were such that had the vaccination been performed properly in each case the Army should have been essentially 100 percent immune to this disease. It was required that all personnel be vaccinated without unnecessary delay after entry on active duty and once every 3 years thereafter. In addition, provision was made for the vaccination or revaccination of all personnel ordered to duty beyond the continental limits of the United States unless such vaccination has been accomplished during the 12-month period prior to departure. Provision was also made for the revaccination of all personnel on the occurrence of the disease in a command or in the presence of a threat of such an outbreak.[22] In other words, smallpox vaccination at least once every 3 years was required for all personnel and more frequent vaccinations were authorized and recommended in the event of possible exposure to the disease.

---

[20] WD AG Memo S40-6-43, 12 Apr 43, sub: Smallpox vaccination at induction and reception centers. AG: 720.3.

[21] Smallpox vaccination. Bull. U. S. Army M. Dept., No. 79, Aug 1944, p. 2.

[22] See footnote 6, p. 274.

Experience

Effectiveness. The Army experience with smallpox during the war years is further testimony to the effectiveness of vaccination in the prevention of this disease. There occurred during this period a total of 115 cases of which 10 were reported from the United States and 105 from overseas. This is in rather sharp contrast to the experience of the last war during which a total of 853 cases were reported, 780 from the United States and 73 from overseas stations.[23] While the current record is an excellent one and shows a marked improvement over that of World War I, it appears profitable to inquire briefly into the reasons for the occurrence of even a few cases in a 100-percent vaccinated group. The review of the incidence figures reveals that almost half the cases reported occurred in the India-Burma theater and the Persian Gulf Command, the cases reported from these areas being 33 and 15 respectively. (See chapter on smallpox in another volume in this series.) Investigations conducted by the surgeons of these theaters led to the conclusions that failure to vaccinate properly was responsible.[24] These conclusions were based on the fact that, with very few exceptions, the individuals who developed smallpox either presented no indication of a previous satisfactory vaccination as evidenced by a scar, or the scar present was the result of vaccination in infancy or childhood. The records of such individuals, however, almost invariably indicated immune reactions to vaccinations performed while in the military service. The fact that they then developed smallpox is clear indication of unsatisfactory performance of the vaccination procedure and failure to read and interpret the result properly. These findings were confirmed by study of the few cases which occurred in this country.[25]

Additional evidence pointing to unsatisfactory routine vaccination practice was found in the unusually high proportion of individuals presenting vaccinia or vaccinoid reactions when vaccinations were carefully performed in special situations and the results critically observed and analyzed. Two such instances are cited as examples.

In the Persian Gulf Command in 1944, 16,515 individuals were revaccinated with a fresh potent vaccine because of the occurrence of cases in the area and among military personnel. The result in reactions were as follows: vaccinia, 9.1 percent; vaccinoid, 35.5 percent; immune reactions, 55.4 percent.[26]

In the face of an outbreak of smallpox among civilians employed in the 1155th Army Air Force Base Unit (Fortaleza, Brazil), all military personnel

---

[23] See footnote 17, p. 281.

[24] (1) ETMD, CBI, 30 Apr 44. HD. (2) ETMD, Persian Gulf Comd, 21 May 44. HD. (3) ETMD, India-Burma Theater, 1 Jun 45. HD.

[25] File: Smallpox, Incidence, Treatment, and Control, ZI. HD: 710.

[26] ETMD, Persian Gulf Comd, 17 Aug 44. HD.

subject to exposure were revaccinated in August 1944.[27] Of the 155 individuals concerned, reactions of vaccinia resulted in 95, vaccinoid in 9, immune reactions in 39. Twelve were interpreted as being failures and repetition of the procedure was required.

In both instances the individuals concerned had all been vaccinated within 3 years and many within a considerably shorter period, obviously unsuccessfully in many cases. It was the consensus of the various observers that these failures were traceable to the use of outdated or improperly refrigerated vaccine or faulty technique. The basic fault, however, lay in the failure to observe and assign the proper interpretation to the reactions following vaccination. There was apparently a certain tendency to consider that all individuals not responding with a vaccinia or vaccinoid reaction were immune. This, of course, was fallacious and such individuals in many instances were in fact not immune at the time of vaccination, nor did they profit by the procedure if in fact it was an undetermined failure. As a result such individuals were unprotected.

Thus while the record with respect to the occurrence of smallpox among troops during the war period was probably the best ever achieved under kindred circumstances, the fact remains that failure of proper vaccination in individual cases did result in cases and death from this disease.

Reactions. Reactions, in the sense of untoward effects and complications following smallpox vaccination, were of little moment. A certain number of those vaccinated did require medical care because of fever, infection at the site of vaccination, et cetera. These incidents are not worthy of detailed study but an approximation of the extent of their occurrence is of some interest. For this purpose, the experience in the United States for the year 1943 may be taken as a representative sample. During that year there were admitted to Army hospitals in the continental United States, 5,260 individuals with admission diagnoses of reaction to smallpox vaccination. While there is no accurate method of determining the portion of total vaccinations thus represented, a figure for such reactions of approximately 1.7 per thousand vaccinations may be arrived at by considering that one vaccination was performed on each individual entering active service with the Army during the period. Since the total number of vaccinations performed was unquestionably greater than this, this ratio is undoubtedly high, but, even so, represents a small price to pay for the protection afforded. Of some interest is the fact that untoward reactions to vaccination tended to increase somewhat during the summer months. Applying the same method of calculation referred to above, it is estimated that the rates for such reactions were approximately 0.7 per thousand in January, and 3.3 per thousand during August. The only immediately available explanation

---

[27] Ltr, Chief Surg USAF South Atlantic to SG, 8 Sep 44, sub: Epidemiological report on smallpox at Fortaleza, Brazil. HD: 710.

for this is that during the summer months there is a greater tendency toward maceration of the vaccinated area through increased skin warmth and perspiration, and thus a more favorable site for secondary infection is afforded. Also, in some areas the opportunity for contamination from outside sources, such as dust, is greater in summer than in winter.

The only other type of untoward reaction to smallpox vaccination reported was postvaccinal encephalitis. (See Table 25.) This condition was reported in

TABLE 25. POSTVACCINAL ENCEPHALITIS

Case	Date	Time between vaccination and onset of symptoms	Outcome	Remarks
	1942			
1	March	10 days	Fatal	Pathological diagnosis: meningo-encephalitis, cause undetermined.
2	May	31 days (?)	Recovery complete	Symptoms and signs more closely simulated those of peripheral neuritis than of encephalitis.
3	November	7 days	Recovery partial.	
4	November	(?) Onset nervous symptoms 17 days after induction.	Fatal	Pathological diagnosis: infective polyneuronitis.
	1943			
5	February	3 days	Fatal	No specimens submitted to Army Medical Museum.
6	August	17 days	Recovered.	
	1945			
7	February	10 days	Recovered with some loss of vision.	
8	March	2 days	Recovery complete.	

8 individual instances, 4 such cases being reported in 1942, 2 in 1943, none in 1944, and 2 in 1945. Such study of these cases as it has been possible to make indicates that, while in fact they all ocurred following smallpox vaccination, there is reason to doubt that some of them, at least, were in fact true postvaccinal encephalitis. The onset of central nervous system symptoms varied from 2 to 31 days following vaccination. Only 3 occurred after an interval of 7 to 10 days. Of the entire group of 8 cases, 3 were fatal. Post mortem specimens from 2 of

these were studied at the Army Medical Museum and the pathologic diagnoses arrived at were meningo-encephalitis, cause undetermined, in one case, and infective polyneuronitis in the other. Unfortunately, no specimens were available in the case of the third fatality. Of the remaining 5 cases, there were 3 who were reported to have recovered completely, and 2 with minor neurologic residuals. While the proof or disproof of true postvaccinal encephalitis in these reported cases cannot be made, it is considered that in at least half of them the only relationship between the presenting condition and vaccination was one of time and not of cause and result. The other 4 may have been encephalitis resulting from smallpox vaccination. Table 25 presents a résumé of these cases.

It is of some interest to note that no postvaccinal tetanus was reported among the many millions of vaccinations performed. Inasmuch as tetanus immunization was commonly not completed until some weeks after the smallpox vaccination in Army inductees, and hence could have afforded no protection for the majority of such individuals, freedom from this complication must be attributed to the high quality of vaccine used, the technique of application, and the avoidance of dressings over the site of vaccination.

TETANUS IMMUNIZATION

Development and Adoption

Administration of tetanus toxoid was the first new, generally applied immunization procedure to be adopted for the Army during the World War II emergency and this, added to typhoid and smallpox vaccination, became the third of the group of procedures referred to for administrative purposes as routine immunizations. Of all new procedures adopted during the war period, tetanus immunization was probably the most successful.

The use of the toxoid prepared from the toxin of *Clostridium tetani* for the production of active immunity to tetanus was not new at the time of its adoption by the Army. This prophylactic procedure was first applied in France prior to 1930.[28] Following this pioneer work, extensive investigation of the usefulness of the procedure was carried on and numerous reports attesting to its efficacy were published both in this country and abroad.

Tetanus immunization using toxoid was adopted by the British, Canadian, and French Armies some time before its application in United States Forces.[29]

---

[28] (1) Ramon, G., and Zoeller, C.: L'anatoxine tétanique et l'immunisation active de l'homme vis-à-vis du tétanos. Ann. de l'Inst. Pasteur 41: 803–833, Aug 1927. (2) Ramon, G., and Zoeller, C.: Sur la valeur et la durée de l'immunité conférée par l'anatoxine tétanique dans la vaccination de l'homme contre le tétanos. Compt. rend. Soc. de biol. 112: 347–350, 3 Feb 33.

[29] (1) Rpt, Intelligence Div, Off of Chief Naval Opns, Navy Dept, 25 Sep 40, sub: Great Britain, immunization against tetanus and gas gangrene. (2) Ltr, Dr. R. D. Defries, Actg Dir Connaught Laboratories, to Dr. W. T. Harrison, Dir Div of Biological Control, Natl Inst of Health, 16 May 40. HD: 720.3 Tetanus Toxoid. (3) Ltr, Gaston Ramon, Institute Pasteur, France, to Dr. W. T. Harrison, Natl Inst of Health, 17 May 40. HD: 720.3 Tetanus Toxoid.

Toxoid was universally administered to personnel of the French Army as early as 1936. Information received from France in 1940 indicated that no cases of tetanus had occurred in immunized individuals up to that time. It was estimated that some 80 percent of the British Expeditionary Force in Flanders in the early phase of the war were protected from tetanus by toxoid. During this harrowing experience, the incidence of tetanus among British wounded was reported to have been but 0.45 per thousand, none occurring in any one previously immunized with toxoid. (Immunization to tetanus as well as other immunizations is on a voluntary basis in the British Army, and it was the policy to administer prophylactic antitoxin to all wounded including those known to have received toxoid previously.)

The first step toward the adoption of active immunization to tetanus in the United States Army was taken in the spring of 1940. At an informal meeting, representatives of the Army, Navy, and the Public Health Service agreed unanimously that such a procedure was desirable and should be adopted at once.[30] A formal recommendation that all military personnel on active duty be actively immunized against tetanus was made by The Surgeon General on 28 May 1940 in a letter to The Adjutant General.[31] In this letter it was pointed out that tetanus is one of the most serious complications of traumatic surgery and one that requires consideration in any skin perforating wound. The advantages of active immunization with toxoid over the administration of tetanus antitoxin for passive protection were emphasized and the necessity for early action as a means of preparedness was stressed. In addition an outline of the proposed method for the administration of the toxoid was presented. The War Department, while receptive to the proposal in general, was unwilling to adopt immediately this new immunization procedure. Accordingly, the correspondence between The Surgeon General and the War Department, initiated by the letter of 28 May 1940, was continued by 10 indorsements until 27 January 1941. Throughout this correspondence, The Surgeon General urged repeatedly that definite action be taken for the adoption of the procedure pointing out that, for effectiveness, early basic immunization of all military personnel was required and that this could not be accomplished on the eve of combat. He further indicated that the procurement of sufficient quantities of toxoid would require long-range definite commitments with the manufacturers. In support of his position, The Surgeon General referred in his indorsement of 3 December 1940 to the minutes of the meetings of three National Research Council committees in which each recommended strongly the adoption of this method for the prevention of tetanus in the Armed Forces. Reference was also made to a letter from the Surgeon General, United States Public Health Service (30 October

[30] Memo, Lt Col J. S. Simmons, SGO, for Chief Prof Serv Div, SGO, 16 May 40. HD: 720.3 Tetanus Toxoid.

[31] Ltr, SG to TAG, 28 May 40, sub: Active immunization military personnel against tetanus, with 10 inds, 7 incls. SG: 720.3-1.

940), in which the procedure was strongly indorsed, and which pointed out the lifficulties with respect to the procurement of adequate supplies of toxoid or of antitoxin, if toxoid were not to be used, unless definite and specific assurances ould be given at an early date to the various manufacturers of biologics. At he termination of this series of indorsements, the proposal still lacked complete ceptance by the War Department. It had, however, been "approved in rinciple" and The Surgeon General had been instructed to "adopt a procedure hich will provide for required immunizations with tetanus toxoid in event he War Department determines that the prospect of combat is imminent." uthority had also been given (8 January 1941) for the procurement and storage f sufficient toxoid to immunize the total armed force planned to be mobilized n 1 June 1941.

Before the administration of tetanus toxoid to all troops was directed, imited applications of this protective measure were made. In March 1941, he Commander of the Philippine Department requested advice by radio as to he advisability of the routine use of toxoid for all troops in that Department.[32] pon the recommendation of The Surgeon General, he was directed by the War epartment to initiate the procedure immediately,[33] and instructions for the nethod of administration of the toxoid were dispatched to him. Following his, it was recommended to the Assistant Chief of Staff, G–1, that a similar olicy be adopted for the Panama Department, Atlantic bases, and the Hawaiian epartment.[34] On 11 April 1941, The Surgeon General was advised by The djutant General that the commanders of these departments and bases had een directed by radio to proceed with tetanus immunization of all military ersonnel under their command.[35] A schedule for the accomplishment of this mmunization was indicated, the Panama Canal Department being directed to ccomplish the measure at once, the Atlantic bases to comply between 1 May and July, and the Hawaiian Department between 1 June and 1 August 1941. In he light of subsequent events, these actions, particularly as they affected the hilippine and Hawaiian Departments, were most timely. As will be seen, his immunization afforded complete protection against tetanus, and undoubtdly through its application many lives were saved during the early phases of ar in the Pacific.

In May 1941, the matter of the routine active immunization to tetanus of ll military personnel was reopened by The Surgeon General.[36] In a letter to he Adjutant General, the previous recommendations were reviewed, actions

[32] Radio, Comdr Philippine Dept to SG, 13 Mar 41. AG: 720.3 (3–13–41)M–A.

[33] 1st ind, SG to TAG, 13 Mar 41, and 2d ind, TAG to SG, 25 Mar 44, on basic radio cited in footote 32.

[34] Memo, SG for WD ACofS G–1, 27 Mar 41, sub: Immunization with tetanus toxoid. HD: 720.3.

[35] Ltr, TAG to SG, 11 Apr 41, sub: Immunization of military personnel in overseas garrisons. G: 720.3.

[36] Ltr, SG to TAG, 27 May 41, sub: Active immunization of military personnel with tetanus oxoid. HD: 720.3.

taken with respect to the immunization of part of the Forces summarized, and the desirability for uniform policy for the entire Army stressed. On 11 June 1941, such a policy was adopted and it was directed by War Department Adjutant General's letter, that date, that all military personnel on active duty with the Army of the United States, regardless of location, be actively immunized against tetanus immediately.[37]

The Immunizing Agent

The agent chosen for administration to military personnel for the production of active immunity to tetanus was fluid or plain tetanus toxoid. The decision to adopt this form of toxoid rather than the alum precipitated product was made only after careful consideration of the known characteristics of each of these materials and study of the experiences accrued from their use and that of related agents.[38] The satisfactory experience with the fluid preparation in the British and French Armies[39] weighed heavily in the choice of a like preparation for administration to American troops. Relatively little experience had been had at that time with the administration of an alum precipitated agent to large numbers of adults. There seemed little choice between the materials from the point of view of satisfactory antigenic qualities. Both were known to be effective from the point of view of antitoxin production.[40] In fact, if the experience with diphtheria toxoid in children could be taken as a criterion, two doses of the alum precipitated toxoid administered at intervals of several weeks might have been expected to accomplish the same end result as that derived from three doses of the fluid agent. It was appreciated, however, that alum precipitation of an antigen tends to increase its sensitizing powers thus leading to possible complications at the time of repeat doses. The choice between the two materials was a fine one, but the factors in favor of fluid toxoid were considered to outweigh those for the precipitated product and the former was decided upon. As will be seen, subsequent experience demonstrated that this agent was entirely satisfactory. Its effectiveness was complete and the only difficulty encountered following its administration was the occurrence of a limited number of reactions of sensitivity to certain peptone components of

---

[37] Ltr. TAG to CGs all Armies, Army Corps, etc., 11 Jun 41, sub: Active immunization of military personnel with tetanus toxoid. AG: 720.3.

[38] Memo, Drs. McCoy, Harrison, and Leake, USPHS, 17 May 40, sub: Concerning suggested program for the immunization of Army and Navy personnel. HD: 720.3 Tetanus Toxoid.

[39] See footnote 29 (1) and (2), p. 287.

[40] (1) Lincoln, E. M., and Greenwald, C. K.: Active immunization of human beings with tetanus toxoid. Proc. Soc. Exper. Biol. & Med. 30: 1241-1243, 1933. (2) Sneath, P. A. T.: Development of tetanus antitoxin following administration of tetanus toxoid. J. A. M. A. 102: 1288-1289, 21 Apr 34. (3) Bergey, D. H., and Etris, S.: Immunization of humans with alum precipitated tetanus toxoid. Am. J. Pub. Health 24: 582-586, Jun 1934. (4) Jones, F. G., and Moss, J. M.: Studies on tetanus toxoid. I. The antitoxic titer of human subjects following immunization with tetanus toxoid and tetanus alum precipitated toxoid. J. Immunol. 30: 115-125, Feb 1936. (5) Cowles, P. B.: Tetanus immunization. Yale J. Biol. and Med. 9: 409-416, May 1937. (6) See also footnote 29 (1), p. 287.

some of the material used. There is reason to believe that similar reactions might well have occurred with an alum precipitated agent containing the same peptones.

The toxoids used by the Army were procured from commercial biologic laboratories licensed by the Public Health Service for the production and sale of this material, and were required to conform in all respects to the requirements of the Biologics Control Division, National Institute (later Institutes) of Health.[41] Because of the nature of tetanus toxoid, particular precautions were taken to insure the safety of the material distributed for use. Thus, in addition to special care on the part of the manufacturers to prevent contamination or adulteration which might render the product unfit for use and the routine checks made by the National Institute of Health, all such material used by the Army was required to pass satisfactorily an extra test to insure freedom from toxicity. This test was made on samples taken from toxoid lots delivered to Army depots and its completion was required before distribution was effected.

The only change in the toxoid used by the Army during the war period was that required when it was determined that certain reactions following the administration of some of the material were in all likelihood due to sensitivity to specific peptones. The worst offenders appeared to be those toxoids containing Witte's and Berna's peptone. Accordingly, it was necessary to discontinue procurement of toxoids of this type,[42] and to recall from distribution certain lots of toxoid known to contain the reaction producing materials.[43] When it was determined with reasonable surety that the peptone components of some of the toxoids were responsible for the reactions, it was suggested that toxoids produced on a peptone-free hydrolysate medium such as that devised by Mueller and Miller [44] would be highly desirable. To this end, the Director, Biologics Control Division, National Institute of Health, forwarded to all tetanus toxoid manufacturers Mueller's formula for the hydrolysate medium and instructions for its use. He also recommended that it be given full trial in the production of tetanus toxoid.[45] While it was shown that it was possible, in the experimental laboratory at least, to produce satisfactory toxoid from toxins made in this medium, these results were not consistently reproducible and were not achieved by the commercial manufacturers to the extent necessary

[41] (1) Natl Inst of Health, "Minimum Requirements, Tetanus Toxoid," 17 Jun 38 and subsequent modifications. HD: 720.3. (2) Ltr, Chief Prev Med Serv SGO to Bureau Licensing of Biological Products, Natl Inst of Health, 3 Apr 41. HD: 720.3 Tetanus Toxoid.

[42] Memos, Prev Med Div SGO for Chief Finance and Supply Div SGO, 17 Oct 41 and 15 Dec 41, sub: Purchase of tetanus toxoid. HD: 720.3.

[43] Memo, Prev Med Div SGO for Chief Finance and Supply Div SGO, 19 Feb 42, sub: Recall of certain lots of tetanus toxoid. HD: 720.3.

[44] Mueller, J. H., and Miller, P. A.: Tetanus toxin production on a simplified medium. Proc. Soc. Exper. Biol. & Med. 43: 389–390, Feb 1940.

[45] Natl Inst of Health, Cir Ltr to Licensed Manufacturers of Tetanus Toxoid, 3 Oct 41. HD: 720.3.

for large-scale production.[46] As a result, the toxoids used by the Army continued to be those made from toxins produced in media containing various types of peptones (other than Witte's or Berna's) and meat digests. As noted below, the reaction producing qualities of such toxoids were minimal.

Methods and Requirements

The basic administrative requirements for tetanus immunization have already been referred to; namely, the initial direction for the immunization of all troops in the Philippine, Hawaiian, Panama Departments and Atlantic bases, and later the adoption of the procedure as routine for the entire Army. This requirement was subsequently published as an Army regulation, in Section III, AR 40–210, September 1942. This regulation provided that all military personnel be actively immunized to tetanus without unnecessary delay after entry into Federal service, that they receive a single routine stimulating dose at the end of 1 year thereafter and a similar dose prior to embarkation for overseas duty if the initial series or the routine stimulating dose had not been received within 6 months prior to such embarkation. Further stimulating doses were, of course, authorized at the time of injury and the details covering such administration were published in technical directives. These basic requirements remained the same throughout the war except that the requirement for a stimulating dose within 6 months prior to embarkation for overseas travel was rescinded in September 1944.[47] This rescission was based on the knowledge gained from experience that this added precaution was unnecessary.

The first formal technical directions for the administration of tetanus toxoid were published as Circular Letter 34, Office of The Surgeon General, 16 April 1941. These instructions called for a basic series of three subcutaneous injections of 1 cc. each of fluid tetanus toxoid to be administered at intervals of "not less than three or more than 4 weeks." Subsequent injections of 1 cc. each were prescribed as follows:

1. Under normal conditions, at the end of the first year only (after basic series), regardless of duration of service.

2. In time of war, during the months previous to departure for theater of operations unless such departure was within the 6-month period subsequent to the stimulating dose referred to above.

---

[46] (1) Mueller, J. H.; Schoenbach, E. B.; Jezukawicz, J. J., and Miller, P. A.: Production of tetanus toxin on peptone-free media. J. Clin. Investigation 22: 315–318, Mar 1943. (2) Schoenbach, E. B.; Jezukawicz, J. J., and Mueller, J. H.: Conversion of hydrolysate tetanus toxin to toxoid. J. Clin. Investigation 22: 319–320, Mar 1943. (3) Mueller, J. H.; Seldman, L. R., and Miller, P. A.: A comparison of antigenicities of hydrolysate and peptone tetanus toxoids in the guinea pig. J. Clin. Investigation 22: 321–324, Mar 1943. (4) Mueller, J. H.; Seldman, L. R., and Miller, P. A.: Antitoxin response in man to tetanus toxoids. J. Clin. Investigation 22: 325–338, Mar 1943. (5) CMR Infection Disease Rpt No. 15 (Abstracted), "Tetanus," by Dr. J. Howard Mueller, 14 Jul 44. HD: 720.3.

[47] Ltr, TAG to CGs POEs, COs POEs, CofTrans, 28 Sep 44, sub: Stimulating doses of tetanus toxoid. AG: 720.3.

3. As an emergency stimulating dose, to individuals incurring wounds or severe burns on the battle field, to patients undergoing secondary operations and manipulation of old wounds and to others with injuries which might be complicated by the introduction of *Cl. tetani* into the tissues.

Instructions were also given as to the proper recording of completed tetanus immunization. These included:

1. Recording on the immunization register (WD MD Form 81).

2. Stamping of the identification tag at the completion of the initial series with the letter "T" followed by figures indicating the year, and additional date to be stamped on the tag after the routine stimulating dose. "T 41-42" would indicate the completion of the basic series in 1941 and the routine stimulating dose in 1942.

The use of antitoxin for passive immunization was reserved for those with clinical tetanus, and for individuals with wounds or other conditions requiring protection against tetanus who presented no evidence of the previous administration of toxoid.

These instructions were supplemented on 10 November 1941 by the publication of additional information concerning the administration of tetanus toxoid in Circular Letter 110, Office of The Surgeon General. These additional instructions did not alter the basic procedures as outlined above but clarified certain points concerning which questions or misunderstanding had arisen. The most important among these were:

1. In order to avoid unnecessary repetition of injections, it was directed that if the prescribed intervals between doses were exceeded the missed dose or doses should be administered as soon as possible, but a new series should not be started.

2. It was stated that the stimulating dose to be administered prior to embarkation for a theater of operations should be given unless departure was to be within the 6-month period subsequent to the routine stimulating dose (1 year after the basic series) or within the same period after the basic series itself.

3. To avoid the undesirable use of prophylactic antitoxin it was pointed out that a satisfactory immunity producing mechanism is established at the time of completion of the basic three injections of toxoid and hence, toxoid and *not antitoxin* should be administered for emergency protection at any time after the completion of the basic series of injections. (This fact was not definitely known at the time of the publication of the original instructions but was established in October by a study carried on jointly at the Army Medical School and National Institute of Health,[48] the details of which are summarized in the subsequent discussion of effectiveness of toxoid.)

---

[48] Ltr, Dr. M. V. Veldee, Chief Div of Biologics Control, Natl Inst of Health, to Maj A. R. Driesbach, Army Med Center, 27 Oct 41. HD: 720.3 Tetanus-Toxoid, Experimental.

4. In view of the occurrence of some reactions of sensitivity, specific instructions were given with respect to the precautions to be taken in connection with such reactions. These included:

a. Have adrenalin at hand during immunization procedure.

b. Perform intradermal sensitivity tests using 0.1 cc. of 1 to 100 dilution of toxoid on those with a history of previous allergic manifestations, those who have exhibited untoward reactions to a previous dose of tetanus toxoid, and those who are to receive a dose of toxoid in the initial series after an interval of more than 4 weeks has elapsed.

5. If, in the opinion of the surgeon, previous reactions or positive sensitivity tests constituted definite contraindication to further immunization, the procedure was to be abandoned, care being taken to avoid stamping the identification tag to indicate completion of this procedure. If further immunization was not considered to be definitely contraindicated in such individuals, the 1 cc. dose was to be divided and 0.1 cc. administered cautiously. If an anaphylactic type reaction occurred, the immunization was to be discontinued. If not, the remainder of the cubic centimeter was to be administered in 3 or 4 portions at daily intervals.

Though the incidence of known sensitivity to tetanus toxoid was relatively low, the problem did arise of possible disqualification for overseas duty on the grounds of inability to complete immunization because of such sensitivity. The policy with respect to this matter was that sensitivity to tetanus toxoid should not be considered to be disqualifying for overseas duty. In such cases it was indicated that notation should be made on the service record of the individual concerned signifying the sensitivity and that the immunization to tetanus was not completed. In addition, the identification tag should not show complete immunization to tetanus.[49]

The instructions presented in these two circular letters (34 and 110) were subsequently combined with only minor changes and published in Circular Letter 162, November 1942, which represented a compilation of technical instructions covering all the immunization procedures authorized at that time. This circular letter was later replaced by TB MED 114, "Immunization," November 1944. Instructions in this bulletin concerning tetanus immunization were essentially unchanged from those reviewed above with the notable exception that, in conformance with the administrative change previously referred to,[50] the stimulating dose of toxoid within 6 months of departure for a theater of operations was no longer required.

Despite these rather specific instructions, toxoid was not administered in a completely uniform manner. Perhaps the most outstanding deviation from

---

[49] Ltr, CO Camp Crowder, Mo., to CG 7th SvC, 11 Aug 43, sub: Tetanus toxoid immunization of officers and enlisted men assigned to foreign service, with inds. HD: 720.3.

[50] See footnote 47, p. 292.

the prescribed policy was the use of an annual stimulating dose in the European Theater of Operations. There was no clear indication for such a practice at the time and the evidence accumulated since indicates clearly that stimulating doses at such frequent intervals are not required and, hence, are undesirable.

Experience

Effectiveness. The administration of tetanus toxoid for the production of immunity to tetanus proved to be a completely successful procedure. A total of 12 cases of tetanus occurred among Army personnel between 7 December 19[illegible] and 1 January 1946. There were 3 cases in 1942, 5 in 1943, 3 in 1944, and 1945. Four of the 12 occurred overseas but only 1 as a result of a battle wou[illegible] The immunization status of the individuals who developed the disease is shown in the tabulation below.

	Fatal cases	*Total cases*
No active immunization	2	6
Basic immunization (3 injections) accomplished but no booster injection given following injury	1	2
Basic immunization and booster injection following injury received	2	4
Total	5	12

Of the 6 cases occurring in unimmunized persons, 4 resulted from injuries incurred prior to entry on active duty, 1 was in a soldier with 4 months of service, and 1 case occurred in a soldier who, though in the service for a year prior to the onset of the illness (January 1941 to February 1942), had received only 1 dose of toxoid. One of the 2 patients who had received the basic toxoid injections, but no booster dose at the time of injury, was first treated in a French hospital in North Africa and later transferred to an American installation. The other, who was injured while on furlough, was treated by a civilian physician.[51] In the latter case, toxoid was administered after the onset of tetanus symptoms, some 48 hours after the injury. This injection is not considered to be a true emergency stimulating dose of toxoid.

Four patients in the series had received at least 1 booster dose of toxoid in addition to the basic series. One had had 3 such stimulating doses at yearly intervals. One of these did not receive a stimulating dose at the time of injury. All recovered. The other 2 individuals who had received the basic series of injections had been in the service less than 1 year thereafter at the time of injury.

The periods between the injury and the onset of symptoms of tetanus varied from 2 to 40 days. The median incubation period of the 6 immunized cases was 7.5 days, and of the 6 unimmunized, 13.5 days. The nature of the

[51] Goehring, W. O.: Tetanus occurring in immunized individual. Am. J. Surg. 66: 123–125, Oct 1944.

injury resulting in tetanus with the number of cases in each category were: gunshot wound, 5; burn, 1; secondary to operation for osteomyelitis, 1; compound fracture, 2; miscellaneous injuries, 3. These injuries involved the foot in 5 instances, other extremities in 6, and the abdominal cavity in 1 case.

In summary, there were but 12 cases of tetanus in the Army during the war period. Six of these were in unimmunized individuals, including 4 resulting from injuries received prior to entry on active duty, and only 4 cases occurred in soldiers whose records indicated that they had received toxoid in complete accordance with Army requirements including the stimulating dose after injury. Tetanus occurred in only 1 battle casualty. There were 5 deaths from the disease, 2 in individuals who had received no toxoid and 1 in a person who though having had the basic immunization, did not receive a stimulating dose at the time of injury. Thus only 2 deaths from tetanus occurred in individuals immunized in complete accordance with requirements.

The contrast between this occurrence of tetanus and that experienced during World War I is not as striking as might be expected since but 70 cases were reported among Army personnel during the earlier conflict. It is likely, however, that this figure is low due to the incomplete reporting of the time. At that time specific protection was afforded by the administration of prophylactic tetanus antitoxin. There is no satisfactory estimate available as to the occurrence of serum sickness, anaphylaxis, et cetera, caused by this antitoxin, but it appears safe to assume that such reactions occurred to a significant extent. A total of 14 admissions for tetanus among Army personnel were reported to The Surgeon General during the period between the wars (1922–41), 2 more than the total number reported during World War II.

It is manifestly impossible to estimate the number of cases of tetanus actually prevented through immunization. There is, however, evidence to indicate the presence of potential hazards from this disease in areas where Army troops were in operation. In Hawaii, where no cases occurred among Pearl Harbor casualties, the annual incidence among the civilian populatic . in peacetime is said to be about 5.7 per 100,000.[52] No comprehensive data are available concerning the occurrence of tetanus among Japanese troops and natives in the various Pacific operations but sufficient information is at hand to indicate a relatively high incidence of the disease among this inadequately protected group. (Routine active immunization was not practiced in the Japanese Army. Selected personnel may have been immunized.) One Navy report indicated the occurrence of 14 cases of tetanus in a group of 284 Japanese wounded.[53] Similarly, a report from Headquarters, Kwajalein, the Marshall Islands, reported 12 cases of tetanus among 266 wounded Japanese prisoners of war.[54]

[52] Halford, F. J.: Gas gangrene and tetanus; their prevention and management in war wounds. Hawaii M. J. 1: 169–170, 13 Jan 42.

[53] Navy Dept BUMED News Letter, vol. 4, No. 6, 15 Sep 44.

[54] Monthly Sanitary Rpt, Surg APO 241 (Kwajalein Island), Jul 1944. SG: 721.5.

Tetanus among civilian casualties during the Manila operation was not uncommon, a total of at least 473 cases with 389 deaths having been reported.[55] Also, at least 20 cases of tetanus are known to have occurred among civilians on Saipan.[56] Probably the actual number was considerably greater than this. Of this known number, there were 14 fatalities.

Accurate data are likewise not available concerning tetanus among German troops. However, one report indicated that during the Normandy invasion, German ground troops (not immunized) suffered over 80 cases of tetanus but that there were no cases reported from the protected Luftwaffe.[57] That this figure may be minimal is suggested by the fact that there were 53 cases of tetanus among American-held German prisoners of war in the United Kingdom during the period 7 September to 2 October 1944.[58]

The British have reported a total of 103 cases of tetanus from 1939 and 1940 to the end of the war.[59] This total, however, included 34 German, 7 Italian, and 3 French cases. The remainder were in British, Dominion, or Colonial troops. Twenty-seven of the 103 were said to have been previously protected with 2 or more doses of toxoid.

From these rather fragmentary data concerning the occurrence of tetanus in other than American personnel, it is evident that without the benefit of toxoid appreciable numbers of cases of tetanus would have occurred in our troops. In addition, through the avoidance of the use of prophylactic antitoxin in the more than one-half million battle casualties an indefinite number of serious serum reactions and doubtless some fatalities were prevented.

In addition to the evidence of the actual protection reviewed above, certain experimental evidence was obtained in connection with various factors of the immunization processes. Early in the program, it became evident that there was at hand no factual evidence as to the rapidity with which a satisfactory immunity producing mechanism would be produced following the basic series of three injections of toxoid. This information was required for the basis for instructions regarding the administration of the emergency stimulating dose of toxoid after injury. Accordingly, serum specimens were obtained from each of nine individuals a week after the last injection of the initial series.[60] At the same time, a fourth or stimulating dose of toxoid was administered in the same manner as if required by a potentially infected wound. A week after this fourth injection, blood specimens were obtained.

---

[55] ETMD, USAFFE, 2 Jan 45. HD.

[56] ETMD, POA, Nov 1944. HD.

[57] OSS Rpt (Abstract), 27 Jul 45, sub: Medical installations in Munich area; new medical procedures. HD: 720.3 Tetanus Toxoid.

[58] Ltr, Col J. H. McNinch, Off of Chief Surg ETO to Lt Col A. P. Long, SGO, 13 Dec 44. HD: 710 Tetanus.

[59] Cope, Zachary, ed.: Medicine and Pathology. *In* Medical History of the Second World War. London, Her Majesty's Stationery Office, 1952, p. 446.

[60] (1) Long, A. P.: Tetanus toxoid, its use in the United States Army. Am. J. Pub. Health 33: 53–57, Jan 1943. (2) See also footnote 48, p. 293.

All of the first specimens taken (1 week after the third dose) contained at least 0.1 unit of antitoxin per cubic centimeter of serum, and 3 contained 1 unit or more per cubic centimeter. Of the sera taken 1 week after the fourth or stimulating dose, two contained more than 0.1 unit but less than 0.5 unit; 3 contained more than 0.5 unit but less than 1 unit and the remainder contained at least 2 units of antitoxin per cubic centimeter. Since the amounts of circulating antitoxin necessary for protection had been stated by various workers to be 0.01 unit to 0.2 unit per cubic centimeter of serum, it was considered reasonable to assume that there was adequate protection based on active immunity after the completion of the initial series of three injections of tetanus toxoid, and that there was no indication for the use of prophylactic antitoxin after this immunity had been established.[61]

Late in 1942, in an effort to determine the antitoxin response to the stimulating dose of tetanus toxoid administered approximately 1 year after the initial series, serums for antitoxin titration were collected from 32 individuals. Stimulating doses of toxoid were then administered and a second serum specimen obtained 1 week later. Fifteen of these persons were stimulated with a regular commercial toxoid, while 17 were given a special peptone-free material, hydrolysate toxoid. Table 26 shows the results of these tests.[62] It will be noted that while relatively small quantities of circulating antitoxin were present before the stimulating dose, 1 week thereafter adequate protective levels were reached in all but 1 individual who did not appear to respond well. These results compare favorably with those obtained by Mueller and his associates with a considerably larger sample.[63] In their series of 103 individuals to whom stimulating doses were given 1 year after the basic series, titers from approximately 1 unit per cubic centimeter of serum to more than 50 were encountered. Approximately half of this group were given hydrolysate toxoids and the others, regular commercial products. No significant difference was noted between the responses from the two types of materials.

To extend further the knowledge on the immune response to stimulating doses of toxoid, a study was initiated early in 1945 to determine this response at least 2 years after the administration of the routine stimulating dose of toxoid. For this purpose, 22 volunteers were secured who had received their basic series of tetanus toxoid at least 3 years previously and the routine stimulating dose approximately 1 year thereafter with no subsequent doses of toxoid. Blood specimens for antitoxin titration were obtained from each of these men and a stimulating dose of toxoid was administered to 13. Blood specimens were obtained from the latter group on the third and seventh days following the injection of toxoid. Thus it was possible to determine the amount of

---

[61] Ibid.

[62] File: Tetanus Toxoid-Experimental. HD: 720.3.

[63] See footnote 46 (4), p. 292.

TABLE 26. RESULTS OF 1 CUBIC CENTIMETER OF STIMULATING DOSE OF TETANUS TOXOID APPROXIMATELY 1 YEAR AFTER BASIC SERIES

Before stimulation		After stimulation		
		Commercial toxoid	Experimental peptone-free toxoid	
Number	Units antitoxin per cc. serum [1]	Number	Units antitoxin per cc. serum	Number
21	<0.1		<0.01	1
6	0.1		>0.01 <.1	1
3	>0.1 <.3		>0.1 <.3	2
1	>0.1 <1		>0.3 <.6	3
1	Sample destroyed		0.3 or more [2]	4
		15	0.6 or more [3]	6
32		15		17

[1] The antitoxin determinations were made at the National Institutes of Health and the Army Medical School.
[2] Tested for not more than 0.3 unit, actual value not known.
[3] Tested for not more than 0.6 unit, actual value not known.

circulating antitoxin present in all 22, and in 13, the increase in circulating antitoxin at the end of 3 and 7 days after the injection of 1 cc. of toxoid. The results of these determinations are shown in Table 27. It will be seen that only 2 of this group had less than 0.1 unit of antitoxin per cubic centimeter of serum before stimulation, and that 16 had 0.3 unit or more at that time. Thus, with the possible exception of the first 2, all were probably completely protected against tetanus in the event of an injury even though they were not to receive a booster dose. There was little increase in antitoxin level demonstrated at the end of 3 days following the booster dose but there was at least some indication of effect from the stimulus. At the end of 7 days, however, the rise was quite pronounced with only 1 of the 13 demonstrating less than 3 units, and 4 rising to a level of more than 10 units of antitoxin per cubic centimeter of serum.

In addition to the positive evidence of the practical efficiency of tetanus toxoid for the prevention of tetanus, there has been experimental evidence to indicate a protective response to a booster dose of tetanus toxoid administered as late as 3 to 4 years after the initial series, and 2 to 3 years after the routine stimulating dose as applied in the standard Army tetanus immunization regime. Continued investigation will be required to determine the full extent of this period of efficacy of the basic tetanus immunization as applied to adults in the Army.

Reactions. The administration of tetanus toxoid was attended by some reactions, a great majority of which occurred early in the program. At no time were these reactions of sufficient import to hamper seriously the practice

TABLE 27. SERUM ANTITOXIN LEVELS 2 YEARS OR MORE AFTER ROUTINE STIMULATING DOSE OF TOXOID AND EFFECT OF BOOSTER DOSE ADMINISTERED AT THAT TIME [1]

Case number	Prestimulation antitoxin units per cc. serum [2]		Interval since previous dose of toxoid	Poststimulation antitoxin units per cc. serum [2]			
				5 days		7 days	
			months				
1	>0.01	<0.1	34	>0.03	<0.1	>3	<10
2	>.01	<.1	26	>.03	<.1	>1	<3
3	>.1	<.3	28	.3		>30	
4	>.1	<.3	28	>.1	<.3	>10	<30
5	>.1	<.3	27	.1		>3	<10
6	>.1	<.3	26				
7	.3		33	.3		>3	<10
8	.3		26	>.3	<1	>3	<10
9	>.3	<1	33	>.3	<1	>3	<10
10	>.3	<1	27	>.3	<1	>3	<10
11	>.3	<1	27	>.3	<1	>3	<10
12	>.3	<1	26	>.3	<1	>10	<30
13	>.3	<1	26				
14	>.3	<1	25				
15	>.3	<1	27				
16	>.3	<1	27				
17	>.3	<1	27				
18	>.3	<1	23				
19	>.3	<1	26				
20	>1	<3	27				
21	>1	<3	26	>1	<3	>3	<10
22	>1	<3	26	>1	<3	>10	<30

[1] Antitoxin determinations performed in the laboratories of the Department of Bacteriology, Harvard Medical School.
[2] Arrangements made and specimens obtained by Lt. Col. Francis Cook, Medical Inspector, First Service Command.

of active immunization. Reactions encountered were classifiable to two main categories. Those in the first category caused no concern and were manifested by such symptoms as headache, weakness, general malaise, local soreness, and occasionally chills and fever. Such reactions were not unlike those experienced after typhoid vaccination but occurred much less frequently after tetanus toxoid than following the administration of triple typhoid vaccine.

The reactions of the second category occurred in a majority of instances within 30 minutes after the injection and were characterized in general by flushing and itching of the skin, local and generalized urticarial eruptions, and edema of the lips and eyelids. In some instances, edema of the glottis and dyspnea were observed. The nature of these reactions more than their frequency led to considerable study for the determination of their cause. It soon became apparent that they were manifestations of sensitivity to some constituent of the toxoid used. An early opportunity for the investigation of the occurrence of these reactions was afforded by their relatively high incidence in

the Newfoundland Base Command.[64] During this investigation, it was determined that among 1,722 completed immunizations in that command in August 1941, there were 22 reactions of sensitivity among 18 individuals, 1 percent of those immunized presenting symptoms of sensitivity. All reactions followed the second or third dose. Skin sensitivity tests done on a limited number of those reacting, using a 1:100 dilution of the same type of toxoid used for the immunization, demonstrated definite local sensitivity of high degree, while the same type of test recorded on individuals who had experienced a reaction nonsensitive in nature were entirely negative. It was suggested by the investigator that these reactions were the result of sensitization by the first or second dose of toxoid, and that a study be made of the various culture media used in preparation of toxoid to determine the presence of a protein likely to cause such sensitization.

In view of these findings and the observations of Whittingham,[65] Parish and Oakley,[66] and Cooke and his associates,[67] the reports of reactions received in the Surgeon General's Office were carefully scrutinized in an effort to determine the relationship between their occurrence and the use of particular lots or makes of toxoid. By early October 1941, sufficient evidence had been accumulated to indicate very strongly that those toxoids containing Witte's or Berna's peptone were responsible for a great majority of the reactions[68] (toxoids containing Witte's or Berna's peptone had been used in about 75 percent of the injections reported and had been responsible for at least 90 percent of the reactions reported at that time). As a result, the action previously referred to was taken to discontinue the use of toxoids of this nature. This was followed by a significant decrease in the occurrence of these reactions.

An accurate figure as to the exact numbers of reactions of sensitivity which occurred and the proportion of injections resulting in such reactions was never obtained, the problem not having been considered worthy of the detailed investigation throughout the Army which would have been required for this purpose. However, a reasonably good sampling was achieved. Table 28 presents an estimate of the proportion of reactions of sensitivity to the number of injections given for various periods during the first 3 years of the tetanus immunization program.

---

[64] Memo, Dir Prev Med Div SGO for SG, 27 Aug 41, sub: Report by Capt. Long of tetanus toxoid reactions at Newfoundland Base Command. HD: 720.3.

[65] Whittingham, H. E.: Anaphylaxis following administration of tetanus toxoid. Brit. M. J. 1: 292–293, 24 Feb 40.

[66] Parish, H. J., and Oakley, C. L.: Anaphylaxis after injection of tetanus toxoid. Brit. M. J. 1: 294–295, 24 Feb 40.

[67] Cooke, R. A.; Hampton, S.; Sherman, W. B., and Stull, A.: Allergy induced by immunization with tetanus toxoid. J. A. M. A. 114: 1854–1858, 11 May 40.

[68] Memo, Dir Prev Med Div SGO for SG, 7 Oct 41, sub: Reactions to tetanus toxoid, report of conference, Surgeon General's Office, 2 October 1941. HD: 720.3.

The highest proportion of reactions experienced, according to this estimate, was approximatey 63 per 100,000 injections, and by the end of the year following discontinuation of the procurement of toxoids containing the offending peptones this had dropped to about 2 per 100,000. At this time, and certainly during subsequent periods, the actual proportion was in all likelihood considerably lower since negative reports were seldom received; that is, there was a tendency to report actual numbers of injections accomplished only when one or more reactions occurred. Following 15 July 1943, despite the steadily growing Army, the reports were so scattered and few as to make further computations entirely unsatisfactory.

TABLE 28. REACTIONS OF SENSITIVITY TO TOXOID*

	Injections	Reactions	Reactions per 100,000 injections
To 1 October 1941	445, 299	284	63
1 October 1941 to 1 March 1942	1, 559, 285	493	32
1 March 1942 to 15 October 1942	361, 133	22	6
15 October 1942 to 31 December 1942	199, 652	4	2
31 December 1942 to 15 July 1943	163, 692	3	2

*These figures do not represent the total number of reactions during this period nor the total number of injections.

As the early experience indicates, the majority of reactions occurred after the second and third injections. Of these reactions reported in relation to the number of the injection causing the reaction, it was found that 16 percent followed the first injection and the remainder of the reactions were about equally divided between the second and third doses of the toxoid.

Earlier estimates of the proportion of reactions caused by the toxoids containing Witte's and Berna's peptone were also essentially borne out by the continued studies. By June 1942, just under one million injections of toxoid had been reported with indications of the name of the manufacturer and lot number of material used. From this information, it was possible to determine the type of peptone or other protein material contained in the product in question. This revealed that in this series, toxoids made with Witte's peptone had resulted in reactions of sensitivity in about 43 out of every 100,000 injections. Those containing Berna's peptone had caused similar reactions in 79 injections per 100,000, and other toxoids caused 16 such reactions in a similar number of injections.

Viewed in another way, toxoids with Witte's peptone tended to produce these reactions 3.3 times and those with Berna's peptone 5 times more frequently than did other toxoids.

These figures indicate that toxoids other than Witte's or Berna's peptone oxoid were at that time producing a higher proportion of reactions than was ubsequently experienced. This may be explained in part on the basis of obser- ations made in another study, described below, that individuals sensitized by ne of the toxoids most commonly producing reactions may react in a sensitive nanner to toxoids containing meat digests or similar substances, but no peptone. Thus, in late 1941 and early 1942, it was entirely likely that second or third njections of digest toxoid might have been administered to individuals already ensitized by a first injection of a peptone-containing material. Under such a ircumstance, the toxoids other than Witte's and Berna's peptone toxoid might ave precipitated a reaction based on earlier sensitization by a toxoid of another ype.

In an effort to learn something of the duration of the state of sensitivity n individuals who had demonstrated such reactions and to observe the effect of nonpeptone toxoids on such persons, a study was conducted with 40 volun- eers who had previously demonstrated reactions as subjects.[69] Results of this tudy are summarized in Table 29. Of the total of 40 individuals studied, 33 were still positive to a material causing original reactions, 31 were positive to ig stomach digest toxoid, 27 were positive to the other digest toxoid used, and one gave positive reactions to hydrolysate toxoid (toxoid produced on Mueller's ydrolysate media). Of 16 people tested who had received peptone toxoid (Witte's or Berna's) but who had not responded with reactions of sensitivity. 5 were found to be positive to the material originally received, 3 to pig stomach ligest, 6 to the other digest toxoid, and none reacted positively to the hydroly- sate toxoid. These findings indicated that those individuals who had originally reacted in a sensitive manner to the peptone type of toxoids (approximately 1 year previously) were still sensitive to those materials. Since such toxoids were no longer available for use, this caused no concern. However, the fact that such ndividuals might react in a sensitive manner to digest toxoids on subsequent njections was viewed with some misgiving. Some effect from this conditioning probably was felt as indicated above. However, the fact that practically no reactions were reported following stimulating or booster doses during the later months or years indicated that this cross sensitivity was apparently of no great significance.

The entire experience with the reactions of sensitivity following tetanus oxoid served to emphasize the importance of great care in the selection of ntigens for such widespread use as is practiced with immunizing agents in the Army. There can be no doubt but that in the production of materials of this ype the greatest possible care should be taken to prepare materials with the least possible danger of the production of sensitivity consistent with a potent nd stable product.

---

[69] Office memo, A. P. Long, 6 Aug 42, sub: Preliminary report of field study on reactions to sensi- ivity to tetanus toxoid. HD: 720.3.

TABLE 29. RESULTS OF SKIN SENSITIVITY TESTS ON INDIVIDUALS KNOWN TO BE SENSITIVE TO CERTAIN TOXOIDS [1]

Table A — Tests

I. Skin Tests on Individuals Previously Sensitive to Witte Peptone Toxoid

Type of test toxoid	Hydrolysate			Digest [2]			Digest (Pig stomach)			Witte peptone		
Reaction	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative
Number	4	0	13	0	13	2	1	15	1	0	17	0

II. Skin Tests on Individuals Previously Sensitive to Berna Peptone Toxoid

Type of test toxoid	Hydrolysate			Digest [2]			Digest (Pig stomach)			Berna peptone		
Reaction	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative
Number	1	0	22	4	14	5	4	16	3	3	16	4

III. Summary

Type of toxoid	Hydrolysate			Digest [2]			Digest (Pig stomach)			Witte and Berna peptone		
Reaction	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative
Number	5	0	35	4	27	7	5	31	4	3	33	4

Table B

Controls

I. Skin Tests on Individuals Previously Receiving Peptone Toxoid but Exhibiting no Reactions

Type of toxoid	Hydrolysate			Digest [2]			Digest (Pig stomach)			Witte and Berna peptone		
Reaction	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative	Indefinite	Positive	Negative
Number	2	0	14	5	6	5	6	3	7	5	5	6

[1] Intradermal injections of 0.1 cc. of a 1:100 dilution of the toxoids were used for the tests.
[2] Two individuals not tested with this material.

VACCINATION AGAINST YELLOW FEVER

Development and Adoption

The development of a vaccine effective against yellow fever was begun in 1928 with the demonstration of the virus etiology of the disease.[70] The various stages in this development have previously been traced and recorded and require no further review.[71]

Early in 1940 Lt. Col. James S. Simmons foresaw the need to determine Army policy on vaccination of troops against yellow fever. He referred the problem to the Advisory Committee on Tropical Diseases of the National Research Council, and on the basis of his suggestions the committee recommended, in June 1940, that military personnel going into areas where yellow fever was suspected to exist be immunized against that disease.[72] In order that a supply of the vaccine might be available, this group requested the International Health Division of the Rockefeller Foundation to produce a supply of this vaccine for possible use by the Armed Forces. At a subsequent meeting held in October 1940, this committee made further specific recommendations that all military or civilian personnel dispersed to the American tropics or other areas where yellow fever was likely to be encountered should be immunized. It was recommended that the vaccination be done preferably before departure for such areas and that those individuals already in the areas should be vaccinated as early as possible.[73]

In January 1941, The Surgeon General recommended to The Adjutant General that all military personnel stationed in tropical regions of the Western Hemisphere, including Panama and Puerto Rico, be vaccinated against yellow fever.[74] In this recommendation, it was pointed out that in the defense of the Western Hemisphere, it was anticipated that troops would be sent to certain South American countries where exposure to yellow fever was a likelihood. In addition, the possibility of the introduction of this disease into areas where it did not exist at the time was stressed. It was stated that the introduction of the disease into new areas might be accomplished through the increase in travel and exchange of troops between endemic and nonendemic areas or by the willful introduction by enemy action of the causative virus into areas where the vector was already established. Following this recommendation, the War Depart-

---

[70] Stokes, A.; Bauer, J. H., and Hudson, N. P.: The transmission of yellow fever to *Macacus rhesus*. J. A. M. A. 90: 253–254, 28 Jan 28.

[71] (1) Smith, H. H.; Penna, H. A., and Paoliello, A.: Yellow fever vaccination with cultured virus (17D) without immune serum. Am. J. Trop. Med. 18: 437–468, Sep 1938. (2) Gordon, J. E.: The preparation and use of yellow fever vaccine. *In* Virus and Rickettsial Diseases. Cambridge, Harvard University Press, 1940, p. 767–788. (3) Sawyer, W. A.: Yellow fever and its control. *In* Problems and Trends in Virus Research. Philadelphia, University of Pennsylvania Press, 1941, p. 27–39.

[72] Minutes of meeting, NRC Advisory Committee on Tropical Diseases, 19 Jun 40. SG: 040.9–10.

[73] Minutes of meeting, NRC Subcommittee on Tropical Diseases, 24 Oct 40. SG: 040.9–10.

[74] Ltr, SG to TAG, 19 Jan 41, sub: Vaccination of troops against yellow fever. HD: 720.3.

ment, on 30 January 1941, directed vaccination against yellow fever of all military personnel stationed in the tropical regions of the Western Hemisphere, including Panama and Puerto Rico, and the preembarkation vaccination of personnel ordered to these areas.[75] The requirements for vaccination as presented in the original directive were changed a number of times throughout the war period. These requirements will be reviewed below.

The Immunizing Agent

At the time of the adoption of yellow fever vaccination by the Army, the only producer of this vaccine in the United States was the laboratory of the International Health Division of the Rockefeller Foundation. Accordingly, arrangements were made for the procurement of vaccine from this laboratory in accordance with the recommendations of the National Research Council previously cited. This vaccine was a suspension of viable virus prepared from chick embryo cultures of the 17–D strain of yellow fever virus.[76] This material was the Seitz or Berkefeldt filtrate of a 10-percent infected chick embryo emulsion in undiluted, inactivated human serum. The emulsion was placed in ampules and desiccated from the frozen state under vacuum. An immunizing dose was 0.5 cc. of a 1 : 10 dilution of this material. Each lot was tested for sterility, virus content, and for evidence that the neurotropic virulence was low.

Shortly after the arrangements had been made for the procurement of vaccine from the Rockefeller Foundation, discussions were held with representatives of the Public Health Service in connection with the possibility of that agency also undertaking the manufacture of this agent with a view toward ultimately providing all necessary yellow fever vaccine to the Armed Forces. The initiation of this second source of supply was considered desirable inasmuch as the Rockefeller Foundation, while in a position to furnish the vaccine as an emergency measure, had recommended that its manufacture be assumed by some Governmental agency as soon as it was practicable to do so.[77] Accordingly, the Surgeon General of the Public Health Service took the necessary action to establish facilities for yellow fever vaccine production. These facilities were established and, in September 1941, the Administrator of the Federal Security Agency notified the Secretary of War that the Rocky Mountain Laboratory of the Public Health Service was in a position to furnish yellow fever vaccine to the Army.[78] During the intervening period, the Rockefeller laboratories had furnished large quantities of vaccine and the director of that organi-

---

[75] Ltr, TAG to CGs Armies, CAs, etc., 30 Jan 41, sub: Vaccination of troops against yellow fever. AG : 720.3.

[76] (1) Memo, Dr. W. A. Sawyer, International Health Div Rockefeller Foundation, to SG, 9 Jul 40, sub: Manufacture of yellow fever vaccine. HD: 720.3 (3) Memo, Dir Prev Med Div SGO for SG, 31 Jul 40, sub: Conference with Director, Rockefeller International Health Board concerning yellow fever vaccine. HD : 720.3.

[77] Ltr, SG to Surg Gen USPHS, 17 Aug 40, and reply, 3 Sep 40. HD : 720.3. Yellow Fever.

[78] Ltr, Admin Fed Sec Agency to SecWar, 26 Sep 41. HD : 720.3 Yellow Fever.

zation stated his willingness to continue to furnish this material to the Army for the duration of the emergency. It was then mutually agreed by representatives of the Army, Navy, Public Health Service, and Rockefeller Foundation that the latter organization continue to furnish vaccine to the Armed Forces, the Public Health Service to manufacture such material as was considered necessary to meet any anticipated demands of the civilian population and thus also provide an emergency reserve of the agent to be available to the services if for any reason it should become impracticable to continue with the Rockefeller supply.[79]

This arrangement was continued until April 1942 when it became apparent that the outbreak of jaundice in the Army at that time was associated with yellow fever vaccination.[80] While the role of yellow fever vaccine in the production of jaundice was not clearly understood at that time, it was considered advisable to discontinue, temporarily at least, the vaccine currently in use and to substitute an agent from another source. Accordingly, arrangements were made to obtain vaccine from the Public Health Service at least until the true nature of the vaccine-jaundice relationship could be established. In addition, stocks of the original material in this country were called in and supplies in installations outside the country were destroyed.[81]

The first vaccine received by the Army from the Public Health Service was prepared in much the same manner as that obtained from the Rockefeller Foundation and, like that material, contained as a stabilizing agent normal human serum.[82] However, consideration was being given to the production of a vaccine containing no serum and in fact a small quantity of material of this type had been prepared previously and was furnished to the Army late in May 1942.[83] Later in the same month, the decision was made that as soon as feasible all of the yellow fever vaccine used by the Army be made without human serum.[84] In accordance with this decision the vaccine prepared for Army use by both producing laboratories, the Public Health Service and Rockefeller Foundation, was subsequently of the aqueous base, serum-free type. All of the yellow fever vaccine received by the Army after 1 June 1942 had been prepared in this manner.

---

[79] (1) Memo, Dir Prev Med Div SGO for SG, 21 Oct 41, sub: Yellow fever vaccine. HD: 720.3. (2) Ltr, TAG to Admin Fed Sec Agency, 29 Sep 41. HD: 720.3 Yellow Fever.

[80] Memo, Dir Prev Med Div SGO for SG, 15 Apr 42, sub: Report on jaundice and yellow fever vaccination. HD: 720.3 Yellow Fever.

[81] (1) Memo for file, Maj A. P. Long, Prev Med Serv SGO, 15 Apr 42 sub: Change of supply of yellow fever vaccine. HD: 720.3. (2) Memos, Asst Prev Med Serv SGO for Chief Prev Med Serv SGO, 10 and 18 Apr 42, sub: Recall of yellow fever vaccine. HD: 720.3.

[82] Memo, Dir Rocky Mountain Lab USPHS for Chief Prev Med Serv SGO, 5 May 42, sub: Preparation, et al., of yellow fever vaccine at the Rocky Mountain Laboratory. HD: 720.3.

[83] Ltr, Dir Rocky Mountain Lab USPHS to CO Army Med Supply Depot, Brooklyn, N. Y., 20 May 42. HD: 720.3 Yellow Fever.

[84] Memo, Prev Med Serv SGO for SG, 26 May 42, sub: Supply of yellow fever vaccine. HD: 720.3.

From this time, there were two sources of yellow fever vaccine. This allowed both for adequate amounts of the material for current use and for the maintenance of reserve stock piles both in this country and in overseas bases. The bulk of the vaccine used by the Army throughout the remainder of the war was that produced by the Public Health Service, while the Rockefeller Foundation also contributed large quantities of this immunizing agent and maintained large reserve stocks.

Methods and Requirements

The method of administration of yellow fever vaccine remained essentially unchanged throughout the war period. This procedure involved the subcutaneous administration of 0.5 cc. of a 1 : 10 dilution of the desiccated material. Sterile saline solution was furnished in bottles containing the proper amounts for making the desired dilutions. Thus with the 1 cc. vaccine ampule was furnished a bottle containing 10 cc. of saline, and with the 5 cc. ampule, a bottle containing 50 cc. of saline. Ten-fold dilutions yielded 10 cc. and 50 cc. of vaccine respectively, or 20 and 100 doses of 0.5 cc. each.

Detailed instructions for handling, storage, dilution, and administration of the vaccine were furnished in Circular Letter 9, Office of The Surgeon General, February 1941, and later in Circular Letter 162, Office of The Surgeon General, November 1942, and TB MED 114, November 1944. In addition, instructions for the dilution and administration of the vaccine were distributed with the material itself. The lability of this agent was stressed in all the instructions issued, and directions were given that it be shipped and stored at freezing temperatures and that diluted vaccine exposed to room temperatures for longer than 1 hour should not be used.

Possible contraindications to the administration of yellow fever vaccine at the same time as other antigens were considered. It was believed that since smallpox vaccine and yellow fever vaccine both contained living viruses, it was not desirable to administer them simultaneously. It was recommended that if both were to be administered, the yellow fever vaccine be given first and smallpox vaccination done at least 5 days later. Because of the apparent exaggerated reaction to typhoid vaccine when it was administered to individuals experiencing a febrile reaction from yellow fever vaccine, it was recommended that the administration of typhoid vaccine within a 7-day period following yellow fever vaccination be avoided whenever possible.

As previously indicated, the requirements for yellow fever vaccination were changed from time to time throughout the war period. These requirements and the various changes which were made were based on a number of considerations. The basic consideration was the provision for adequate protection against yellow fever of personnel stationed in or traveling through areas where the disease was known or reasonably suspected to exist. A second consideration was

the possibility of the introduction of yellow fever to areas where, while currently absent, the disease might spread rapidly due to the presence of the mosquito vector. Still a third consideration was the necessity for compliance with the quarantine regulations of certain foreign governments. Of all of these factors, the last-named was perhaps the most troublesome, since, unless these regulations were complied with, detention of individuals traveling by air resulted, thus interfering with military travel and the smooth operation of transportation systems, particularly air transport.

The various administrative requirements for yellow fever immunization which were in effect during the years 1941 through 1945 are shown in Appendix A. These requirements varied from that of selective vaccination of individuals stationed in the tropics, which was in effect early in the program, through the vaccination of all military personnel effected during the first half of 1942, to the final policy of the immunization of those individuals whose route of travel or place of station was considered to require this special protection. The areas where hazards from yellow fever were considered to exist were redefined from time to time. This was done for two principal reasons. One was consideration of possible infection in areas where it had hitherto not been considered. This, for example, was the basis for extending the requirement for yellow fever vaccination for those individuals stationed in or traveling to Panama and the Canal Zone. Changes in definition of the areas requiring yellow fever immunization which are found in War Department Circular 254, 1943, and Circular 187, 1944 (see Appendix A) are based on the definition of certain foreign governments, particularly India and Egypt. It was not until May 1944 that the accepted period of immunity following yellow fever vaccination was increased from 2 to 4 years. As will be seen later, it had been considered for some time prior to this that immunity produced by yellow fever vaccine was retained for longer than 2 years, but there was reluctance on the part of both Indian and Egyptian officials to consider individuals vaccinated longer than 2 years previously as immune, and hence incapable of introducing the infection into their respective countries. The solution of this problem, that is the reconciliation of what was considered in this country to be safe practice with the quarantine requirements and regulations of India, particularly, was a long slow process and involved voluminous correspondence and interchange of communications through State Department as well as military channels.[85] The later phases of these negotiations are discussed in the chapter on Foreign Quarantine in Volume II of this series.

In addition to the War Department requirements for yellow fever vaccination as summarized and discussed above, there was a theater requirement for this vaccination for troops stationed in Hawaii and the Central Pacific Area

[85] "Résumé of the Controversy Regarding Yellow Fever Vaccination and Quarantine. India and the United States." HD: 720.3.

from September 1943 until June 1945.[86] Hawaii was not considered to be a yellow fever endemic area and vaccination was not accomplished for individuals prior to their departure from the United States. Instead the vaccine was shipped to Hawaii and administered to troops after their arrival. The basis for the requirement for yellow fever vaccination in Hawaii and the Central Pacific was the concern in the War Department over the potential dangers of the introduction of yellow fever into Hawaii which, because of the presence of *Aedes* mosquitoes, was considered to be a fertile area for the rapid development of an epidemic. Such a situation did not develop and yellow fever was not identified in the area at any time during the war. Vaccination there was, therefore, entirely a precautionary measure taken against this potential hazard.

Experience

Effectiveness. The effectiveness of yellow fever vaccine for the prevention of yellow fever had been well demonstrated prior to its adoption by the Army.[87] It was generally accepted in this country that satisfactory immunity developed within a week to 10 days following vaccination and lasted for an indefinite period beyond 2 years. In 1943, however, additional evidence became available which indicated clearly that the immunity following vaccination persisted for a period of at least 4 years.[88] It was this evidence which, added to previous experiences, made it possible to adopt the 10-day, 4-year policy which was then accepted as meeting the quarantine requirements for unrestricted entry into Egypt and India from yellow fever endemic areas.

As far as the effectiveness of yellow fever vaccine in American troops is concerned, there is little that can be said. No cases of yellow fever occurred. Neither was there appreciable exposure to the disease. Yellow fever did occur sporadically in the general areas in which some troops were stationed both in South America and in Africa. However, it is not known that the disease actually occurred in sufficiently close proximity to Army installations so that exposure actually took place.

Laboratory evidence of the efficacy of the vaccination was, however, obtained. This was done in order to check on the potency of the vaccine as it was used in the field. It was accomplished by the procurement of blood specimens from representative groups vaccinated at various places throughout the country. The presence of protective antibodies in these serum specimens showed defi-

---

[86] (1) Ltr, Mr. J. W. McCloy, Asst SecWar, to CG Hawaiian Dept, 8 Jul 43, and reply, 20 Jul 43. AG: 720 Hawaii. (2) Memo, Chief Prev Med Serv SGO for Mr. J. W. McCloy, Asst SecWar, 13 Aug 43. AG: 720 Hawaii. (3) Ltr, CG Hawaiian Dept to Mr. J. W. McCloy, Asst SecWar, 6 Sep 43. AG: 720 Hawaii. (4) Ltr, CG USAFPOA to TAG, 5 Mar 45, sub: Immunization of personnel proceeding to this theater, with 5 inds. HD: 720.3 POA Reqmts.

[87] See footnote 71 (1) and (2), p. 306.

[88] Fox, J. P., and Cabral, A. S.: The duration of immunity following vaccination with the 17D strain of yellow fever virus. Am. J. Hyg. 37: 93-119, Jan 1943.

nitely that the vaccines used were active and that the desired results were being obtained.[89]

Reactions. The relationship between apparently augmented reactions to typhoid vaccine in individuals recently vaccinated against yellow fever has been discussed. It is believed that this reaction occurred in those individuals expressing a febrile response to the yellow fever vaccine. Such a response had been anticipated, and in the first circular letter prescribing the use of yellow fever vaccine, it was pointed out that approximately 5 percent of vaccinated individuals could be expected to exhibit a slight general and febrile reaction between the fifth and the seventh day following vaccination. These reactions did occur but apparently not to the extent of 5 percent of the individuals vaccinated. Accurate figures of incidence are not available since complete reporting of reactions of this type was not required. In one series of approximately 125,000 vaccinations reported early in the program, febrile reactions were reported in just under 300 individuals; an incidence of approximately 0.2 percent.[90] Essentially no reports of reactions were received subsequently but this figure is considered to be representative of the total experience. Reactions of this type were characterized in the main by variable degrees of malaise, elevation of temperature occasionally as high as 101° F. or higher, and occasional axillary adenitis. There was no indication that these reactions bore any relationship to the postvaccinal jaundice which made its appearance early in 1942.

In March of 1942 it became apparent that the jaundice then occurring among troops was likely to develop into an incidence of epidemic proportions. This in fact did occur and the peak of the epidemic among troops in the continental United States was reached in late June and in overseas contingents about 1 month later. A total of over 50,000 cases of jaundice believed to have occurred in relationship to yellow fever vaccination were reported.[91]

Exhaustive studies and investigations were instituted as soon as it was evident that an epidemic was imminent. Early results obtained from these studies indicated that a causal relationship existed between the occurrence of jaundice and the administration of at least certain lots of yellow fever vaccine 2 to 3 months previously. This relationship seemed to be in connection with the human serum used for the stabilization of the vaccine. Acting on this evidence The Surgeon General in April 1942 discontinued the vaccine in current use. Soon after this, a serum-free vaccine was introduced and no cases of

---

[89] File: Yellow Fever Vaccine Tests. HD: 720.3.

[90] File: Yellow Fever Vaccine Reactions. HD: 720.3.

[91] (1) The outbreak of jaundice in the Army. Mil. Surgeon 94: 386-393, Oct 1942. (2) Sawyer, W. A.; Meyer, K. F.; Eaton, M. D.; Bauer, J. H.; Putnam, P., and Schwentker, F. F.: Jaundice in Army personnel in the western region of the United States and its relation to vaccination against yellow fever. Am. J. Hyg. 39: 337-430, May 1944; idem 40: 35-107, Jul 1944. (3) Walker, D. W.: Some epidemiological aspects of infectious hepatitis in the U. S. Army. Am. J. Trop. Med. 25: 75-82, Mar 1945.

jaundice were reported traceable to yellow fever vaccination with the new type of agent.

It was subsequently shown without question that jaundice could be transmitted to humans by the subcutaneous injection of very small amounts of human serum obtained from individuals developing the disease after yellow fever vaccination and that this jaundice resulted from infectious hepatitis.[92] This and other evidence obtained from the jaundice epidemic experience demonstrated clearly that the jaundice after yellow fever vaccination was not associated directly with the yellow fever virus itself but that it was due to an extraneous or contaminating virus introduced into the vaccine with the human serum component.

Subsequent to this experience, many thousands of individuals were vaccinated successfully with a yellow fever vaccine not containing human serum. Thus the cause of an unanticipated complication of immunization was discovered and effective steps were taken for the prevention of its future occurrence.[93]

CHOLERA, PLAGUE, AND TYPHUS VACCINATIONS

Vaccinations against cholera, plague, and epidemic typhus fever were "special immunization procedures." That is, they were not applied routinely but only for the protection of troops stationed in or departing for areas where danger from the specific disease was considered to be a real or potential hazard and for troops traveling through such areas. Since these vaccinations were considered as a group in the adoption of policies and procedures for their use by the Army, they will be treated in a similar fashion here.

Action looking toward the specific protection of American troops against cholera, plague, and typhus, should such protection be indicated, was taken in the early autumn of 1941. At that time, no American troops were under actual threat of any of these diseases. However, the possibility of future assignment to or even action in areas where these diseases were present was becoming more and more likely. This first action was taken in preparation for the future rather than to meet an existing situation.

The first step taken was the presentation of a memorandum requesting recommendations concerning these immunization procedures to the Chairman of the Division of Medical Sciences, National Research Council.[94] In this

---

[92] Oliphant, J. W.; Gillian, A. G., and Larson, C. L.: Jaundice following administration of human serum. Pub. Health Rep. 58: 1233–1242, 13 Aug 43.

[93] Jaundice following vaccination against yellow fever. J. A. M. A. 125: 1190–1191, 26 Aug 44.

[94] Memo, Col J. S. Simmons, SGO, for Dr. L. H. Weed, Div of Med Sciences NRC, 8 Sep 41, sub: Immunization against certain infectious diseases, notably plague, cholera, and typhus. HD: 720.3 Typhus.

memorandum, guidance was specifically requested with respect to the indications for vaccination and in connection with a definition of the agents to be employed and the methods for their use. In response to this request, a meeting of specialists in the various fields involved was arranged by the National Research Council and pertinent recommendations were made.[95] In essence, these were to the effect that all individuals stationed in or about to enter areas where danger of exposure to typhus fever or cholera existed should be vaccinated with an appropriate vaccine. For typhus, the vaccine recommended was the Cox type, yolk-sac vaccine; and for cholera, a vaccine containing 8 billion killed vibrios per cubic centimeter. It was also recommended that all personnel under serious threat of exposure to bubonic plague be vaccinated with "killed plague bacilli of an approved strain."

Acting on these recommendations, after investigating the source of the supply of the agents involved, The Surgeon General, on 13 November 1941, recommended to The Adjutant General that these procedures be adopted for selective use in the Army.[96] This recommendation was approved and these procedures were adopted on 6 January 1942 with the publication of War Department Circular 4 of that date. This circular stated that military personnel stationed in or traveling to certain areas should be vaccinated against typhus and/or cholera as prescribed by The Surgeon General, and that military personnel under serious threat of exposure to epidemics of plague should be immunized with plague vaccine as prescribed by The Surgeon General. This administrative directive was implemented on 14 January 1942 by technical instructions published in Circular Letter 3, Office of The Surgeon General, subject: Vaccination against typhus fever, cholera, and plague. In subsequent discussion of these procedures, each will be considered separately.

Cholera Vaccination

The Immunizing Agent. The cholera vaccine procured for use in military personnel was prepared by commercial manufacturers in accordance with the recommendations and requirements of the National Institutes of Health, United States Public Health Service.[97] The organism strains chosen for the vaccine were Inaba and Ogawa strains which were agglutinable, smooth, motile, presented characteristic biochemical activities, and were apparently fully virulent and antigenic. A large number of freshly isolated strains obtained from India were studied both at the Army Medical School and at the National Institutes of Health and those chosen for inclusion in the vaccine were considered to be the

---

[95] Minutes of conference on immunization against typhus fever, cholera, and plague called by NRC Subcommittee on Tropical Diseases, 22 Oct 41. HD: 720.3 Typhus.

[96] Ltr, SG to TAG, 13 Nov 41, sub: Immunization against typhus, cholera, and plague. HD: 720.3 Plague.

[97] (1) Memo for file, 20 Feb 42, sub: Conference regarding cholera vaccine held at the Army Medical School. HD: 720.3. (2) Ltr, Dr. M. V. Veldee, Natl Inst of Health, to Lt Col A. P. Long, SGO, 4 Apr 44. HD: 720.3 Cholera.

best obtainable for vaccine production. The finished vaccine consisted of a suspension of phenol-killed cholera vibrios containing 8 billion organisms per cubic centimeter of the vaccine.

Methods and Requirements. The method prescribed for the administration of cholera vaccine was first presented in Circular Letter 3, Office of The Surgeon General, 1942, previously referred to, and was republished subsequently in Circular Letter 162, Office of The Surgeon General, 1942, and TB MED 114, 1944. The initial vaccination consisted of two subcutaneous injections of 0.5 cc. and 1 cc. respectively at 7- to 10-day intervals. Stimulating doses of 1 cc. each at intervals of 4 to 6 months were recommended in the presence of serious danger of infection. This procedure as originally adopted was continued without change throughout the war.

Cholera vaccination was required for troops who were stationed in or traveling to areas where danger from cholera was considered to exist. The requirements as stated in the original War Department directive of 6 January 1942 were as follows: "All military personnel stationed in or traveling through Asia or other regions where cholera is known to be present in endemic or epidemic form will be immunized with cholera vaccine as prescribed by The Surgeon General." The vaccine was administered in this country only after receipt of orders directing travel to one or another of the areas concerned. It was fully realized that such immunity as did accrue from cholera vaccination was in all likelihood incomplete and probably of short duration. It was therefore emphasized that this procedure should not in any way serve as a substitute for sanitary or other measures for prevention and control of the disease.

The official War Department requirements for this procedure are found in Appendix B. During certain periods of the war, cholera vaccination was required for travel to areas where in fact no cholera existed. This was made necessary on administrative grounds in view of the uncertainty of the actual destination of certain troop contingents in some instances, and because of the difficulty in accomplishing the vaccination in an active theater as a last minute procedure prior to an operational move. In a similar manner and for much the same reasons, cholera vaccination was required for all operational Army Air Force personnel including those assigned to the Air Transport Command. While this policy undoubtedly resulted in the vaccination of individuals for whom no danger of exposure ever existed, it was the only practicable method of accomplishing the protection of all of those for whom it was considered necessary.

Effectiveness. While there had been little experience in the Army with cholera vaccination prior to World War II, this procedure had been practiced for many years in those areas where cholera is more or less a constant threat. First among these areas were India, China, and the Malay States. The results of vaccination, however, were never clear-cut and had not clearly demonstrated

the value of the procedure. Strong, in reviewing this past experience, states that "While prophylactic inoculation in cholera has been very widely employed for many years no definite unanimity of opinion exists in regard to its value during an epidemic though in general the reports have been favorable regarding its use."[98]

An analysis of large scale experience with cholera vaccine was presented in a study of a cholera epidemic in the Province of Madras, India, in 1942 and 1943.[99] In this epidemic, the study of two large groups, one vaccinated, the other unvaccinated, revealed that the incidence was 10.6 times more in the unvaccinated than in the "protected" group. From this and other supporting data, the authors drew the conclusion that ". . . there is definite proof that the protected persons are 10 to 14 times less susceptible to getting cholera than the uninoculated persons in the community." It was the feeling of the authors of this report that the protection afforded from vaccination persisted from 5 to 12 months.

The validity of these conclusions can neither be confirmed nor refuted by the experience with cholera among American troops during the war. The fact remains, however, that the occurrence of cholera among these troops was negligible. The disease was present in epidemic or semiepidemic form in a number of areas in which troops were stationed. These included China, India, and Burma. The only cases in American military personnel occurred in China in the summer of 1945 when 6 cases and 1 death were reported from the Liangshan area, and 7 cases and 1 death from Chihchiang.[100] The source of the infections in the Liangshan group was considered to have been baked goods secured from a local bakery. The cases at Chihchiang were believed to have resulted from the drinking of contaminated water. All of those developing cholera at Liangshan had been vaccinated in August 1943 with American vaccine (just over 2 years before the onset of illness). Information concerning subsequent or stimulating doses was not complete. However, it was determined that 5 of the 6 individuals involved had received a stimulating dose of Chinese vaccine in April and May 1944. Five of the group also received stimulating doses of Chinese vaccine in October 1944 and the sixth was given a dose of American vaccine in September 1944. In April 1945, five of the individuals concerned received American vaccine and the remaining person was given a booster dose of Chinese vaccine in May of the same year. Two received stimulating doses as late as July 1945. This group then appeared to have been

[98] Strong, R. P.: Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases. Philadelphia, The Blakiston Company, 1944, p. 634.

[99] Adisehan, R., Dir Pub Health Madras, India: Statistical evaluation of anti-cholera inoculation as a personal prophylactic against cholera and its efficacy in the prevention and control of cholera epidemics. HD: 710.

[100] ETMD, China theater, Aug 1945. HD.

reasonably well vaccinated although the exact nature of the Chinese vaccine used was not known.

Information on the original immunizations on the patients at Chihchiang was not obtained but all seven of the individuals had received a stimulating dose of vaccine as late as April and July 1945, the one man vaccinated in April having received Indian vaccine. These few cases of cholera in American personnel in China occurred at a time when there was a sharp outbreak among the Chinese in the Chungking area. Stringent precautionary measures were applied to safeguard the troops in that area from contaminated food and water. The relative effects of this procedure and of vaccination for the prevention of the disease in American personnel could not be determined. It was necessary to assume that the result obtained accrued from a summation of all the protective measures applied and that under similar circumstances, none of these measures may be omitted with safety.

No cases of cholera occurred in military personnel in the India-Burma theater although a sharp epidemic was experienced in the civilian population of Calcutta early in 1945.[101] Some evidence of the efficacy of vaccination in the prevention of the disease in this situation was derived from the fact that cholera did occur in approximately 50 British and Indian troops in the area at that time.[102] It was the practice of the British in this area to vaccinate only after the epidemic started, rather than to practice immunization before hand as was done for American personnel. The risk to which the British and American troops were exposed would appear to have been comparable although American sanitation may have been superior. As with experience in China, the only conclusion that could be drawn was that troops could be protected from cholera by the application of all the available preventive measures including vaccination.

Reactions. Almost no reports were received of untoward reactions following cholera vaccination. The vaccine used appeared to have been essentially free from reaction producing substances.

Plague Vaccination

The Immunizing Agent. The plague vaccine secured for use in the Army was commercially prepared in accordance with National Institute of Health requirements and standards.[103] The first procured (approximately 100,000 cc.) was prepared from avirulent stock culture strains. The remainder of the material obtained was made from virulent plague bacilli. The original virulent strains used were the Ureka strain isolated from a human case of plague in 1941 and F8251 isolated from infected fleas in 1941.[104] These strains were

[101] ETMD, India-Burma theater, 1 Jun 45. HD.

[102] Med Intel Rpt, U. S. Navy Liaison Off, Calcutta, 28 Jul 45, sub: Cholera. HD: 710.

[103] Natl Inst of Health, Minimum Requirements for Plague Vaccine, 20 Apr 45.

[104] Ltr, Dr. M. V. Veldee, Natl Inst of Health, to Maj A. P. Long, SGO, 8 Apr 42, with incls. HD: 720.3 Plague.

replaced in the latter part of 1942 by a virulent Indian strain (No. 337, Hooper Foundation, University of California).[105] The finished vaccine was a suspension of formalin-killed plague bacilli containing 2,000 million organisms per cubic centimeter.

Methods and Requirements. Instructions for the use of plague vaccine were first published in Circular Letter 3, Office of The Surgeon General, 14 January 1942, and subsequently in Circular Letter 162, Office of The Surgeon General, 28 November 1942, and TB MED 114. Initial vaccination was accomplished by the subcutaneous administration of 2 doses of vaccine, 0.5 cc. and 1 cc. each, at intervals of 7 to 10 days. Subsequent doses of 1 cc. each were to be administered when stimulation of immunity was considered necessary. Under serious threat of exposure to plague infection, it was recommended that such doses be given as frequently as every 4 to 6 months.

Basic War Department policy for plague vaccination requirements contemplated administration of the vaccine to troops in areas where and when special danger from the disease was found to exist. Thus vaccination was not to be accomplished prior to embarkation for overseas but rather supplies of the vaccine were furnished to the theaters for use as indicated.[106] This policy was adhered to throughout the war with but two exceptions.

In view of the endemicity of plague in the Azores and in accordance with the recommendation made by the Surgeon of the British Base at Lagens, those ordered to permanent duty in the Azores were vaccinated prior to departure.

The second exception was made in connection with troops departing for duty in the western part of the Pacific Ocean Areas. At the request of theater officials, personnel ordered to duty in those areas were given plague vaccine prior to embarkation during part of the year 1945.[107] This practice was discontinued, however, shortly after the termination of hostilities.[108]

Effectiveness. The effectiveness of plague vaccination as practiced for American troops was not determined. No cases of plague were reported but neither was there indication that actual exposure occurred. The disease was present, however, in areas where American forces were stationed. These included the Azores where the disease smoulders in low endemic proportions, New Caledonia where two cases were reported in 1942, the Suez Area in Egypt where there was a brisk outbreak in late 1943 and early 1944, and the Dakar-Marrakech area where a moderate epidemic occurred in 1943 and 1944. Plague was also present in China and India in areas where American troops were

---

[105] Minutes of Conference on Plague Prevention and Therapy, Division of Medical Sciences, NRC, 15 Oct 42. HD: 720.3.

[106] WD Cir 4, 6 Jan 42.

[107] Ltr, TAG to CGs AAF, AGF, ASF, POEs, CofTrans, and SG, 20 Nov 44, sub: Immunization of troops moving overseas, and Amendment No. 2, 1 Feb 45. AG: 720.3.

[108] Memo, Troops Mvmts Branch Mobilization Div ASF to Opns Branch AGO, etc., 20 Aug 45, sub: Revised clothing and equipment chart for troops moving to all overseas commands (Change # 11). HD: 720.3 Travel Rqmts, POA.

stationed. (See chapter on plague and plague control in another volume in this series.)

Vaccination of American troops was practiced in all these areas in addition to rodent and flea abatement programs and general protective measures. Credit for the protection of American personnel against plague must of necessity be given to all of the procedures applied. The true value of plague vaccination alone could not be determined from the situations encountered and the experiences obtained.

Reactions. Reactions reported in connection with the administration of plague vaccine were minimal and no difficulties developed from this aspect of the use of plague vaccine of the type applied in the Army during the war.

Typhus Vaccination

The Immunizing Agent. The first typhus vaccine recommended for use by the Army was the Cox vaccine. This consisted of a 2-percent formalinized yolk-sac suspension of louse-borne epidemic typhus rickettsiae, Breinl strain. The rickettsiae were cultivated in the yolk sac of fertile hens' eggs and extracted by centrifugation and then washed.[109] As with all other biologic agents obtained commercially, acceptance for use in the Army was based on conformance with the minimum requirements of the National Institute of Health.

When the use of typhus vaccine was first contemplated it was being produced by only one commercial manufacturer and some time was required before large quantities of the agent could be made available. The supply situation was further clouded by the fact that sufficient funds were not available to purchase the quantities which would be needed soon after the procedure was officially adopted.[110] During the period between the official adoption of typhus vaccination and the time adequate procurement from commercial sources was effected, considerable amounts of the vaccine were furnished by the laboratories of the United States Public Health Service.[111] By March 1942, however, a number of commercial laboratories had accepted contracts for the production and supply of typhus vaccine and some 239,000 vials had been placed on order for delivery within the subsequent 6 months.[112]

The use of typhus vaccine for the protection of military personnel served as a stimulus to investigations aimed at improvement in the quality and effectiveness of this agent. Those most actively engaged in this work were investi-

---

[109] Cox, H. R.: Use of yolk sac of developing chick embryo as medium for growing rickettsiae of Rocky Mountain spotted fever and typhus groups. Pub. Health Rep. 53: 2241–2247, 23 Dec 38.

[110] Memo, Dir Finance and Supply Div for Dir Prev Med Div, 24 Nov 41. HD: 720.3 Typhus.

[111] Memo for file, 1 Jan 42, sub: Typhus vaccine. HD: 720.3.

[112] Table. Procurement status of typhus vaccine on order with manufacturers, 5 Mar 42. HD: 720.3.

gators at the National Institute of Health, the Connaught Laboratories of Toronto, Canada, and the Army Medical School.[113]

It was early recognized that the original Cox vaccine was deficient in antigen content. In December 1941, the workers at the Connaught Laboratories in Toronto demonstrated the ether method of extracting rickettsiae from yolk-sac suspensions. The vaccine recommended consisted of an ether extraction of the yolk-sac suspension followed by centrifugation and resuspension of the rickettsiae. Following this the Army Medical School initiated an experiment to compare the various typhus vaccines then available and susceptibility of being used by the Army. They consisted of the Cox vaccine described above, the ether extracted yolk-sac vaccine of the Connaught Laboratories, the French epidemic mouse-lung vaccine and the Mexican murine rat-lung vaccine. The results of these experiments showed the Cox vaccine and the Mexican murine rat-lung vaccine did not adequately protect guinea pigs against epidemic type of rickettsiae. The other two vaccines, however, did appear to afford good protection. A soluble antigen obtained from ether extracted yolk-sac suspension was demonstrated independently and at approximately the same time by two of the research laboratories (Army Medical School[114] and National Institute of Health).[115] A vaccine containing a greater concentration of rickettsiae and soluble antigen was prepared and tested in man and guinea pigs. This new method of processing eliminated centrifugation which in turn eliminated the loss of antigen in the form of minute rickettsiae and in the form of soluble antigenic material. On 25 May 1942, at a conference called by the Subcommittee on Tropical Diseases of the National Research Council, it was agreed that "Typhus vaccine should contain both the soluble antigen heretofore discarded and all of the available rickettsiae bodies," and that the "ether extraction method without centrifugation is at present the best method of preparation of vaccine. . . ."[116] On 26 August it was recommended that the Army, Navy, and Public Health Service use a typhus vaccine made from 10-percent yolk-sac suspension including the so-called soluble antigen formalin killed and prepared by ether extraction.[117]

By September 1942, all manufacturers of typhus vaccine for Army use had been instructed by the National Institute of Health to prepare this new type agent.[118] However, in order to avoid a break in the supply, the new material

[113] (1) Memo, Col J. S. Simmons to SG, 26 Dec 41, sub: Report on conference on typhus vaccine attended at Connaught Laboratories, U. of Toronto. HD: 720.3. (2) Memo, Chief Virus Lab, Army Med School, for Dir Army Med School, 20 Mar 42, sub: Report on the testing of four different typhus vaccines in guinea pigs. HD: 720.3. (3) Natl Inst of Health Bull. No. 183, Studies on Typhus Fever, 1945. (4) "Outline of Methods Developed for the Preparation of a Concentrated Typhus Vaccine," Army Medical Center, 20 Nov 42. HD: 720.3 Typhus. (5) Connaught Laboratories Memos No. 3 and 4. War Project Med 8 (NRC Canada), 13 Nov 42. HD: 720.3 Typhus.

[114] See footnote 113 (2).

[115] See footnote 113 (3).

[116] Minutes, NRC Conference on Immunization against Typhus Fever, 25 May 42. HD: 720.3.

[117] Minutes, NRC Conference on Typhus, Cholera, and Plague, 26 Aug 42. HD: 720.3 Typhus.

[118] Memo for file, 12 Sep 42, sub: Typhus vaccine. HD: 720.3.

was brought in gradually and a number of months passed before all the vaccine procured for Army use was being made by the improved methods. By late March 1943, however, sufficient supplies of this improved agent had been procured to allow the discontinuance of distribution of the "old" or original type of material.[119]

With the increase in experience in production and testing of the vaccine, it was possible to improve its quality still further. Such improvement was exemplified in May 1943 when the National Institute of Health increased the stringency of the antigenicity requirements which the vaccine was required to meet before it could be released for distribution.[120] As a result of the efforts directed toward the preparation of an effective typhus vaccine and the continued supervision and control over its production by the Biologics Control Division, National Institute of Health, it was considered that this agent as supplied for the use in American troops was the most effective obtainable and certainly superior to any previously produced.

Methods and Requirements. The methods of use of typhus vaccine were first prescribed in Circular Letter 3, Office of The Surgeon General, 14 January 1942. The initial vaccination consisted of three 1 cc. doses administered subcutaneously at intervals of 7 to 10 days between doses. It was recommended that stimulating doses of 1 cc. each be administered in a similar fashion at 4 to 6 months intervals in the presence of serious danger from infection.

This method of administration of vaccine was followed until September 1944 when in accordance with the recommendation made by a National Research Council conference group, the basic immunization was limited to two 1 cc. injections of the vaccine.[121] Instructions concerning this new method as well as the recommendation that stimulating doses be administered on a seasonal basis rather than at certain time intervals were published in TB MED 114, November 1944. No other changes in the methods of administering typhus vaccine were effected.

The administrative requirements for typhus vaccination as they obtained at various periods throughout the war are shown in Appendix C. The basic policy contemplated the protection of those troops likely to be exposed to disease. Vaccination of the entire Army against typhus was not done. At the end of the war, typhus vaccination was a requirement for travel to, or station in, virtually all overseas theater bases. This was necessary both because of the wide distribution of typhus throughout the world and because troops ordered to certain typhus-free areas were subject to movement to typhus areas on short notice. Since it was considered that the protection afforded from vaccination

---

[119] Memo, Chief Epidemiology Branch SGO for Dir Supply Serv SGO, 23 Mar 43, sub: Typhus vaccine. HD: 720.3.

[120] Natl Inst of Health, Memo for Manufacturers of Typhus Vaccine, 11 May 43. HD: 720.3.

[121] (1) Minutes, NRC Conference on Typhus, 22 Jun 44. HD: 720.3. (2) Ltr, TAG to CGs POEs, COs POEs, CofTrans, 8 Sep 44, sub: Inoculation for typhus fever. AG: 720.3

was considerably augmented by stimulation some months after the initial vaccination the value to such individuals was actually increased by having received the first doses of vaccine some time before actual danger from exposure occurred.

Effectiveness. As indicated, vaccination was practiced for all troops subjected to possible exposure to epidemic typhus fever. However, the prevention of typhus, like that of a number of other infectious diseases, was based not on vaccination alone but on the application of other protective procedures as well. First among there were the facilities, materials, and instructions provided for the prevention of louse infestation of troops and the performance of rapid and sure disinfestation should lousiness occur. The degree of louse infestation of American personnel was very low. For example in the European theater in December 1944, it was determined that only 0.5 percent of 1,800 troop units had experienced lousiness among their personnel, there being less than 25 individuals infested.[122] The objective of the typhus prevention and control measures applied in the Army was the provision of the greatest degree of protection obtainable and not the determination of the comparative efficacy of the various procedures used. This objective was realized in the occurrence of less than 100 cases of epidemic typhus among Army personnel (see discussion on typhus fever in another volume in this series). Twenty-eight cases were reported from the European Theater of Operations, 19 from Africa and the Middle East, and 17 from the Mediterranean theater. In all of these areas, typhus fever was prevalent among civilians at one time or another during the occupation by American troops and the opportunities for exposure were undoubtedly numerous.

While the exact role played by vaccination in the prevention of typhus among troops could not be clearly defined, it was generally accepted that this measure was an effective one. Such cases of typhus as did occur among vaccinated individuals were apparently considerably milder than those experienced by unvaccinated individuals in the same area. This fact was first noted in North Africa in 1943 where about a dozen cases of the disease, all of which were mild, occurred among Americans who were vaccinated. Unvaccinated British troops on the other hand experienced about three times as many cases, one-third of which ended fatally.[123] It was also the experience that when vaccinated laboratory workers contracted typhus the disease was modified considerably from that experienced under similar situations before specific protection was afforded by the type of vaccine used in the United States Army. In summarizing the efficacy of typhus vaccine, it was agreed by those present at the National Research Council conference on typhus, held in June 1944, that "The evidence is all in favor of the opinion that while vaccination against

[122] ETMD, ETO, Jan 1945. HD.

[123] (1) Ltr, Lt Col Y. Kneeland, and others, to Chief Surg ETOUSA, 2 Mar 44, sub: Report of mission on typhus, ETO. HD: 710. (2) NATOUSA Cir Ltr 43, 11 Nov 43, sub: Typhus fever control. HD.

epidemic louse-borne typhus fever does not always prevent infection, it causes the disease to be mild and appears thus far to prevent death from typhus." [124] The experience subsequent to this meeting offered no evidence other than in corroboration of this opinion. By the end of the war, no reports of deaths from epidemic typhus fever in vaccinated Army personnel had been received in the Office of The Surgeon General.

Reactions. Untoward reactions to typhus vaccine were not significant either in number or severity and presented no interference with the vaccination program.[125] Reports were received early in 1943 of reactions occurring immediately after injection of the vaccine and characterized by intense pain and burning. On investigation, these symptoms were determined to be the result of excess residual formalin in certain lots of vaccine. Following the discontinuation of use of these particular lots, no further reports of reactions of this type were received.

With the extensive use of vaccines produced in eggs, there arose the possibility of the occurrence of reactions of sensitivity to these agents. Such reactions, however, did not materialize in any appreciable number. From the few reports of reactions of allergic nature following typhus vaccination, it was shown, however, that this vaccine was capable of precipitating such a response. This was not entirely unexpected since it was known that approximately 10 percent of the typhus vaccine protein nitrogen was attributable to ovalbumen.[126] Such allergic reactions as did occur appeared for the most part to have been on a basis of the presence of sensitivity to egg protein before the vaccination rather than the development of this sensitivity through the administration of vaccine containing the allergen. Two fatal anaphylactic reactions following the administration of typhus vaccine were reported. In both instances, investigation revealed the preexistence of a sensitivity to egg which was not detected prior to the injection of the vaccine. These occurrences led to the adoption of routine questioning of personnel who were to receive vaccines produced in eggs. A question usually used was "Do you eat eggs or chicken?" A negative answer required further study to determine the presence or absence of sensitivity.

INFLUENZA VACCINATION

Development and Adoption

The influenza vaccine adopted by the Army and the methods for its use were developed through the activities of the Commission on Influenza, Board for the Investigation and Control of Influenza and Other Epidemic Diseases

[124] See footnote 121 (1), p. 321.

[125] File: Immunization, Reactions, Typhus Vaccine. HD: 720.3.

[126] (1) Memo, Chief Div of Virus and Rickettsial Diseases, Army Med School, for Dir Epidemiology Div SGO, 17 Jan 44. HD: 720.3 Typhus Vaccine. (2) Rpt of Joint Investigation, Div of Virus and Rickettsial Diseases, Army Med School, "Allergenic and anaphylactogenic properties of vaccines prepared from embryonic tissues of developing chicks," 1944. HD: 720.3 Egg Sensitivity, Reactions.

516336 O—55— —22

in the Army [127] (later called Army Epidemiological Board), which was administered through the Preventive Medicine Service, Office of The Surgeon General.

Influenza vaccination was first adopted by the Army in the autumn of 1943.[128] At that time the procedure was applied in certain Army Specialized Training Program units in the Second, Sixth, Seventh, and Ninth Service Commands. This selective vaccination was in accordance with provisions of AR 40–210, and was accomplished as a field trial of the procedure. Following the successful results of this trial, information was published stating that influenza vaccine had been approved for the Army but that it would be recommended for use only in the face of an outbreak or threatened outbreak of the disease.[129] It was also pointed out that at that time the supply of vaccine was limited and that large quantities would not be available before the latter part of 1944. Because of this limitation of supply, the material that was available was stockpiled in a central depot in the United States so that the most judicious use could be made of it should the need arise.[130]

Some relatively small-scale influenza vaccination was accomplished in the Army in the late spring of 1945 but it was not until September of that year that vaccination of large numbers of military personnel was undertaken. At that time, in view of the possibility of an influenza outbreak during the coming winter, vaccination of the entire Army was directed.[131] Because of the special nature of the procedure it was not adopted as routine but only for a one-time application to be accomplished, for personnel already in the Army, during the months of October and November and for recruits as they entered the service, from that time through 15 April 1946.[132]

The Immunizing Agent

The vaccine used was a suspension of killed (formalinized) influenza virus types A and B made from the growth of the virus in the allantoic fluid of the embryonated chicken egg. The vaccine was prepared commercially in accordance with the minimum requirements of the National Institute of Health and recommendations issued by the Office of The Surgeon General.[133]

---

[127] (1) Bayne-Jones, S.: Board for the Investigation and Control of Influenza and other Epidemic Diseases in the Army. Army M. Bull. No. 64, Oct 1942, pp. 1–22. (2) Francis, T.: The development of the 1943 vaccination study of the commission on influenza. Am. J. Hyg. 42: 1–11, Jul 1945.

[128] Book message 30–33, SG to CGs 2d, 6th, 7th, and 9th SvCs, 15 Oct 43. HD: 720.5 Influenza.

[129] TB MED 85, 15 Aug 44.

[130] Ltr, SG to CGs AGF, AAF, all theaters, etc., 12 Aug 44, sub: Influenza vaccine. HD: 720.3.

[131] WD Cir 267, 5 Sep 45.

[132] (1) WD Cir 381, 21 Dec 45. (2) Teletype message SPMDR, WD to CGs AAF, AGF, and ASF, 27 Feb 46. HD: 720.3 Influenza. (3) WD Cir 113, 18 Apr 46.

[133] (1) Natl Inst of Health, Minimum Requirements for Influenza Vaccine, 1 Jun 44 and subsequent revisions. (2) SGO, Recommendations for the Preparation of Influenza Virus Vaccine, Types A and B, for the United States Army, 9 May 44; 2 Apr 45; Feb 1946. HD: 720.3.

The type A virus component consisted of equal quantities of the PR8 Strain and the Weiss Strain of influenza virus A. The type B component was made up entirely of the Lee Strain of virus B.

Methods and Requirements

The vaccine was administered in a single dose of 1 cc. given subcutaneously. Because the virus was grown in eggs it was emphasized that the vaccine should not be administered to individuals hypersensitive to egg protein.[134]

It was required that all Army personnel be vaccinated during the months of October and November 1945. Those who did not receive the vaccine during those periods were vaccinated as soon thereafter as possible. All military personnel embarking for overseas travel between 1 October 1945 and 15 April 1946 were required to have received influenza vaccine subsequent to 1 October 1945. No repetition of the vaccination was required although a booster dose of 1 cc. after an interval of approximately 30 days was contemplated if the situation warranted.

Experience

Effectiveness. The results of the 1943 trials of influenza vaccine in Army Specialized Training Program units were considered to be highly successful and have been amply described elsewhere.[135] These trials were conducted in nine Army Specialized Training Program units in various sections of the country. The timing of the actual vaccinations was most fortunate since, in most instances, it was accomplished approximately 2 weeks before the outbreak of the 1943–44 epidemic of influenza type A. Over 12,000 individuals were included in the studies. This number was almost equally divided into a vaccinated group and a control group. The aggregate results showed the occurrence of approximately 3.5 cases among the controls for each case in the vaccinated group. The evidence gathered also strongly suggested that the protection from vaccination developed in about 1 week, thus indicating the probable value of the vaccine when given just before or even at the onset of an epidemic. As was expected, there was no significant difference between the vaccinated and the

---

[134] See footnote 131, p. 324.

[135] (1) Members of Commission on Influenza, Army Epidemiology Board: A clinical evaluation of vaccination against influenza. Preliminary report. J. A. M. A. 124: 982–985, 1 Apr 44. (2) Rickard, E. R.; Thigpen, M., and Crowley, J. H.: Vaccination against influenza at the University of Minnesota. Am. J. Hyg. 42: 12–20, Jul 1945. (3) Hale, W. M., and McKee, A. P.: The value of influenza vaccination when done at the beginning of an epidemic. Am. J. Hyg. 42: 21–27, Jul 1945. (4) Eaton, M. D., and Meiklejohn, G.: Vaccination against influenza: a study in California during the epidemic of 1943–44. Am. J. Hyg. 42: 28–44, Jul 1945. (5) Hirst, G. K.; Plummer, N., and Friedewald, W. F.: Human immunity following vaccination with formalinized influenza virus. Am. J. Hyg. 42: 45–56, Jul 1945. (6) Salk, J. E.; Menke, W. J., and Francis, T.: A clinical epidemiological and immunological evaluation of vaccination against epidemic influenza. Am. J. Hyg. 42: 57–93, Jul 1945. (7) See also footnote 127 (2), p. 324.

unvaccinated group with respect to the occurrence of the so-called common respiratory infections or common cold.

The vaccination of all military personnel in the autumn of 1945 was also timely in that an outbreak of mild influenza type B occurred throughout the country during the month of December 1945.[136] While this outbreak actually touched the Army very lightly, it was extremely difficult to arrive at a quantitative estimation of the part played by immunization in the prevention of the disease among troops. Unlike the situation in 1943–44, there were no unvaccinated control groups among military personnel for direct comparison. The only comparisons possible, therefore, were with other Service groups who were unvaccinated and with the civilian population. These comparisons, based on the relative experience of these groups in the 1943–44 influenza A epidemic as well as the current epidemic of influenza B, indicated strongly that the vaccination of military personnel was responsible for a considerable reduction in morbidity from that which could have been expected had this measure not been applied.[137] The degree of this reduction could not be accurately measured for the Army as a whole but in two instances where direct comparison could be made between small groups of vaccinated and unvaccinated persons, the total incidence of the acute respiratory infections among the vaccinated as compared to that in the unvaccinated was 1.15 percent to 9.9 percent, and 1.9 percent to 16.9 percent respectively.

From all the evidence available from the 1945 experience it was concluded that vaccination played a significant role in the prevention of influenza B among military personnel in the United States during the epidemic period.

Reactions. Experience gathered during the trials of influenza vaccination in 1943 indicated the occurrence of systemic reactions following administration of the vaccine in 16 to 20 percent of those vaccinated. These reactions were characterized by generalized aching, chilliness, malaise, and mild fever. Only a small proportion of those experiencing reactions of this type required hospitalization.[138] There were no anaphylactic reactions encountered in the groups studied at the time although there were reports of two instances of cutaneous eruption following vaccination.

Specific reports of reactions encountered following administration of the vaccine in 1945 were not required. However, some reports were forwarded to the Office of The Surgeon General in accordance with the general instructions regarding the reporting of reactions of unusual severity or number.[139] These reports showed considerable variation in the occurrence of reactions. Some

---

[136] ASF Monthly Progress Report, Sec. 7, Health, 31 Dec 45.

[137] ASF Monthly Progress Report, Sec. 7, Health, 31 Mar 46.

[138] Rpt, Dir Influenza Commission, Army Epidemiology Bd, to President Army Epidemiology Bd, 8 Feb 44, sub: Preliminary report of the clinical evaluation of vaccination against influenza. HD: 720.3.

[139] File: Immunization Reactions—Influenza Vaccine. HD: 720.3.

organizations reported as few as 7 percent generalized reactions while others indicated that as many as 85 percent of those receiving the vaccine experienced generalized reactions of varying degrees of severity. The most common incidence was considered to be between 25 and 50 percent. These reactions were characterized in general by fatigue, aching muscles, headache, chilliness or slight actual chills, and fever. The onset was usually within 8 to 10 hours after vaccination. Only a small proportion of the reactions were of sufficient severity to require hospital care. Local reactions consisting of burning and stinging of the arm with some residual soreness and stiffness were not uncommon.

In addition to the local and generalized reactions referred to there were reported three reactions of an anaphylactic nature. Two of these were fatal. All were considered to have been allergic responses to the egg component of the vaccine in individuals previously sensitized to egg protein.

JAPANESE B ENCEPHALITIS VACCINATION

Development and Adoption

Large-scale vaccination of human beings against Japanese B encephalitis was first practiced by the Russians, but vaccines prepared in the United States according to their procedures were found to possess little or no immunogenic potency on assay in animals. In early 1943, however, a mouse brain vaccine with immunogenic potency measurable in animals and in human volunteers was developed in this country.[140]

Action was initiated in September 1944 to obtain a stock of this vaccine and to sponsor and encourage efforts toward the improvement of this agent.[141] Because of the unique nature of the vaccine and the difficulties inherent in its preparation only limited supplies were available in the summer of 1945. Its use was officially adopted by the War Department in July 1945, however, and vaccine was sent to Okinawa as it became available.[142]

The Immunizing Agent

The vaccine adopted consisted of a 10-percent saline suspension of virus-infected mouse brain, the virus having been inactivated by formaldehyde. The Nakayama strain of Japanese B encephalitis virus was used.[143] This material was procured from commercial biologic manufacturers and was prepared and

---

[140] Sabin, A. B., and others: The St. Louis and Japanese B types of epidemic encephalitis. Development of noninfective vaccines: report of basic data. J. A. M. A. 122: 477–486, 19 Jun 43.

[141] (1) Minutes of Conference on Japanese B Encephalitis Vaccine, SGO, 23 Sep 44. HD: 720.3. (2) Memo, Chief Prev Med Serv SGO for SG, 7 Oct 44, sub: Japanese B encephalitis vaccine. HD: 720.3.

[142] (1) TB MED 181, Jul 1945. (2) Memo, Dir Epidemiology Div SGO for Chief Supply Se v SGO, 13 Aug 45, sub: Japanese B encephalitis vaccine. HD: 720.3.

[143] See footnote 140.

tested for use in the Armed Forces in accordance with National Institute of Health Minimum Requirements for this agent.[144]

Subsequently, a vaccine prepared from infected embryonated eggs was developed in the Division of Virus and Rickettsial Diseases of the Army Medical School.[145] This vaccine consisted of a 20-percent suspension of virus infected chick embryo tissue inactivated with formaldehyde. None of this material was available for use during the war. It was first produced in large quantities by the Army Medical School Laboratories in 1946, and used subsequently in Japan, Korea, and Okinawa.[146]

Methods and Requirements

The method of use of Japanese B vaccine as prescribed in TB MED 181, July 1945, was the "subcutaneous injection of two doses of 2 cc. each with an interval of 3 days between doses." The large individual doses were considered necessary in view of the apparent low antigenicity of the material and the short interval was considered desirable as a safeguard against reactions due to the establishment of a sensitive state following the first dose. In view of the low order of neutralizing antibody response among the vaccinated on Okinawa [147] and the corroborating evidence obtained in the Virus and Rickettsial Disease Division of the Army Medical School,[148] this method was later abandoned and the following procedure adopted for use in the preepidemic vaccination program on Okinawa and Japan in the summer of 1946. "Two doses of 1 cc. each mouse brain vaccine with 7 day intervals constitutes basic preepidemic course to be followed 1 month after first injection by one single 1 cc. booster dose of either mouse brain or preferably chick embryo vaccine. Booster dose may be given earlier in presence of threatened epidemic." [149]

Administrative requirements for this vaccination were limited sharply by the geographic distribution and the seasonal occurrence of the disease and in the first season of its use (1945) by the limited supply of vaccine. Thus the procedure was first limited to "the use of combat troops in areas where adequate mosquito control cannot be accomplished and not to be (applied) until cases of the disease have occurred." [150] This requirement essentially limited the use

---

[144] Natl Inst of Health "Minimum Requirements Japanese B Encephalitis Vaccine for Use in Armed Forces," 8 Nov 44.

[145] Warren, J.: A vaccine against Japanese B Encephalitis prepared from chick embryos, 1945. HD: 720.3.

[146] Ltr, SG to CG Army Med Ctr, 21 Jan 46, sub: Production of Japanese B encephalitis vaccine. HD: 720.3.

[147] Rpt, W. McD Hammon, Consultant to SecWar, SGO, sub: Results of neutralization tests on sera of military personnel on Okinawa vaccinated by Japanese B mouse brain vaccine, 1946. HD: 720.3.

[148] Rpt, Chief Div of Virus and Rickettsial Diseases, Army Med School, Mar 1946, sub: Japanese B encephalitis vaccine. HD: 720.3.

[149] Radio SPMDR, CG ASF to CinC AFPAC, 29 Apr 46. HD: 720.3 Jap B Encephalitis.

[150] See footnote 142 (1), p. 327.

of this vaccine to certain combat troops on Okinawa in the early summer of 1945. This policy was modified in August 1945 to the extent that the vaccine was authorized for all troops in the area where the disease was occurring. However, limitation of such general vaccination was necessary because of inadequacy of the supply of vaccine.[151] This policy was still further modified in the spring of 1946 to allow for preepidemic vaccination of those troops considered to be at the greatest risk.

Experience

Effectiveness. A limited vaccination program was carried on in Okinawa in August 1945 in the face of an epidemic of the disease beginning among natives in July. A total of 53,139 individuals were known to have received the full course of vaccine and, in view of the limitations of reporting, it was considered that several thousand more may have been vaccinated.[152] It was agreed by competent observers that the 1945 experience did not yield information from which conclusions concerning the efficacy of the vaccine could be drawn. The bulk of the vaccinations were accomplished as the epidemic was on the wane. Of the 38 reported cases of encephalitis among military personnel, 20 occurred before any troops in the area from which the cases originated were vaccinated. Twelve cases occurred subsequently in nonvaccinated persons and 6 in those who had received the vaccine. The fact that vaccination in Okinawa did not result in appreciable response in neutralizing antibody titers was suggestive of lack of protection but the state of knowledge concerning the significance of such a response precluded complete acceptance of this finding as evidence of the immunogenic failure of the vaccine. As previously indicated, there was sufficient optimism concerning the value of the procedure to justify its use during the 1946 encephalitis season in Japan and the Ryukyu Islands, particularly Okinawa.

Reactions. In the preliminary studies carried out by the members of the Neurotropic Virus Commission some 1,000 persons (nonmilitary) were vaccinated with a noninfective mouse brain vaccine.[153] Approximately 500 of these received Japanese B virus vaccine, the other 500, St. Louis virus vaccine. The majority of the subjects developed transitory local reactions at the site of the injection consisting of erythema, swelling, itching, and in some, pain and tenderness. However, these were not considered to be of consequence. Between 8 and 9 percent of the total group experienced what were considered to be significant untoward reactions. These were mild in all but one instance.

---

[151] Radio, WD to CinC AFPAC, 13 Aug 45. HD: 720.3 Jap B Encephalitis Vaccine.

[152] Med Bull 20, Hq Army SvC I (Okinawa), 6 Oct 45, sub: Report on immunization with Japanese B encephalitis vaccine. HD: 720.3.

[153] Rpt, Commission on Neurotropic Virus Diseases SGO, 24 Jun 43, sub: Preliminary report on the vaccination of man against the St. Louis and Japanese B types of epidemic encephalitis. HD: 720.3.

The complaints most commonly expressed were those of headache, nausea, weakness, and drowsiness. Four persons receiving the St. Louis encephalitis vaccine experienced generalized urticaria. The one severe reaction followed administration of the St. Louis vaccine, and its onset was 5 days after the second dose. This patient developed unmistakable signs and symptoms of encephalitis, the etiologic diagnosis of which could not be made with certainty. It was considered to be either demyelination encephalitis from heterologous brain tissue or possibly true St. Louis encephalitis, the latter possibility being quite remote.

The true incidence of untoward reactions following the vaccinations on Okinawa could not be determined since the exact number of persons receiving the vaccine was not known. There were no stated criteria for the type of reactions to be reported, hence considerable variation in reporting was inevitable. The reactions reported appeared to have been those experienced among the 53,139 persons known to have been vaccinated with the full course and 2,274 who received one injection only.[154] Sixty-one local reactions were recorded, including those with pain and swelling at the site of injection and occasionally axillary lymph node enlargement. Actual abscess formation requiring drainage was reported in 5 individuals in 2 small units, suggesting the possibility of a break in technique and the introduction of a microorganism other than the virus of the vaccine. Only 19 systemic reactions characterized by malaise, fever, headache, and nausea were reported. Nineteen allergic reactions were recorded. These consisted largely of urticarial manifestations and in some instances angioneurotic edema with moderate respiratory difficulties.

Eight instances of neurologic reactions were reported. None of these were suggestive of a demyelinizing process. Three were so mild and transitory that a diagnosis could not be established. There appeared to be little doubt that there was involvement of the nervous system in the remaining 5 cases but association with the vaccine was not clear in all. In 2 the relationship may have been temporal only, in that the symptoms and signs did occur after the vaccine was administered (2 days and 4 days respectively). The other 3 cases, polyneuritic in nature, occurred at such periods after vaccination as to make causal relationship possible.[155]

The allergic reactions and those of nervous system involvement were the most important encountered. The absence of symptoms or signs pointing to demyelination was reassuring. Nevertheless the development and use of a vaccine free from nervous system tissue were considered most desirable and it

---

[154] See footnote 152, p. 329.

[155] Ltr, Actg Dir Commission on Neurotropic Virus Diseases SGO to Chief Prev Med Serv SGO, 22 Apr 46, sub: Neurological "reactions" in military personnel inoculated with Japanese B encephalitis vaccine on Okinawa in 1945. HD: 720.3.

was planned to substitute such an agent for the original vaccine to the greatest extent possible during the 1946 season.

IMMUNIZATION FOR SPECIAL SITUATIONS

Immunization procedures other than those referred to in the foregoing paragraphs were authorized and applied occasionally to meet special situations. These included those for protection against diphtheria, Rocky Mountain spotted fever, measles, infectious hepatitis, and scarlet fever. The administration of rabies vaccine to persons bitten by animals known or suspected to be rabid was also practiced when indicated.

Diphtheria Immunization

This procedure was not practiced routinely for United States troops but was reserved for those situations where such protection was considered to be particularly indicated. This policy was based on the following considerations. First, it was felt that although the age distribution of diphtheria had been shifting somewhat in recent years and the disease was becoming more and more one of young adults, its incidence among the age group represented by military personnel had not yet become sufficiently high, in this country at least, to cause concern. In other words, it was considered that the proportion of troops possessing actual or latent active immunity to diphtheria was sufficiently high that a significant incidence of the disease among them would be unlikely except under unusual conditions. It was considered that at least 55 to 60 percent of American troops were immune to diphtheria. This conclusion was derived in part from a study involving approximately 3,000 personnel at the end of their training period in this country. Of this group 55.6 percent were immune as determined by the Schick test. Undoubtedly others possessed some degree of latent immunity not measurable by this method.[156] A somewhat similar study was conducted in a general hospital in the North African theater where it was found that 71.5 percent of a group of 1,283 person were Schick negative.[157] The difference in the results in these two groups was considered to be due to the possible stimulation of immunity in the overseas group through actual contact with the disease. Also the latter group was made up in part of hospital detachment personnel including nurses and medical officers, persons more likely to have had contact with the disease and hence, more opportunity for the development of immunity than had the group studied in this country.

The second consideration in the decision not to immunize troops routinely against diphtheria was based on the fact that while toxoid was believed to be

---

[156] Diphtheria susceptibility and immunization. Bull. U. S. Army M. Dept. No. 76, May 1944, pp. 104–108.

[157] Karelitz, S., and Moloshok, R. E.: Immunity to diphtheria in Army personnel. War Med. 6: 232–235, Oct 1944.

the immunizing agent of choice it was known that there would be an appreciable occurrence of reactions in adults following the use of this agent.

The first instructions issued concerning diphtheria immunization were those published in Circular Letter 162, Office of The Surgeon General, 1942. These instructions indicated that the fluid or plain diphtheria toxoid was the agent to be used. They also referred to the reactions to be expected and indicated that only Schick positive persons should be immunized and then only in the presence of a definite hazard from the disease. The dosage recommended was 0.5 cc., 1 cc., and 1 cc. to be administered subcutaneously at intervals of approximately 3 weeks.

In May 1944, these instructions were simplified somewhat in TB MED 47. In this publication, the Schick test was described in some detail and an explanation of the various reactions to this test was presented. It was recommended that in the persons demonstrating "combined" reactions to the test, immunizations not be accomplished or if done, that small divided doses be employed. In TB MED 114, published in 1944, these instructions were modified and it was recommended that the regular course of 3 doses referred to above be preceded by 48 hours by a dose of 0.1 cc. given subcutaneously and that the administration of the remaining doses be limited to those exhibiting no severe reactions to this test dose. (A severe reaction was considered to be local edema, induration more than 6 cm. in diameter, or a marked constitutional reaction with fever in excess of 101° F.) The occurrence of such a reaction after any of the subsequent doses was also considered to be a contraindication of further injections of the toxoid. This method of immunization was thought to be particularly applicable in those situations where the performance of mass Schick test surveys prior to immunization were not practicable. It was felt that such situations might not be uncommon in view of the time required and the difficulties surrounding the satisfactory conduct of such testing. As a part of one of the studies previously referred to,[158] diphtheria immunizations were conducted in this manner without regard to the Schick test status of the personnel being immunized. In this study, reactions of considerably less severity than those described above were accepted as contraindications to further doses. It was determined that almost 60 percent of a group starting such a regime would complete the full series. Thus it was felt that the use of 0.1 cc. of toxoid subcutaneously as an initial test dose would exclude from subsequent treatment the majority of the reactors. No method was seen to eliminate entirely untoward reactions to diphtheria toxoid in adults, and it was realized that the regime described did not allow for the accomplishment of the complete immunization of any group of persons. It was believed, however, that such a program would raise the general level of immunity sufficiently to prevent a serious outbreak.

[158] See footnote 156, p. 331.

The first and only instance of the application in this country during the war of a diphtheria immunization program directed by the War Department was in the autumn of 1945. At that time, in view of the increase in diphtheria among general hospital personnel in the Zone of Interior, all such persons coming into contact with patients were Schick tested and the positives immunized.[159] In April 1946 because of the rise in incidence of diphtheria in the European and Mediterranean theaters, all military personnel under the age of 35 and all civilian employees and dependents of similar age were required to be immunized or Schick negative before traveling to those theaters.[160] At about the same time a program was undertaken to immunize personnel in the European theater most likely to be exposed to the disease.[161] A short time later, all dependents between the ages of 6 months and 15 years departing for theaters other than those referred to were required to be immunized to diphtheria before departure.

Diphtheria immunization was practiced only rarely in overseas installations during the war and then usually for units or groups considered to be exposed to unusual opportunities for infection. For example, some immunizations were done in the North Africa-Mediterranean theater because of the high incidence of diphtheria among civilians.[162] Also certain organizations in the Southwest Pacific area were Schick tested and the toxoid was administered in 1944.[163] In some of these units diphtheria toxoid was administered in two doses of 0.3 cc. and 0.4 cc. given 1 month apart. This program resulted in generalized reactions in approximately 8 percent of those immunized, local reactions in about 17 percent. None of these was considered to be severe in nature. Immunization programs were also carried out in selected organizations in the Persian Gulf Command[164] and the Alaskan Wing, Air Transport Command.[165]

Rocky Mountain Spotted Fever

Vaccination against Rocky Mountain spotted fever was practiced only to a limited extent. Early in the war the policy was established that mass vaccination of troops against this disease would not be undertaken. This policy was adopted in view of the general past experience with the disease which indicated a low attack rate even in those areas where it occurs with the greatest frequency. Consideration was given to the fact that protection by vaccination did not

---

[159] ASF Cir 415, 9 Nov 45.
[160] WD Cir 100, 3 Apr 46.
[161] ETMD, ETO, 27 Feb 46. HD.
[162] Monthly Sanitary Rpt, 51st Med Bn MTO, Nov 1943. SG: 721.5.
[163] (1) Ltr, SG to CG US Army Forces in South Pacific, 17 Feb 44, sub: Diphtheria. HD: 720.3.
(2) Ltr, Surg POA to SG, 6 Dec 44, sub: Transmittal of report on diphtheria. SG: 710.
[164] Monthly Sanitary Rpt, Persian Gulf Comd, Feb 1944. SG: 721.5.
[165] Monthly Sanitary Rpt, Sta 3 ATC, APO 938, 3 Apr 44. SG: 721.5.

appear to be absolute and was apparently of short duration. For protection against Rocky Mountain spotted fever emphasis was placed on frequent inspection of individuals in tick-infested areas with prompt removal of ticks found on the body.[166]

This policy did not prohibit vaccination entirely but limited it to personnel located in regions where danger from the disease was particularly great and where prolonged contact with brush was inevitable. Thus vaccination was considered applicable to such groups as patrols and guards operating in areas highly infested by ticks where Rocky Mountain spotted fever was considered to be a definite hazard.

The vaccine used was furnished by the Rocky Mountain Laboratory of the National Institute of Health. Both the "tick vaccine" and that produced in embryonated eggs were used.[167] During the year 1942 enough vaccine was supplied to vaccinate approximately 20,000 individuals. Vaccine was administered in 2 doses of 2 cc. each, with an interval of 5 to 7 days. This was considered somewhat excessive in view of the policy expressed above. Accordingly in subsequent years the National Institute of Health was requested to allot a total of 50,000 cc. of vaccine for use in the Army each year.[168] From this quantity suballotments were made to the various service commands and instructions were issued emphasizing the desirability of limiting vaccination to the special situations previously described. As a result, the quantity of vaccine distributed was just over 40,000 cc. in 1943, and 13,000 cc. in 1944.[169]

In 1944 the dosage schedule was changed from a total of 4 cc. given in 2 doses to 3 doses of 1 cc. each.[170] During the 1945 season, the National Institute of Health distributed to the Army enough vaccine for approximately 16,000 persons. The increase over 1944 being due largely to the vaccination of prisoners of war employed in areas of high tick infestation.

Only 81 cases of Rocky Mountain spotted fever were reported among troops during the war years. None of these were in vaccinated individuals. This was perhaps less of an indication of the efficacy of the vaccine than of the fact that the disease did not represent a problem of any magnitude among Army personnel. While the Army experience could not be taken as evidence of the protection offered by Rocky Mountain spotted fever vaccination, there was reason to believe that the protection was considerable. The total experience with the procedure over the years has suggested that it is probably comparable

---

[166] (1) Ltr, SG to Surg 9th CA, 2 Apr 42, sub: Vaccination against Rocky Mountain spotted fever. HD: 720.3. (2) Ltr, SG to CGs all SvCs, attn Surgs, 8 Jun 44, sub: Rocky Mountain spotted fever vaccine. HD: 720.3. (3) TB MED 114, 1944.

[167] See footnote 166 (2).

[168] Ltr, Actg Dir Epidemiology Div SGO to Natl Inst of Health, 3 May 44. HD: 720.3 Rocky Mountain Spotted Fever.

[169] Ltr, Dir Rocky Mountain Lab, Natl Inst of Health, to Actg Dir Epidemiology Div SGO, 1 Jun 44, with incl. HD: 720.3 Rocky Mountain Spotted Fever.

[170] See footnote 166 (3).

to typhus vaccination in effect and that, while prevention may not be complete in all cases, those that do occur in vaccinated individuals tend to be mild.

Reactions to Rocky Mountain spotted fever vaccines were of little consequence and hence little information is available concerning them. Both local and systemic reactions were somewhat more frequent following use of the early tick vaccines than after the yolk-sac egg vaccines used later. The latter type agents were prepared in the same manner as was epidemic typhus vaccine. As might be expected, reactions from these vaccines were very similar both in extent and nature. However, no reports were received of true anaphylactic reactions following Rocky Mountain spotted fever vaccine administration.

Measles Prophylaxis

Because of the problems presented by measles during World War I consideration was given to the provision of specific protection against this disease early in the recent war period. There being no agent available for the production of active immunity, the use of human immune serum globulin for passive protection was the only procedure available.[171] In view of the short duration of this protection, the dose of globulin required, and the technique of its administration (10 cc. given intramuscularly), this method for the prevention of measles was reserved for debilitated persons and those whose protection was necessary for military reasons.[172]

Stocks of immune serum globulin were not available until early 1944 and at that time the quantity was limited. Accordingly this material was furnished routinely only to ports of embarkation for use in the protection of embarking troops.[173] Arrangements were made to furnish this material to other installations on special request as a specific need arose.

In actual experience, globulin was used for the prevention of measles only very rarely, the main reason being that measles failed to become a serious problem among troops for whom specific protection was urgently needed. All instances of its use were not reported and there were only two reports received which contained indications of the efficacy of the procedure. One of these reported the administration of globulin to 610 enlisted men who were exposed to measles just before embarkation. None of the individuals so protected developed measles.[174] The same procedure was applied to an Air Force unit under similar conditions and in this unit no measles developed subsequent to

---

[171] Cohn, E. J.; Onsley, J. L.; Strong, L. E.; Hughes, W. L., and Armstrong, S. H.: Chemical, clinical, and immunological studies on the products of human plasma fractionation. J. Clin. Investigation 23: 417–432, Jul 1944.

[172] (1) Memo, Chief Epidemiology Branch SGO for Chief Prof Serv SGO, 15 Dec 42. HD: 720.3 Measles. (2) See also footnote 166 (3), p. 334.

[173] (1) Ltr, SG to CG Boston POE, attn Surg, 10 Mar 44, sub: Use of immune serum globulin, Item No. 16055, for the prevention of measles. HD: 720.3 Measles. (2) Memo, Prev Med Serv SGO for Dir Supply Serv SGO, 25 Jul 44, sub: Item No. 1605500, immune serum globulin. HD: 720.3.

[174] Ltr, Surg Camp Kilmer, N. J., to SG, 10 Jun 44, sub: Immune serum globulin for prevention of measles. HD: 720.3 Measles.

the administration of the globulin and no reactions were reported in connection with the injections.[175]

Viral Hepatitis Prophylaxis

Evidence obtained from studies conducted in the Mediterranean Theater of Operations in 1944 and 1945 indicated the probable effectiveness of gamma globulin (immune serum globulin) for passive protection against naturally occurring viral hepatitis.[176] However, the practical value of this procedure was somewhat limited due to the short duration of the protection afforded (probably not more than 2 or 3 months) and the dose and method of administration (10 cc. intramuscularly). These limitations militated against the application of the measure on a large scale and though recommended for use when the indications arose, passive immunization against hepatitis was practiced only rarely.[177]

Studies conducted in one of the general hospitals in this country in 1944 and 1945 indicated the possible value of globulin for the prevention of post-transfusion hepatitis (homologous serum hepatitis).[178] This and other work led to the administration of globulin to general hospital patients in this country who had been wounded overseas and had received transfusions of blood or plasma.[179] The globulin was administered intramuscularly to those whose wounds had occurred at least 4 weeks and not more than 16 weeks previously. It was also given to those who, though not wounded, had been given blood or plasma not more than 16 weeks prior to the opportunity for the administration of globulin.

Subsequent investigative work as well as results from the administration of globulin to returned casualties as outlined failed to corroborate the earlier findings and the practice was discontinued early in 1946.[180]

Scarlet Fever Immunization

It was recognized that the available methods for immunization against scarlet fever were of little value, at least for military personnel. However, the immunizing agent was supplied (scarlet fever streptococcus toxin) and provisions were made for its use for the protection of nurses, ward attendants, and others in close contact with cases of the disease. The probability of un-

---

[175] Hq Troop Carrier Comd, Stout Field, Ind., Prev Med Bull 7, 20 Apr 45. HD: 720.3 Immune Serum Globulin.

[176] (1) Gellis, S. S., and others: The use of human immune serum globulin (gamma globulin) in infectious (epidemic) hepatitis in the Mediterranean Theater of Operations. J. A. M. A. 128: 1062–1063, 11 Aug 45. (2) ETMD, MTO, Feb 1945. HD.

[177] TB MED 206, 3 Nov 45.

[178] Grossman, E. B.; Stewart, S. G., and Stokes, J.: Post-transfusion hepatitis in battle casualties and a study of its prophylaxis by means of human immune serum globulin. J. A. M. A. 129: 991–994, 8 Dec 45.

[179] ASF Cir 329, 31 Aug 45.

[180] (1) ASF Cir 24, 28 Jan 46. (2) Ltr, Surg 2d SvC to CG ASF, attn SG, 13 Aug 45, sub: Prevention of hepatitis. HD: 720.3 Immune Serum Globulin.

toward reactions following the administration of the toxin and the limitations of its value were stressed.[181] As was anticipated, the procedure was seldom practiced.

Gas Gangrene

Throughout the war period, gas gangrene was a perplexing and to some extent an unsolved problem. While principally surgical in nature, this problem presented some aspects referable to preventive medicine. Among these were those matters relating to the prevention and to some extent treatment of the condition by immunological methods. At no time, however, were there established policies for the prophylaxis of gas gangrene through the routine use of antitoxin or toxoid. It was generally agreed that effective surgery plus the proper use of the new antimicrobial agents provided the most effective prophylactic and therapeutic procedures available.

An effective active immunizing agent was considered definitely indicated and desirable. Almost from the onset of hostilities, great efforts were made to develop such an agent. Numerous reports of the Committee on Medical Research of the Office of Scientific Research and Development and reports of the National Research Council attest to the diligence of these efforts. However, at the end of the war while much progress had been made no toxoid or other agent had been made available for active immunization to gas gangrene.

OTHER PROBLEMS OF THE IMMUNIZATION PROGRAM

Administrative Requirements for Immunizations in Overseas Theaters

The administrative requirements established by the War Department for the various immunizations have been presented in the foregoing paragraphs in the discussions of the individual procedures. In most of the overseas theaters or separate commands, local requirements were published in theater or command directives. In a number of instances, these included stipulations for the application of certain procedures in a manner particularly adapted to local needs. Appendix D shows these various overseas requirements.

Immunization Records

The proper preparation, maintenance, and forwarding of records of immunization presented some problems during the war period.

The designation of the completion of tetanus immunization by embossing the identification tag with the numerals of the years of completion of the basic series and single stimulating dose was mentioned in a discussion of tetanus immunization. This procedure appeared to be satisfactory and with a few

[181] (1) SG Cir Ltr 162, 1942. (2) Also see footnote 166 (3), p. 334.

minor exceptions gave rise to no difficulties. None of the other immunizations were recorded in such a special manner.

It was required that records in duplicate be prepared showing all immunizations received by each person in the military service. These records were made on special forms known as immunization registers. The form employed from the beginning of the war until early 1945 was WD MD Form No. 81 (Immunization Register) and that employed after January 1945 was WD AGO Form 8–117 (Immunization Register and other Medical Data).

The greatest difficulty encountered with respect to these records was in connection with their ready availability when required. Early in the mobilization period particularly, appreciable numbers of immunizations were repeated unnecessarily because of the failure in forwarding adequate records of the immunization status of personnel being transferred to new stations. This was corrected in part by administrative action requiring the forwarding of information of all incompleted immunizations with such individuals. However, the fault was not satisfactorily corrected until early 1945 when the new form was adopted and provisions were made for each person to have a copy in his possession. Under this system the unnecessary repetition of immunizations was reduced to a minimum. The adoption of the new form and the improved methods for its handling and disposition made readily available information concerning the immunization status of each individual as well as that on allergic states, spectacles, dentures, et cetera. This was of considerable value to the person concerned as well as to those responsible for his medical care and processing.

Supply Problems

Although the matter of supply of the various immunizing agents was closely related to the immunization program, it will be discussed here only briefly since a general discussion of medical supplies is presented elsewhere in the history.

As already indicated, the number of immunization procedures used in the Army increased from 2 or 3 at the beginning of the war to a dozen or more which were applied at one time or another before its end. The success of these procedures was dependent upon the availability of adequate quantities of satisfactory immunizing agents of the various types required. Almost all of these agents were procured from commercial manufacturers of biologic products and were purchased for Army use subject to the conformance with the minimum requirements and standards of the Biologics Control Division, National Institute of Health, United States Public Health Service. The interest, efforts, and cooperation of the personnel of that agency in their assistance to the Medical Department of the Army were of the highest order. Without their expert

assistance, advice, and guidance, as well as their official actions, the program would have functioned poorly if at all.

The procurement, storage, and issue of biologicals consisted of two separate but closely related main aspects. One of these included the fiscal, contractual, business, and mechanical handling of the large quantities of materials required. The other aspect was the control over the many technical details connected with the supply of the various agents used. For the coordination of these two aspects of the problem, it was necessary that there be the closest cooperation between the Supply Service, Office of The Surgeon General, and the Preventive Medicine Service through which the immunization program was administered. By this cooperative effort it was possible to establish, for the purchasing office, estimates of requirements for the various biologicals in keeping with the overall anticipated needs and to effect judicious distribution of materials so that the maximum use could be obtained from the quantities available. Such distribution control was of particular importance in the early phases of the war when many immunizing agents were in short supply. In turn the establishment of immunization policies depended upon knowledge concerning the availability of the various agents required, and it was only through cooperative, long-range planning that it was possible to accomplish the desired procedures by having at hand the necessary materials.

Other matters requiring technical control were those dealing with physical conditions of storage and shipment of biologicals. Requirements for refrigeration were established as well as for methods of shipment for the various materials. For example, great emphasis was given to the necessity for maintaining smallpox and yellow fever vaccines at freezing temperatures while other agents could be shipped and stored under less carefully controlled conditions.

It was found that, in general, it was desirable that all technical matters relating to the nature, type, potency, safety, keeping qualities, et cetera, of the various prophylactic biologicals be the responsibility of the Preventive Medicine Service and that the office function as the liaison on all such matters with the manufacturers and with the National Institute of Health. This plan was effectively followed with but few exceptions throughout the war. It was materially aided by assignment to the Preventive Medicine Service of an officer experienced in the production and testing of biologicals.

Long-range planning for the procurement of biologicals was found to be a necessity. Many of the materials in this category required extended periods of time for their manufacture even if the equipment was available and the techniques perfected. Thus for large supplies it was necessary that contracts be let well before the time of anticipated use of the various agents. It was also found that because of the limited civilian outlet for many of the biologicals required by the Army the manufacturers were loath to expand their production

346836 O—55——23

facilities until assurance would be given for definite quantity purchases by the Army.

In general, the supply of prophylactic biologicals was adequate to meet the needs. As indicated, there were shortages from time to time but through careful distribution planning the greatest use was made of the quantities available so that essentially no serious situation developed because of lack of the proper immunizing materials.

Antivaccination Activities

Throughout the war period, particularly during the early years, there was built up in the Office of The Surgeon General a considerable file of correspondence initiated by antivaccinationist individuals or groups.[182] Many of the letters were from sincere but misinformed persons who expressed opposition to the principle of compulsory immunization of American soldiers. Other communications voicing opposition to the use of immunization procedures in the Army were from individuals obviously attempting to foster the cause of one or another of the groups of unorthodox or nonmedical so-called healing professions. Their efforts in this regard took the form of attacks on regular recognized medical practices such as the use of vaccines and other immunizing agents.

Considerable time and attention were given to the answering of these complaints and protests. Argument was avoided wherever possible and straightforward information was provided, whenever requested, concerning the immunization procedures followed for Army personnel. It was pointed out that Army practices followed the precepts of the best medical and scientific teaching in the country and that it was the intent of the War Department to continue to follow these teachings.

These antivaccinationist activities led to no real difficulties in the accomplishment of the immunization program and were reflected only to an extremely limited extent in the attitude of militarized personnel. The policy requiring certain immunizations for all personnel on active duty with the Army was clear. The only exceptions afforded were those based on definite medical contraindications. The legality of this policy was upheld by The Judge Advocate General and enforcement was accomplished in all instances.[183]

CONCLUSION

The World War II Army immunization program was in the main successful. Certainly, smallpox, typhoid and the paratyphoid fevers, tetanus, and typhus which were all real hazards occurred with very low frequencies. It is

[182] File, Antivaccination. HD: 720.3.

[183] Ltr, JAG to TAG, 27 Nov 42, sub: Policy to be pursued in the event a soldier refuses to submit to preventive immunization. HD: 720.3 Legal Status.

fair to attribute at least some of this relative freedom from these infectious diseases to the immunizations practiced. There were but a few cases of cholera and none of either plague or yellow fever. There is no way to tell whether these diseases were, in fact, controlled in whole or in part by immunization since the degree and extent of exposure to them cannot be determined. The high degree of effectiveness of yellow fever vaccine had, of course, been well demonstrated previously. It must be remembered also that yellow fever vaccination for certain troops and forces was very necessary both because of potential exposure and to expedite their movement through the compliance with quarantine regulations of several countries.

The immunization program was large, comprehensive. and complicated. Some of the complications arose from its selective nature; that is, the requirement for specific immunizations for certain world areas. Though difficult to administer, this selective type of program was shown to be effective, and definitely to be preferred over the application of all procedures to all personnel.

This program demonstrated perhaps as well as any other of the Medical Service, the necessity for close coordination and cooperation between the professional and technical groups and administrative, fiscal, and logistic activities. Without this cooperation and coordination during World War II, the Army immunization program would undoubtedly have failed.

APPENDIX A

Administrative Requirements for Yellow Fever Vaccination

Date	*Requirements*	*Authority*
30 January 1941	All military personnel stationed in the tropical regions of the Western Hemisphere, including Panama and Puerto Rico. Those ordered to these areas to be vaccinated prior to departure.	WD AG Ltr (1–10–41) MA-M, 30 Jan 41, sub: Vaccination of troops against yellow fever. AG: 720.3.
9 May 1941	All military and civilian personnel stationed in tropical regions including Bermuda; all personnel who embark on Army transports for station in or travel through these regions; all personnel of tactical and mobile units of GHQ Air Force; all other Air Corps personnel on a voluntary basis.	WD AG Ltr (4–17–41) M-WPD-M, 9 May 41, sub: Vaccination of troops against yellow fever. AG: 720.3.
24 January 1942	All military personnel to be immunized as soon as practicable; those vaccinated in accordance with previous instructions not to be immunized a second time.	WD AG Ltr (12–26–41) MB-A-M, 24 Jan 42, sub: Vaccination of troops against yellow fever. AG: 720.3.
2 June 1942	All troops leaving United States by air or water. Vaccine available at ports of embarkation and for the Air Surgeon only.	WD AG Ltr (5–13–42) MB-M, 2 Jun 42, sub: Vaccination of troops against yellow fever. AG: 720.3.
29 June 1942	Vaccination limited to military personnel traveling to or through or stationed in areas where yellow fever is endemic. These areas defined by The Surgeon General as: In the Western Hemisphere, the mainland of South America lying between latitudes 13° N. and 30° S. including the islands immediately adjacent. In the Eastern Hemisphere, the portion of Africa lying between latitudes 16° N. and 12° S. including the islands immediately adjacent.	WD AG Ltr (6–22–42) MB-SPGA-PS-M, 29 Jun 42, sub: Vaccination of troops against yellow fever. AG: 720.3. Ltr, SG to CGs AGF, AAF, SOS, all Armies, CAs, Depts, Bases and Ports of Embarkation, COs all Exempted Stas, Chiefs of SvCs, 29 Jun 42, sub: Vaccination against yellow fever. SG: 720.3.

Date	*Requirements*	*Authority*
17 November 1942	Same requirements as 29 June 1942, with redefinition of endemic areas to include the Republic of Panama and the Canal Zone.	Ltr, SG to CGs AGF, AAF, SOS, all Armies, SvCs, Depts, Overseas Forces, Bases and Ports of Embarkation, COs all Exempted Stas, 17 Nov 42, sub: Vaccination against yellow fever. SG: 720.3.
27 November 1942	All military personnel of the Air Transport Command and civilian personnel detailed to flying duty with the Air Transport Command to be immunized against yellow fever as a routine procedure.	Ltr, CG ATC to CG North Atlantic Wing, CO Caribbean Wing, CG South Atlantic Wing, CG Africa-Middle East Wing, CO Alaskan Wing, CO India-China Wing, HQ AFATC, 27 Nov 42, sub: Immunization. HD: 720.3.
28 November 1942	All Army Air Forces personnel of air and ground echelons of operational and replacement training units.	Ltr, Air Surg to CG each Air Force, 28 Nov 42, sub: Medical. HD: 720.3.
11 February 1943	Same as 29 June and 17 November 1942, with added provision that if travel is by air, vaccination is to be accomplished at least 10 days prior to departure in order to avoid delays en route. Individual certificates of vaccination required for those traveling to India.	WD AG Memo 40–7–43, 11 Feb 43, sub: Summary of immunization requirements for overseas duty.
15 October 1943	Same as 11 February 1943, with added requirement that individuals destined for India and passing through endemic areas as defined in letter of 29 June 1942, or any part of Angola, French West Africa, French Equatorial Africa, or Eritrea be vaccinated not more than 2 years nor less than 14 days before entering these areas.	WD Cir 254, 15 Oct 43.

Date	Requirements	Authority
11 May 1944	All military and civilian personnel subject to field service with the Army and others authorized to travel to or through endemic yellow fever areas by Army transport or airplane to be vaccinated against yellow fever within 4 years and not less than 10 days prior to entry into an endemic yellow fever area. The yellow fever endemic areas redefined as follows: In the Eastern Hemisphere, that portion of Africa lying between latitude 18° S. and the northern borders of French West Africa, French Equatorial Africa, and the Anglo-Egyptian Sudan, including the islands immediately adjacent thereto. In the Western Hemisphere, the mainland of South America lying between latitudes 13° N. and 30° S., including the islands immediately adjacent, and Panama, including the Canal Zone. However, transit through the Panama Canal with brief sojourns within the terminal port cities or Army posts within the Canal Zone will not be considered as travel through an endemic area.	WD Cir 187, 11 May 44
9 November 1944	Restatement of policy established in WD Cir 187, 1944.	TB MED 114, 9 Nov 44.
21 June 1945	Discontinuance of yellow fever immunization authorized for personnel returning from ETO by air to the United States through Morocco, Dakar, and Brazil.	Radio WARX 20323, OPD WDGS to Supreme Hq Allied Expeditionary Forces, Frankfort, Germany, 21 Jun 45.
6 September 1945	Routine yellow fever immunization of Army Air Forces personnel discontinued. This personnel in the future to receive yellow fever immunization only in the case of individuals traveling to or through areas where yellow fever is endemic.	AAF Ltr 25–15C to all Air Force Comds, 6 Sep 45, sub: Immunization for overseas duty.

APPENDIX B

Administrative Requirements for Cholera Vaccination

Date	*Requirements*	*Authority*
6 January 1942	All military personnel stationed in or traveling through Asia or other regions where cholera is known to be present in endemic or epidemic form.	WD Cir 4, 6 Jan 42.
27 February 1942	All military personnel assigned to the Air Transport Command and civilian Air Transport Command personnel detailed to flying duty.	Ltr, CG ATC to Wing Comdrs and Hq AFATC, 27 Feb 42, sub: Immunization. HD: 720.3.
28 November 1942	All Army Air Forces personnel of air and ground echelons of operational and replacement training units.	Ltr, Air Surg to CG each Air Force, 28 Nov 42, sub: Medical. HD: 720.3.
11 February 1943	Personnel proceeding to or through Asia including the Middle East and islands of East Indies.	WD AG Memo W 40–7–43, 11 Feb 43, sub: Summary of immunization requirements for overseas duty.
22 January 1944	All personnel moving to the Southwest Pacific area.	WD AG Ltr (12 Jan 44) OB-S-SPMOT-M, 22 Jan 44, sub: Vaccinations of personnel moving to SWPA. AG: 720.3.
9 November 1944	Personnel stationed in or traveling to or through Asia, including the area around the Persian Gulf and islands of the East Indies (this requirement in addition to that shown in the 22 January 1944 letter, which remained in force).	TB MED 114, 9 Nov 44.
20 November 1944	Military personnel moving to Pacific Ocean Areas and civilian personnel with destination within the Pacific Ocean Areas, west of the Hawaiian Islands.	WD AG Ltr (17 Nov 44) AB-S-E-SPMOT-M, 20 Nov 44, sub: Immunization of troops moving overseas. AG: 720.3.
1 February 1945	Personnel moving to destination within Pacific Ocean Areas, west of 150° E. longitude (amendment to letter of 20 November 1944).	WD AG Ltr (29 Jan 45) OB-S-E-SPMOT-M, 1 Feb 45, sub: Amendment No. 2 to letter 20 Nov 44. AG: 720:3.

Date	*Requirements*	*Authority*
19 May 1945	Military personnel moving to Pacific Ocean Areas and to the Southwest Pacific; civilian personnel moving to these areas when the destination is west of the Hawaiian group and north of Australia.	WD AG Ltr (16 May 45)OB-S-E-SPMOT-M, 19 May 45, sub: Immunization for troops moving overseas. AG: 720.3.

APPENDIX C

Administrative Requirements for Typhus Vaccination

Date	*Requirements*	*Authority*
6 January 1942	All military personnel stationed in or traveling through Asia, Africa, continental Europe, or other areas where danger from epidemic typhus fever exists.	WD Cir 4, 6 Jan 42.
5 April 1942	All military personnel stationed in or traveling through the mountainous regions of Venezuela, Colombia, Equador, Peru, Bolivia, Chile, Mexico, and Central America (except Panama). This in addition to areas mentioned in WD Cir 4, 1942 above.	WD AG Ltr (3–28–42) MD-M, 5 Apr 42, sub: Vaccination against typhus. AG: 720.3.
11 July 1942	All military personnel stationed in or traveling through the British Isles. This in addition to areas cited in directives of 6 January and 5 April above.	WD AG Ltr (6–22–42) MD-SPMCE-PS-M, 11 Jul 42, sub: Vaccination against typhus for personnel traveling through the British Isles. AG: 720.3.
27 November 1942	All military personnel assigned to the Air Transport Command and civilian Air Transport Command personnel detailed to flying duty.	Ltr, CG ATC to Wing Comdrs and Hq AFATC, 27 Feb 42, sub: Immunization. HD: 720.3.
28 November 1942	All Army Air Forces personnel of air and ground echelons of operational and replacement training units.	Ltr, Air Surg to CG each Air Force, 28 Nov 42, sub: Medical. HD: 720.3.
11 February 1943	Personnel proceeding to or through Asia, Africa, Europe (including the British Isles) and the mountainous regions of Central and South America (including Mexico but excepting Panama). (Summary of directives of 4 January, 5 April, and 11 July 1942 above.)	WD AG Memo 40–7–43, 11 Feb 43, sub: Summary of immunization requirements for overseas duty.
22 January 1944	All personnel moving to the Southwest Pacific area.	WD AG Ltr (12 Jan 44) OB-S-SPMOT-M, 22 Jan 44, sub: Vaccination of personnel moving to Southwest Pacific area. AG: 720.3.

Date	*Requirements*	*Authority*
9 November 1944	Personnel stationed in or traveling through Asia, Europe (including the British Isles), mountainous regions of Central and South America (including Mexico but excepting Panama), Alaska, the Southwest Pacific, and certain islands in the South Pacific.	TB MED 114, 9 Nov 44.
20 November 1944	Military personnel moving to Pacific Ocean Areas and civilian personnel with destination within the Pacific Ocean Areas, west of the Hawaiian Islands.	WD AG Ltr (14 Nov 44) OB-S-E-SPMOT-M, 20 Nov 44, sub: Immunization of troops moving overseas. AG: 720.3.
1 February 1945	Personnel moving to destination Pacific Ocean Areas, west of 150° E. longitude (amendment to letter of 20 November 1944 above).	WD AG Ltr (29 Jan 45) OB-S-E-SPMOT-M, 1 Feb 45, sub: Amendment No. 2 to letter 20 Nov 44. AG: 720.3.
19 May 1945	Military personnel moving to Pacific Ocean Areas and to the Southwest Pacific; civilian personnel moving to these areas when the destination is west of the Hawaiian group and north of Australia.	WD AG Ltr (16 May 45) OB-S-E-SPMOT-M, 19 May 45, sub: Immunization for troops moving overseas. AG: 720.3

APPENDIX D

Administrative Requirements for Immunization of Overseas Areas by Diseases*

SMALLPOX

Command	Initial immunization	Revaccination	Authority
Chinese Combat Command (Prov), USF China theater.	Entry to service	Every 6 months, on or about 1 April and 1 October.	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	do	Every year (previously every 6 months).	India-Burma Theater Cir 5, 20 Jan [illegible]
USAF in Australia	do	Every 3 years	USA[illegible] r Ltr 12, 18 Jul 42.
		Every 3 years. Revaccinate on entry to theater if not done within preceding 12 months.	USA[illegible] g 50-30, 23 Nov 42.
USAF in South Pacific Area	do	Every 3 years	SPA [illegible] 87, 12 Jun 1944.
South Pacific Base Command	do	Every 3 years and in presence of epidemic.	SOPAC [illegible]ase Comd Memo 78, 28 Jun 45.
USAF in the Far East	do	Every 3 years and within 1 year of return to SWPA.	USAFFE Cir 25, 25 Mar 45.
USAF in the Middle East	do	Every 3 years if vaccinia or vaccinoid. Repeat in 1 year if immune.	USAFIME Med Sec Cir 7, 21 Oct 42.
	Within 1 year prior to departure from the United States.	do	USAFIME Memo 3, 7 Apr 43.
Persian Gulf Service Command.		Prior to leaving the Middle East for return to the United States.	PG SvC Med Branch Cir 3, 12 Apr 43 (in accordance with instructions from theater headquarters).
	Within 1 year prior to departure from the United States.	Every 3 years if vaccinia or vaccinoid. Repeat in 1 year if immune.	PG SvC Cir 37, 20 Apr 43.

*Based on data available to author in Preventive Medicine Service and Historical Division, Office of The Surgeon General, on 1 June 1946.

SMALLPOX—Continued

Command	Initial immunization	Reimmunization	Authority
USAF South Atlantic	Entry to service	Every year	USAFSA Memo 2, 10 Jan 44.
		Every 3 years or in presence of epidemic.	USAFSA Memo 3, 24 Jan 44.
European theater	do	Every year	ETO Adm Cir 63, 9 Sep 43.
	Immediate if no record since 1 July 1943.	Immediate if no record since 1 July 1943.	Ltr, CG ETO to CGs each Army, Air Force, Corps, Div, etc., 7 Feb 44, sub: Immunization. HD: 720.3.
	Entry to service	Every 3 years	ETO Cir 62, 4 Jun 44. ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.

TYPHOID-PARATYPHOID

Chinese Combat Command (Prov), USF China theater.	Entry to service	Every year	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	do	Every year (previously every 6 months).	India-Burma Theater Cir 5, 20 Jan 45.
USAF in Australia	do	Every 3 years and in presence of epidemic.	USASOS Cir Ltr 12, 18 Jul 42.
	do	3 years after initial dose, and in presence of epidemic.	USASOS Reg 50–30, 29 Nov 42.
		Every year, and in presence of epidemic.	USASOS Reg 50–30, C 1, 21 Sep 43.
USAF in South Pacific Area	do	Every year	SPA Memo 87, 12 Jun 44.
South Pacific Base Command	do	Every year and in presence of epidemic.	SOPAC Base Comd Memo 78, 28 Jun 45.
USAF in the Far East	do	Every year, in presence of disease, and within 1 year prior to return to theater.	USAFFE Cir 25, 25 Mar 45.

USAF in the Middle East	do	Every year	USAFIME Med Sec Cir 7, 21 Oct 42.
Persian Gulf Service Command.	do	do	USAFIME Memo 3, 7 Apr 43. & PG SvC Supply Cir 37, 20 Apr 43.
USAF South Atlantic	do	do	USAFSA Memo 2, 10 Jan 44.
European theater	do	do	ETO Adm Cir 63, 9 Sep 43.
	Immediate if no record since 1 July 43.	Immediate if no record since 1 July 43.	Ltr, CG ETO to CGs each Army, Air Force, Corps, Div, etc., 7 Feb 44, sub: Immunization. HD: 720.3.
	Entry to service	Every year	ETO Cir 62, 4 Jun 44. ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.

TETANUS

Chinese Combat Command (Prov), USF China theater.	Entry to service	1 year after initial dose, and in presence of wound or operation.	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	do	1 year after initial dose and as necessary thereafter.	India-Burma Theater Cir 5, 20 Jan 45.
USAF in Australia	do	1 year after initial dose, within 6 months prior to combat, and after injury.	USAFIA Cir Ltr 12, 18 Jul 42.
	do	1 year after initial dose and within 6 months prior to entry to theater (possible second stimulating dose), and after injury.	USASOS Reg 50–30, 29 Nov 42.
USAF in South Pacific Area	do	1 year after initial dose	SPA Memo 87, 12 Jun 44.
South Pacific Base Command	do	1 year after initial dose, and when indicated clinically.	SOPAC Base Comd Memo 78, 28 Jun 45.

TETANUS—Continued

Command	Initial immunization	Reimmunization	Authority
USAF in the Far East	Entry to service	1 year after initial, after injury, and within 1 year prior to return to theater.	USAFFE Cir 25, 25 Mar 45.
USAF in the Middle East	do	At end of 6 months [after initial] providing none given in United States, and after injury.	USAFIME Med Sec Cir 7, 21 Oct 42. USAFIME Memo 3, 7 Apr 43.
Persian Gulf Service Command.	do	do	PG SvC Supply Cir 37, 20 Apr 43.
USAF South Atlantic	do	Every year	USAFSA Memo 2, 10 Jan 44.
European theater	do	Every year	ETO Adm Cir 63, 9 Sep 43.
	Immediate if no record since 1 February 1944.	Immediate if no record since 1 February 1944.	Ltr, CG ETO to CGs each Army, Air Force, Corps, Div, etc., 7 Feb 44, sub: Immunization. HD: 720.3.
	Entry to service	Every year, after injury and on operative procedure on old wounds.	ETO Cir 62, 4 Jun 44.
	do	1 year after initial, after injury, and on operative procedure on old wounds.	ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.

TYPHUS

Chinese Combat Command (Prov), USF China theater.		Every 6 months on or about 1 April and 1 October.	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	Theater requirement	Every 6 months	India-Burma Theater Cir 5, 20 Jan 45.
USAF in Australia	For task forces operating from Northern Australian bases and for Air Corps.	Every 4 to 6 months in danger of infection.	USAFIA Cir Ltr 12, 18 Jul 42.

	In threat of epidemic or assignment to Asia, Africa, or continental Europe.	do	USASOS Reg 50–30, 29 Nov 42.
USAF in South Pacific Area	If proceeding to SWP, and not previously immunized.	In presence of definite exposure	SPA Memo 87, 12 Jun 44.
South Pacific Base Command	When stationed in or proceeding to west of 130° E. or north of 30° N. if not previously immunized.	When stationed in or proceeding to west of 130° E. or north of 30° N., every 6 months on or about 1 February and 1 November in endemic area and in presence of epidemic.	SOPAC Base Comd Memo 78, 28 Jun 45.
USAF in the Far East	Theater requirement	In presence of disease, and within 6 months prior to return to theater.	USAFFE Cir 25, 25 Mar 45.
USAF in the Middle East	do	Every 3 months	USAFIME Med Sec Cir 7, 21 Oct 42. USAFIME Memo 3, 7 Apr 43.
Persian Gulf Service Command.	do	do	PG SvC Supply Cir 37, 20 Apr 43.
USAF South Atlantic	do	Every 6 months	USAFSA Memo 2, 10 Jan 44.
European theater	do	Every year	ETO Adm Cir 63, 9 Sep 43.
	Immediate if no record since 1 July 1943.	Immediate if no record since 1 July 1943.	Ltr, CG ETO to CGs each Army, Air Force, Corps, Div, etc., 7 Feb 44.
	Theater requirement	Every year, and every 4 to 6 months in danger of infection.	ETO Cir 62, 4 Jun 44.
	do	Every year about 1 December, and every 3 to 6 months in danger of infection.	ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.

34623O—55—24

CHOLERA

Command	Initial immunization	Reimmunization	Authority
Chinese Combat Command (Prov), USF China theater.	Theater requirement	Every 6 months, on or about 1 April and 1 October.	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	Theater requirement and between 6 months and 6 days prior to departure for travel by air to or through Egypt.	Every 6 months and between 6 months and 6 days prior to departure for travel by air to or through Egypt.	India-Burma Theater Cir 5,O 20 Jan 45.
USAF in Australia	For task forces operating in Northern Australian bases, and Air Corps.	Every 4 to 6 months in danger of infection.	USAFIA Cir Ltr 12, 18 Jul 42.
	In threat of epidemic, or assignment to Asia, Africa, or continental Europe.	do	USASOS Reg 50–30, 29 Nov 42.
USAF in South Pacific Area	When proceeding to SWP theater if not previously immunized.	In presence of exposure	SPA Memo 87, 12 Jun 44.
South Pacific Base Command	When stationed in or proceeding to west of 130° E. or north of 30° N. if not previously immunized.	When stationed in or proceeding to west of 130° E. or north of 30° N. Every 4 to 6 months in endemic area, and in presence of epidemic.	SOPAC Base Comd Memo 78, 28 Jun 45.
USAF in the Far East	Theater requirement	Every 6 months for personnel serving in Philippine Islands, and within 6 months of return to theater.	USAFFE Cir 25, 25 Mar 45.
USAF in the Middle East	do	Every 6 months	USAFIME Med Sec Cir 7, 21 Oct 42. USAFIME Memo 3, 7 Apr 43.
Persian Gulf Service Command.	do	do	PG SvC Supply Cir 37, 28 Apr 43.
USAF South Atlantic	do	do	USAFSA Memo 2, 10 Jan 44.
European theater	For travel or station in Asia (including Middle East) and East Indies.	Every 4 to 6 months in the areas indicated.	ETO Adm Cir 63, 9 Sep 43.

	For travel or station in Asia (including Middle East), the Southwest Pacific area, and East Indies.	Every 4 to 6 months when necessary [in the areas indicated].	ETO Cir 62, 4 Jun 44.
	do	Every 4 to 6 months in presence of danger of cholera.	ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.
PLAGUE			
Chinese Combat Command (Prov), USF China theater.	In threat of exposure to epizootics and epidemics of human bubonic or pulmonic plague.		China Theater Cir 13, 4 Apr 45.
USAF in Australia	In threat of exposure to epidemics of human bubonic or pulmonic plague (no vaccine in Australia at the time).		USAFIA Cir Ltr 12, 18 Jul 42.
	For assignment to Asia, Africa or continental Europe, or in threat of epidemic.	When indicated	USASOS Reg 50–30, 29 Nov 42.
USAF in the Far East	In presence of disease		USAFFE Cir 25, 25 Mar 45.
European theater	In threat of exposure to epidemic	When indicated	ETO Adm Cir 63, 9 Sep 43.
	do	Every 4 to 6 months when necessary.	ETO Cir 62, 4 Jun 44.
	do	Every 6 months; in presence of danger of plague.	ETO Cir 1, 7 Jan 45. ETO Cir 68, 25 May 45.

YELLOW FEVER

Command	Initial immunization	Reimmunization	Authority
Chinese Combat Command (Prov), USF China theater.		Every 4 years	China Theater Cir 13, 4 Apr 45.
USF India-Burma theater	For travel into yellow fever zone		India-Burma Theater Cir 5, 20 Jan 45.
USAF in Australia	Advised but temporarily discontinued until new vaccine supplied.		USAFIA Cir Ltr 12, 18 Jul 42.
	For personnel in endemic regions		USASOS Reg 50-30, 29 Nov 42.
USAF in South Pacific Area		Initial vaccination will be considered to protect for 4 years.	SPA Memo 87, 12 Jun 44.
South Pacific Base Command.	Theater requirement if not vaccinated during preceding 4 years.		SOPAC Base Comd Memo 228, 26 Dec 44.
USAF in the Far East	In presence of disease		USAFFE Cir 25, 25 Mar 45.
USAF in the Middle East	Theater requirement		USAFIME Med Sec Cir 7, 21 Oct 42.
			USAFIME Memo 3, 7 Apr 43.
Persian Gulf Service Command.	do		PG SvC Supply Cir 37, 20 Apr 43.
	Between 2 years and 10 days prior to departure for zone of the interior.		PG SvC Cir 64, 26 Jul 43.
	For personnel passing through or stationed in Anglo-Egyptian Sudan, Eritrea, and any country south of 15th Meridian at least 9 days prior to entry; and personnel returning to zone of the interior by unknown route, 9 days prior to departure [cites Memo 9, USAFIME, 14 Aug 43].	Every 2 years	PG SvC Cir, 8 Sep 43.

	Theater requirement and for travel to endemic zone.	do	Ltr, CG PG SvC to COs all Districts, Posts, Camps, and Stations, 3 Mar 44, sub: Yellow fever vaccine. HD: 720.3.
USAF South Atlantic	Theater requirement	Every 3 years	USAFSA Memo 2, 10 Jan 44.
	Theater requirement and 2 years to 2 weeks prior to entry into endemic areas.	do	USAFSA Memo 3, 24 Jan 44.
European theater	For personnel in yellow fever zone.		ETO Adm Cir 63, 9 Sep 43.
	For entry into or passage through yellow fever zone.		ETO Cir 62, 4 Jun 44.
	do	Every 4 years	ETO Cir 1, 7 Jan 45.
			ETO Cir 68, 25 May 45.

DIPHTHERIA

Persian Gulf Service Command.	In presence of disease		PG SvC Chart "Immunizaton Required," 31 Mar 43. HD: 720.3.
European theater	In presence of hazard and positive Schick test.		ETO Adm Cir 63, 9 Sep 43.
	Disease among troops with likelihood of spread.		ETO Cir 62, 4 Jun 44.
	do	Usually none	ETO Cir 1, 7 Jan 45.
			ETO Cir 68, 25 May 45.
	In accordance with AR 40–210, 25 Apr 45; TB MED 114, 9 Nov 44; TB MED 143, Feb 1945.		ETO Cir 69, 28 Sep 45.
USAF in the Far East	In presence of disease		USAFFE Cir 25, 25 Mar 45.

INFLUENZA

Command	Initial immunization	Reimmunization	Authority
European theater	Theater requirement		ETO Cir 69, 28 Sep 45.
USAF in the Far East	Presence of disease		USAFFE Cir 25, 25 Mar 45.

The volumes comprising the history of the Medical Department of the United States Army in World War II are divided into two series: (1) The Administrative and Operational series which constitutes a part of the general series of the history of the *United States Army in World War II*, published under the direction of the Office of the Chief of Military History, and (2) the Professional, or clinical and technical, series published as *The Medical Department of the United States Army* under the direction of the Office of The Surgeon General. Both series are being prepared by the Historical Unit, Army Medical Service. As part of the clinical series, this is the second of a group of volumes to be published concerning preventive medicine.

Index

Abbot, Camp:
  attitude conditioning program, 203
  consultation service, 189, 199–200
Aberdeen Proving Ground:
  consultation service, 216
  mental conditioning program, 181, 202, 203, 204
  retraining program, 209
Accident(s):
  causative agents, 239, 251–253
  environment as causative factor, 255–257
  host factors in causation, 253–255
  injury. *See* Accidental injury.
  prevention:
    advisory board, 243
    directive, 244
    ecologic approach, 250–257
    historical background, 237–241
    importance, 244–247
    overseas:
      European theater, 245, 264
      Mediterranean theater, 246, 264, 267
      North African theater, 266
      Persian Gulf Command, 266
      reporting of accidents, 244, 245
      Southwest Pacific area, 246, 264, 267
      special studies, 245
    policy, 241
    program in Office of The Surgeon General, 243–244
    safety program, 241–243
    training, 264–265
  proneness, 254–255
  reporting system, 243, 244
  See also Safety program.
Accidental injury:
  causes, 264, 265
  days lost, 239
  deaths, 239, 251
    causes, 253
    rates, 251, 252, 253
  definition, 236–237
  disability discharge, 239
Accidental injury—Continued
  during maneuvers, 240
  hospital admission rates, 239, 251
  in civilian population, 235–236
  manpower loss, 248–249
  See also Nonbattle injury.
Adjutant General, Office of The:
  classification course, 177
  clothing research, 45
  consultation service development, 176, 215
  neuropsychiatrists, functions outlined, 183–184, 189
  preventive psychiatry activities, 208–209, 211
Adolph, E. F., clothing studies, 55
Adviser system, in mental hygiene program, 201, 204–205
Aero-Medical Center, clothing research, 47
Africa:
  typhus fever, 322
  yellow fever, 311
Age, requirements for induction, 2, 3
Agriculture, Department of, studies in—
  DDT use, 58–59
  mite control, 56
  nutrient cooking loss, 86
  protective clothing, 51
Air Corps. *See* Army Air Forces
Aircraft accidents, injuries:
  deaths, 251, 252, 253
  disposition of patients, 265
  hospital admissions, 251
Air Forces. *See* Army Air Forces.
Air Provost Marshal, on safety advisory board, 243
Air Surgeon, Office of the:
  research in—
    clothing, 47
    nutrition, 93
  tropical uniform, report, 61
  vitamins for aircrews, request, 136

Air Transport Command:
cholera vaccination requirements, 316
diphtheria immunization, 333
nutrition, India-Burma theater, 145
Alaska:
clothing field studies, 50, 64
nonbattle trauma, hospital admissions, 248
tests for protection against pest insects, 65
Alaskan Wing, Air Transport Command, diphtheria immunization, 333
Alcohol:
factor in accidents, 253
poisoning, 247, 263–264
Aleutian Islands, clothing, 36
Allied Military Government, responsibility for prisoners of war in European theater, 140
Amebiasis:
cause of rejection, 5
preventive measures, 27
American Association of Psychiatric Social Workers, 211
American Expeditionary Forces:
clothing, 38–41
laundry facilities, 41–42
American Red Cross:
items for nurses' uniforms furnished, 41
personnel for social work, 211
snack bars provided, 139
social histories provided, 189, 195
World War I activities, 41, 42
American Revolution:
accidents, 237–328
sanitary rules, 13
Anemia, nutritional deficiency, 166–167
Anglo-American ration scale, 115
Antiaircraft Replacement Training Center, mental hygience service, 180, 188, 203
Antivaccination activities, 340
Anzio beachhead, ration for, 118
APPEL, Lt. Col J. W., mental hygiene activities, 186, 202, 207, 208
A ration:
components, 91, 104, 124, 128
need for, 132
use in—
hospitals, 123
troop trains and troopships, 22, 92
A ration—Continued
United Kingdom, 124–128
Zone of Interior, 90, 91
Arctic area, nutrition report, 166
Arctic overshoe, 38
Armed Forces, manpower requirements and utilization, 3, 7
Armies:
Eighth, nutrition study, 157–158
Fifth:
casualties, battle and nonbattle, 256–257, 260
cold injury, relation to clothing, 67, 68
nutrition studies, 117
sanitation conference, 25
shoepacs used, 68
shower and clothing exchange units, 26
trenchfoot, incidence, 67, 68
First:
accidents during maneuvers, 240
sanitation during maneuvers, 16
Second, sanitation during maneuvers, 16
Seventh, clothing report, 69
Sixth, personal hygiene, 28
Third:
accident prevention, 256
clothing report, 72
enemy food captured, 131
Armored Division, 2d, bathing facilities, 22
Armored Force Medical Research Laboratory. *See* Armored Medical Research Laboratory.
Armored Medical Research Laboratory, studies and tests:
anthropometric measurement, 49, 253
clothing, 47, 48–49, 52–53
flameproof treatments, 49, 75
physiologic studies, 32, 47, 48, 49, 52–53
protective, 75
shoes, 62, 64, 79
socks, 77
winter clothing, 64
design of equipment, 268
energy expenditure, 87, 101
toxicity of mildew-proofing agents, 77
Army, United States, enlistments, 2, 3
Army Air Corps. *See* Army Air Forces.
Army Air Forces:
accidental injury, 258. *See also* Aircraft accidents, injury.

Army Air Force—Continued
aptitude tests, 9, 176
cholera vaccination requirements, 315
diet for flying personnel, 92, 93, 94, 154
measles prophylaxis used, 335
physical standards for enlistment, 3
rations, 95, 125, 134, 135, 136
research and studies in—
clothing, 47
nutrition, 92–93, 118
Eighth Air Force, 92
Fifteenth Air Force, 17
Second Air Force, 92–93
Twentieth Air Force, 93
oxygen requirements studied, 86–87
safety program, 242
tropical uniform, 60, 63
volunteers for, 3
women's branch formed, 2
Army Epidemiological Board, influenza vaccine development, 323
Army General Classification Test, in screening, 8, 179, 191
Army Ground Forces:
classification system, 187
clothing field tests, 50, 75
consultation services at training centers, 187, 215
nutrition survey, 96, 97
ration planning, 93, 95
Army Group, 12th, bathing facilities, 22
Army induction board, seminar, 181
Army Industrial Hygiene Laboratory:
clothing research, 49
toxicity of dyes and mildew-proofing agents, tests, 77, 78
Army Medical Museum, post mortem study of pestvaccinal encephalitis, 287
Army Medical School, research:
cholera vaccine strains, 314
Japanese B encephalitis vaccine, 328
tetanus toxoid, 293
typhoid-paratyphoid vaccination, 272, 273, 275
typhus vaccine, 320
woolens tested for bacteria, 43
Army Nurse Corps:
field uniforms, 41
mosquito boots, 63
Army Safety Program, 244, 268–269
Army Service Forces:
consultation services, training centers, 187, 215
Geneva Convention, interpretation, 106
jungle combat clothing tests, 54
restraining, psychoneurotic soldiers, 208–209
safety program, 241–243
Army Signal Corps:
energy-expenditure tests, 87
nonbattle injuries, 259
Army Specialized Training Program, influenza vaccine trials, 325
Ascorbic acid:
amount—
consumed in diet, 103, 157, 158
in rations, 126, 133, 144
deficiency in troops, 161, 162, 163
Asia, cholera vaccination requirement, 315
Assam, bathing facilities, 29
Atabrine—
for suppression of malaria symptoms, 20, 27
relation to atypical lichen planus, 86
Athletics, nonbattle injury, 251, 252
Atterbury, Camp, nutrition study, 86
Attu:
clothing, 36
cold injury incidence, 66–67
Atypical lichen planus, 86
AUGUST, Maj. H. E., recommendations on consultation services, 215
Australia:
laundry facilities, 28
nonbattle injury, 253–254
personal hygiene, 27
procurement of food, 156–157
rations, adequacy, 156
Aviation Medicine, National Research Council Committee on, aviation clothing studies, 35, 47
Avitaminosis, in troops, 150, 154, 156
Azores, plague, 318

BABCOCK, Maj. M. J., nutrition survey, 142, 148
Barber(s):
in American Revolution, 13
kit, use in European theater, 24
personal cleanliness rules, 15

Bathing:
anti-louse measure, 15
facilities overseas:
China-Burma-India theater, 29
European theater, 20–23
improvised, 25, 28, 29
Middle East theater, 25
North African tehater, 25
Southwest Pacific area, 27, 28
regulations, 14
Battle casualty:
definition, 236
dispositions, comparison with nonbattle, 249
rates, comparison with nonbattle, 256, 260
BAZETT, H. C., studies in blood volume changes, 32–33
BEACH, E. F., nutrition study, 162
Bed nets, for protection against mosquitoes, 15, 20, 56
BEERS, C., recommendations for mental patients, 173
Belvoir, Fort, mental hygiene service, 180, 188, 204, 209–210
Benning, Fort, parachute injury study, 257
Benzyl benzoate, miticide, 57
Beriberi:
hospital admissions, 160
incidence, 164
Chinese troops, 143, 164
recovered prisoners, 154, 168
Berna's peptone, in tetanus toxoid, 291, 292, 301, 302, 303, 304, 305
BERRYMAN, G. H. nutrition survey, 102, 104
Biologicals, procurement, storage, and issue, 339
Biologics Control Division, National Institutes of Health:
Army immunization program, corporation, 338
production of typhus vaccine, supervision, 321
Blanding, Camp, mental hygiene service, 213, 214, 215
BLISS, Brig. Gen. R. W., prediction of nonbattle injury, 255
Board for Investigation and Control of Influenza and Other Epidemic Diseases in the Army. *See* Army Epidemiological Board.
Boot(s):
combat, 59, 62, 71
for prevention of cold injury, 67
for wear in tropics, 62
mosquito, 62–63
rubber, 40
Bragg, Fort, mental hygiene service, 192
B ration:
acceptability, 121, 122, 146, 147
caloric value, 115–116, 118
components, 91, 118, 119, 130, 138, 146, 152
deficiencies, 119–120, 133
results of prolonged consumption, 87
stocked overseas, 19, 141
stocked overseas, 129, 141
105, 123
supplementation, 117, 120, 133
Brazil, smallpox, 284
British-American rations, 124
British Army:
cholera, 316, 317
hospitals in North Africa, 114
nutritional problem, 111
protective clothing, joint project, 65
psychiatric problems, 173
rations, 111, 124, 141, 142, 153
tetanus, 297
tetanus toxoid used, 287–288, 290
trenchfoot, preventive measures, 68
typhus, 322
British Composite Pack, use by American troops, 114
British Fighting Vehicle Physiological Laboratory, studies, 48
British Medical Research Council, clothing research, 47
British Ministry of Agriculture, foodstuffs for United States troops, 139
British Ministry of Food, foodstuffs for United States troops, 139
Bureau of Standards, clothing research, 47
Burma, cholera, 316–317
Burns:
casualty from, 262–263
disposition of patients, 263, 265
preventive measures, 263, 266

Calcium:
amount—
consumed in diet, 103, 138
in rations, 126, 140, 144
deficiency in dietary, 142, 157, 158
deficiency in troops, 142, 157
Callan, Camp, mental hygiene service, 180, 188, 203
Calorie(s):
deficiency in troops, 157, 164, 166, 168
expenditure, 108
intake, 97, 100, 104
requirements, 89, 91, 101, 109, 117
value in—
food consumed, 97, 99, 100, 103, 104
food planned, 99 104
rations, 117, 126
B, 115, 120, 130, 151
C and K, 116, 129
Chinese, 144
prisoner of war, 119, 139, 140
ten-in-one, 130
Camp—
Abbot:
attitude conditioning program, 203
consultation service, 189, 199–200
Atterbury, nutrition study, 86
Blanding, mental hygiene service, 213, 214, 215
Callan, mental hygiene service, 180, 188, 203
Carson, ration field trials, 104, 161
Claiborne, mental hygiene service, 226–227
Croft, mental hygiene service:
intake procedure, 195
mental screening, 191, 192, 193
outpatient psychiatry, 214
reclassification board, 198
Crowder, mental hygiene service, 194–195, 226
Hood, mental hygiene service, 189, 201, 204–205
Lee:
clothing field tests, 50, 78
mental hygiene service, 200–201, 202, 214
ration field tests, 87, 122
Plauche, outpatient psychiatry, 214
Camp—Continued
Roberts, mental hygiene service:
administration, 188, 190
caseload, 214
intake procedure, 195
personnel adjustment lectures, 212–213
therapy, 199
Upton, study of shoe sizes, 40
Wheeler, mental hygiene service, 198
Wolters, mental hygiene service:
administration, 188, 190
intake procedure, 195
lecture program, 213
morale, evaluation, 227–228
reclassification board, 198
screening, 191, 193
CAMPBELL, C. M., value of preventive psychiatry, 171
Camptocormia, studies, 201
Canadian Army:
physical profile system, 8
protective clothing, joint project, 65
tetanus toxoid adopted, 287
Canadian Research Committee, research in aviation clothing, 47
Canal Zone, yellow fever vaccination requirements, 310
Carbohydrate, amount—
consumed, 103
in diet for flight crews, 93
in diet for patients with hepatitis, 120–121
in rations, 126
Cardiovascular disorders, rejection for, 4
Carlisle Barracks, clothing research, 44
Carotene, amount in rations, 126
Carson, Camp, ration field trials, 104, 161
Cassino beachhead, rations for, 118
Casualty, classification, 236–237. *See also* Battle casualty; Nonbattle casualty
Cavalry, nonbattle injury, 259
Cavalry Reconnaissance Squadron, 44th, bathing facilities, 22
Central Canada, winter clothing, 64
Central Pacific Area:
jungle combat uniform tests, 54
yellow fever vaccination requirement, 310–311
Chanute Field, selection of students, 176

Cheilosis, symptom of nutritional deficiency, 143
Chemical Corps, responsibility for impregnation of clothing, 74
Chemical warfare agents, protective clothing, 38
Chemical Warfare Service:
  gas masks, responsibility, 76
  protective clothing:
    studies, 43, 75
    toxicity testing, 49, 77
  safety program, 241, 242
Chemicals, causative agent in nonbattle injury, 252
China:
  bathing facilities, 29
  cholera, 315, 316–317
  plague, 318
China-Burma-India theater:
  bathing facilities, 29
  cholera, 316–317
    vaccination, 315
  diarrhea and dysentery, 277
    preventive measures, 20
  dye in laundry marking, skin sensitivity, 77
  jungle combat uniform field tests, 54
  malaria preventive measures, 20
  mosquitoproof fabrics, studies, 55–56
  nonbattle injury, 247, 248
  nutrition, 87, 141–153, 166
  personal hygiene, 28–30
  rations for, 112, 141–153
  training in personal preventive health measures, 17, 18
  typhoid fever, 277
  vitamin supplementation of rations, 143, 145, 151, 152
Chinese troops:
  beriberi, 164
  nutritional deficiency, 87, 141, 143
  ration, 149
Chlorine, fungicidal agent, 81
Chloropicrin, for typhus control, 57
Cholera:
  epidemic, India, 316
  incidence in troops, 316–317
  vaccination:
    administrative requirements, 315, 347–348, 356–357
    development and adoption, 313–314
Cholera—Continued
  vaccination—Continued
    effectiveness, 315–317
    methods, 315
    reactions, 317
  vaccine, 314, 316, 317
Cincinnati, University of, rebuilt-shoe sterilization studies, 82
Civilian Defense, Office of, cooperation in safety program, 242
Civil War:
  mental hygiene, 172
  neurology, 173
  nonbattle trauma, 233
  smallpox vaccination, 281
Claiborne, Camp, mental hygiene service, 226–227
Classification:
  directives, 178, 197
  for job assignment, 8
  in preventive psychiatry, 176–186, 187
  of registrants, 2
  personnel, 176, 188, 191
  policies, 197
  testing program, 179
Climate, studies in relation to clothing, 35, 45–46, 49
Climatic Research Laboratory, studies in—
  anthropometric measurement, 81
  clothing, 46
Clinical psychologists, functions, 175, 176, 177, 189, 210, 211
Clostridia, found in woolen clothing, 44
Clostridium tetani, in tetanus toxoid, 287
Clothing:
  adaptation to military requirements, 35
  adaptation to physiologic needs, 35, 45–55
  arctic, 43, 64, 65
  aviation, 47
  cold weather, 36, 37, 38, 63–73
  contaminated with *Clostridia*, 43–44
  decontamination, 48, 57, 58
  desert, 55
  design, 35, 36, 47, 48
  development, 42, 43, 44
  directives, 78, 79
  disinfestation, 42, 57, 58
  durability, 35
  electrically heated, 47, 48

Clothing—Continued
environmental hazards, relation, 36
exchange system, 22, 23, 26
fabrics, 35, 47, 48, 51, 66
allergy to, 77
for cold weather, 36, 52, 63–73
for hot climates, 36
for jungle uniform, 51, 52, 53, 54
fireproofing, 49
fit, 35, 39, 69, 80
causative agent in accidents, 252
hospital, 41
hot weather, 36, 51–63
impregnation:
against chemical agents and fire, 38, 74, 75
against insects, 38, 42, 57, 58–59
effect on uniform, 53, 56
physiologic effects, 74, 75
processes, 38, 76
toxicity, 49, 57, 74, 75
industrial medicine aspects of, 82–83
jungle, 48, 51, 52
materials, 48
medical problems associated with, 50–73
medical research, 45–50
nurses, 41
porosity, 53
properties, 35–38
protective against—
chemical agents, 38, 75
cold, 38, 49
cold injury, 38 42, 72
drowning, 47
fire, 38, 47, 49, 75
insects, 15, 42, 49, 83
mosquitoes, 55–56
schistosomiasis, 59
solar radiation, 55
relation to—
climate, 46, 65, 71
cold injury, xi, 38, 42, 66–73
environmental hazards, 35
fatigue, 45
heat regulation, xi, 51–55
industrial hazards, 38
skin diseases, 61–62
research, 47, 51–55
salvage, 81–82
science, 31
shortages, 27, 60–61, 68–69
Clothing—Continued
specialized uniforms, 43
supply, 35, 38, 71
tariffs, 80–81
tests, 43, 44, 46, 50
thermal insulation, 47
toxicity testing, 49
training in proper use, 69
tropical, 43, 60–61
tropic-proofed, 77
waterproofing, 49
weight, 39
wind resistant, 43
winter, 44, 71
woolen, tested for bacteria, 43
World War I, 38–42
Clothing, National Research Council Subcommittee on, studies:
cold weather clothing, 65
impregnation of clothing, 74, 75
jungle clothing, 51, 54
mosquitoproof fabrics, 56
physiologic aspects of clothing, 35, 47
Coast Artillery, nonbattle injury, 258
Coast Guard, United States, women's branch, 2
Cohen, Col. S. A., accident prevention recommendation, 240, 264
Cohen, Lt. Col. R. R., mental conditioning, 181, 202
Cold:
causative agent in nonbattle injury, 251, 252
physiologic effects, 49, 65
physiologic mechanisms for adaptation, 32-33
trauma. *See* Cold injury.
Cold injury:
incidence, 63, 67, 68, 70, 72
World War I, 64
included in nonbattle casualty, 257
relation to clothing, xi, 38, 42, 66–73
See also Trenchfoot.
Combat boot, 62, 67, 71, 72
Combat ration. *See under* Ration.
Commission, physical standards for, 1
Compensation, for disability, 1
Connaught Laboratories, typhus vaccine studies, 320

Consultation services, replacement training centers. *See under* Preventive psychiatry.
Cook, G., meaning of mental hygiene, 172
Cook, Maj. E. L., "Accidental Trauma" 233–269
Cooke, R. A., study of reactions to tetanus toxoid, 301
Corps:
  II:
    nutrition inspection, 114
    rations for, 116
    sanitation conference, 25
  IV, sanitation conference, 25
Corps Area:
  First, clothing research, 45. *See also* Service Command.
C ration:
  components, 129
  criticism, 114
  misuse, 132
  nutritional adequacy, 117, 133
  palatability, 114, 133
  recommendations, 91, 123
  results of prolonged consumption, 87, 120
  stocked in United Kingdom, 129
  suitability for hospital use, 96
  supplementation, 130, 133
  use in—
    European theater, 131
    India-Burma theater, 145
    New Guinea, 157
    Pacific theater, 155
    Tunisian campaign, 116
  use restricted, 129
Craft, Camp, mental hygiene service:
  intake procedure, 195
  mental screening, 191, 192, 193
  outpatient psychiatry, 214
  reclassification board, 198
Crowder, Camp, mental hygiene service, 194–195, 226
Cruvant, Lt. Col. B. A.:
  psychiatric services, 180, 222
  training units reports, 210
Cutts, F. B., report on beriberi, 164

D chocolate bar, ration supplement, 94, 131, 155
DDT, for louse control, 42, 58
Decubitus ulcers, relation to nutrition, 86
Defects, disqualifying for military service, xi, 2, 4
Deferment from military service, 3
Deficiency diseases:
  in recovered prisoners, 167
  minor symptoms in troops, 92, 98, 102, 114, 117, 118, 119, 161, 162, 163, 164
  research, 161, 169–170
  See also Malnutrition; Nutrition, deficiences.
Dehydrated food. *See under* Food.
Dental requirements for induction, 4
Department of Agriculture. *See* Agriculture, United States Department of.
Dependents, induction regulations, 2, 3
Dermatitis venenata (Dhobie mark), 77
Dermatomycosis, prevention, 16
Dermatophytosis, relation to clothing, 62
Dermovaccine, glycerinated calf, 281
Desert sores, relation to bathing facilities, 25
Desert Training Center, studies on effects of dry heat, 49
Deutsch, A., meaning of mental hygiene, 171
Devens, Fort, mental hygiene service, 214
Dhobie itch, skin lesion, 30
Dhobies, laundry methods, 29–30
Diarrhea and dysentery:
  hospital admissions, 17
  incidence, 276, 277, 278
    Middle East theater, 26
    North African theater, 119
  methods of transmission, 23, 25
  prevention, 20, 26, 27
  World War I, 277
Dibutylphthalate, for mite control, 56
Diet:
  for flight crew, 93
  for patients in hospitals, 93–94, 119–120, 147, 156
    prisoners of war, 119
    with hepatitis, 120–121
  for recovered Allied military personnel, 137
  from Army rations, 86
Dietary:
  adequacy, 90, 95, 97
  allowances, 86
  deficiencies, 142

Dietary—Continued
directives, 89
for Chinese troops, 144, 157–158
nutritional balance, 89
nutritional content, 96, 101
standards for Army, 86
DILL, D. B.:
clothing report, 54
physiologic studies, 45
Dimethylphthalate, for mite control, 56, 57
Diphtheria:
immunity to, 331
immunization:
administrative requirements, 359
contraindications, 332
reactions, 332, 333
incidence, 333
toxoid, 331, 332
Discharge for disability, 1, 2, 3, 5
Disease:
death rates, 235
included in nonbattle casualty, 257
noneffectiveness from, 248–249
Dishwashing, relation to transmission of diarrhea, 25
Division:
5th, clothing tests, 43
9th, bathing facilities, 22
35th, bathing facilities, 22
37th, nutrition survey, 155
85th, shower and clothing exchange unit, 26
Draft boards. *See* Selective Service System, local boards.
D ration, use, 129, 130, 157
Drowning, nonbattle death, 251, 253
Dubbin, for waterproofing shoes, 40, 76
DUBOIS, E. F., study in aviation medicine, 47
DUNBAR, F., report on psychosomatic studies, 254–255
DuPont Co., flameproof treatment for clothing, 75
Dyes, sensitivity to, 77
Dysentery. *See* Diarrhea and dysentery.

Eastern Defense Command, personal hygiene training, 16
Edema, in recovered prisoners, 167
Edgewood Arsenal, work on protective clothing, 43
Edible waste:
amounts, 97, 98, 99, 102
reasons for, 100
Education, requirements for induction, 2
Egg, sensitivity to, 323
Egypt:
plague, 318
yellow fever vaccination requirements, 310, 311
Eighth Air Force, nutrition study, 92
Eighth Army, nutrition study, 158
Eighth Service Command, neuropsychiatric consultant, 227
EISENDORFER, Maj. A., psychiatric treatment, 199–200
Emergency ration. *See under* Ration.
Encephalitis, Japanese B. *See* Japanese B encephalitis.
Encephalitis, postvaccinal, 286–287
Energy requirement studies, 86, 107, 125
Engineer Replacement Training Center, Fort Belvoir mental hygiene service, 180, 188, 204, 209–210
Engineer Replacement Training Center, Fort Leonard Wood:
personnel consultant service, 178
psychiatric caseload, 214
Engineers, Corps of:
accidental injury, 256, 258
low back injury, 261
safety measures, 241
Engineers, Office of the Chief of, safety program, 242
England, nutrition study, 92
Enlistment(s) in Army:
number, 2
physical standards, 1
Epidemiology Division, Office of The Surgeon General, immunization program, 271, 278
Equipment, tropic-proofed, 77
Equipment laboratory, Army Air Forces, clothing studies, 47
European theater:
accidental deaths, 253
accidental injury, 252
accident prevention program, 256, 264, 265
aircrew tests, followup study, 9
alcohol poisoning, deaths, 265, 264
barber kit, use, 24

340336 O 55 25

European theater—Continued
bathing facilities, 20–23
civilian food problem, 110
clothing, 69, 71–73, 79–80
cold injury, 69, 72, 79, 80
diarrhea and dysentery, 277
diphtheria, 333
food for combat troops, 92
footgear, survey, 70
gas mask for patients, 76
laundry facilities, 22, 23
louse infestation and control, 83, 322
nonbattle injuries, 245, 248
nutrition, 92, 122–123
recovered prisoners, 167, 168
personal hygiene, 20–24
prisoners of war, 139–140
rations, 123, 124–140
sensitivity to dyes and fabrics, 77
shoes, fitting of, 78–80
tetanus toxoid administration, 295
training in personal preventive measures, 17, 18
trenchfoot, 13, 20, 69, 72, 79, 80
typhoid fever, 277
typhus fever, 322
Evacuation Hospital, 8th accidental injuries, 256
EVERTS, Lt. Col. W. H., retraining centers, report, 209
Expeditionary Force Menu No. 1 (B ration), 93, 143, 145, 146
Explosives, nonbattle injury, 251, 252, 253
Eye injury, 261–262

Fabrics:
allergy to, 77
characteristics, 39, 43, 44, 47
for cold weather, 37, 65, 66, 73
for hot dry climates, 36, 55
for jungle uniform, 48, 51, 52, 53, 54, 59
Falling trees, nonbattle injury, 252
Falls, nonbattle injury, 250
Far East, clothing impregnation tests, 57
FARRELL, Col. M. J.:
preventive psychiatric measures, 185, 188, 207
rehabilitation of psychoneurotics, report, 208
Fat, amount—
consumed, 103
in hepatitis diet, 120–121
in rations, 126
Fatigue:
factor in accidents, 253
relation of clothing, 45
Federal Security Agency, yellow fever vaccine arrangements, 307
Feet, care of, 14–15, 16, 17, 28, 38
Field Artillery, nonbattle injury, 258
Field Artillery Replacement Training Center, Camp Roberts, mental hygiene service:
administration, 188, 190
caseload, 214
intake procedure, 195
personnel adjustment lectures, 212–213
therapy, 199
Field Artillery Replacement Training Center, Fort Bragg, mental hygiene service at, 192
Field jacket, development, 43
Fifteenth Air Force, nutrition studies, 117
Fifth Army:
casualties, battle and nonbattle, 256, 260
clothing, 37
cold injury, relation to clothing, 67
nutrition studies, 117
sanitation conference, 25
shoepacs, use, 68
shower and clothing exchange units, 26
trenchfoot, incidence, 67, 68
Fifth Service Command, nutrition studies, 86
Filariasis, cause for rejection, 5
Finance Department, survey of dietary of small units, 136
FINEBERG, Maj. M. H., report on accidents, 240–241, 264
Fire and Accident Advisory Board, 243
Firearms, accidents, 251, 252, 253, 265
Fire, nonbattle injury, 251, 252
Fire prevention, advisory board, 243
Fire-retardant for clothing, 75
First Army:
accidents during maneuvers, 240
sanitation during maneuvers, 16
First Corps Area, clothing research, 45
Five-in-one ration, 116, 117
Flight lunch, 92, 94

Florida, jungle clothing field tests, 51
Fly control, relation to diarrhea, 25
Food:
  caloric value, 97, 99, 100, 103, 104
  captured enemy foodstuffs used, 131
  classification, 90, 97, 98, 127
  conservation, 102, 112
  consumed, 92, 96, 97, 101
  dehydrated, 138, 145, 146, 147, 152, 153
  for civilians in liberated and occupied areas, 109–110
  for combat troops, 91
  for prisoners of war, 105–109
  groups, 102, 123
  habits, 89, 110–112, 141, 153
  handlers, 25
  handling, 96, 156
  leftover, 103
  preparation, 96, 103, 110–112, 122, 149, 153, 154
  procurement, 95, 109
    from local sources, 131, 139, 155, 156–157
  quantity consumed, 87, 97, 98, 99, 101–104
  spoilage, 155, 156
  supply, 112–113, 154
  transportation, 149, 151, 154
  unauthorized, 25, 26, 27
  waste, 98, 100, 102, 111, 121, 122, 127
    campaign against, 121, 123
  See also Ration(s).
Food and Drug Administration, 86
Food and Nutrition Board, National Research Council, 86, 159
Food and Nutrition Division, Office of The Surgeon General, 87, 95
Food Service Program, Office of The Quartermaster General, 92
Footgear:
  for cold weather, 65, 66–73
  for desert, 55
  for tropics, 62–63
  relation to cold injury, 38, 66–73, 79–80
  relation to skin diseases, 62
  research, 47, 48, 64, 71
  shortage, 68–70
  sizing and fitting, 77–80
  toxicity of dyes and finishing materials, 77–78
Footgear—Continued
  waterproofed, 73, 76
  World War I, 39–41
FORBES, W. H., clothing study, 35, 47
Foreign Economics Administration, 155
Formaldehyde fumigation, for rebuilt shoe sterilization, 82
Fort—
  Belvoir, mental hygiene service, 180, 188, 204, 209–210
  Benning, parachute injuries study, 257
  Bragg, mental hygiene service at, 192
  Devens, mental hygiene service, 214
  Francis E. Warren, mental hygiene service, 226
  Knox, energy expenditure studies, 87, 101
  Leonard Wood:
    personnel consultant service, 178
    psychiatric caseload, 214
  Lewis, mental hygiene service, 189, 199, 214
  Meade, food consumption survey, 110–111
  Monmouth:
    energy expenditure studies, 87
    mental hygiene service, 179–180, 183
  Riley, clothing field test, 43
FOURT, L., clothing study, 36
FRANKFURTH, V. L., comment on psychiatric screening, 191
FREEDMAN, Maj. H. L., mental hygiene unit development, 179–180
French Army:
  tetanus toxoid, use, 288, 290
  trenchfoot incidence, 68
FRIEND, Capt. M. R., report on indirect group therapy, 209–210
Frostbite, relation to clothing, 38. *See also* Cold injury.
Fumigation gases, for typhus control, 57
Fungus infections, 27, 28, 38, 81–82

Gamma globulin:
  measles prophylaxis, 335
  viral hepatitis prophylaxis, 336
Garrison ration. *See* under Ration.
Gas gangrene, prophylaxis for, 337
Gas masks, for wounded men, 76–77
Gastrointestinal disease. *See* Diarrhea and dysentery.

General hospital:
12th, admissions for burns, 262
17th, nutrition survey, 121
21st, eye injuries, 261–262
Wakeman, nutrition studies, 86
Walter Reed, hospital diet studies, 86
General service classification, 3, 4, 8
Geneva Convention, food for prisoners of war, 105, 106, 108, 140
German Army:
ration, 140
trenchfoot, incidence, 68
German prisoners of war, 105–109
Germany, survey of civilian food needs, 110
Glider Infantry, 326th, complaints on rebuilt shoes, 82
Globulin. *See* Gamma globulin.
Glossitis, symptom of nutritional deficiency, 143
Gloves, protective, 47, 56, 64
GOLDEN, W. R. C., nutrition study, 162
GOLDMAN, Lt. Col. G. S., consultation service, effectiveness, 196, 198
Gonorrhea, deferment for, 6
GORDON, J. E., "Accidental Trauma," 233–269
GRAY, J. P., meaning of mental hygiene, 172
GRIFFITH, Lt. Col. W. H., nutrition report, 118, 120, 121
Ground Forces. *See* Army Ground Forces.
GUTTMACHER, Lt. Col. M. S.:
clinical psychologists, utilization, 211
mental hygiene services, supervision, 174, 213
military value of psychiatry, 218

Hair cut, regulations, 13
HALLORAN, Col. R. D.:
consultation service, recommendations, 187, 188
psychiatric screening, evaluation, 185
HAMMOND, W. A., Surgeon General, reforms instituted, 173
HARRIS, M., clothing research, 36, 47
Harvard Fatigue Laboratory, clothing research, 45, 46, 47
Harvard University, School of Public Health, study of clothing related to cold injury, 63
Hawaii:
tetanus in civilian population, 296
yellow fever vaccination requirement, 310–311
Head nets, for protection against mosquitoes, 56
Health education, personal health practices, XI, XII
Health Education Unit, Office of The Surgeon General, training aids, 17
Health, National Institutes of. *See* National Institutes of Health.
Heat:
causative agent, nonbattle injury, 251, 252
physiologic mechanisms for adaptation, 31, 32, 33–35
trauma, XI
Hemoglobin deficiencies in troops, 163
Hepatitis:
diet, 120
jaundice following, 313
posttransfusion, 336
HERBERTSON, Lt. Col. E. R., study of Anglo-American ration scale, 115
HERRINGTON, L. P., clothing studies, 47
HILGER, Maj. D. W., importance of psychiatric preventive measures, 208
HILLMAN, Brig. Gen. C. C., proposal for retraining of psychoneurotic soldiers, 208
HINDE, Brigadier H. M., study of Anglo-American ration scale, 115
Homologous serum hepatitis, prevention, 336
Hood, Camp, mental hygiene service, 189, 201, 204–205
Hospital(s):
diets, 93–94
evacuation, 8th, accidental injuries, 256
general:
12th, admissions for burns, 262
17th, nutrition survey, 121
21st, eye injuries, 261–262
Wakeman, nutrition studies, 86
Walter Reed, hospital diet studies, 86
laundry facilities, 28
ration:
in European theater, 133–134
in India-Burma theater, 143, 147, 148, 149, 150, 151

Hospital(s)—Continued
ration—Continued
in North African theater, 119–120
in Pacific theater, 154, 156
in United Kingdom, 128–129
overseas, 93–95
supplement, 94, 131, 151
Turner's Lane Hospital, studies of nervous disorders, 173
HOULOOSE, Maj. J., psychiatric orientation, 190
HOWE, Col. P. E.:
nutrition studies, 102, 104, 117
rations in India-Burma, recommendations, 145
Human Nutrition and Home Economics, Department of Agriculture Bureau of, 86
HUNT, Maj. R. C.:
adviser system, 205
psychiatric screening, 190, 191
Hygiene, John B. Pierce Laboratory of, 46

Immersion heaters, for bath centers, 22
Immune serum globulin. *See* gamma globulin.
Immunzation:
administrative reqirements in overseas theaters, 337
Army program, 271–272
cholera vaccination:
administrative requirements, 315, 347–348, 356–357
development and adoption, 313–314
directives, 314, 315
effectiveness, 315–317
immunizing agent, 314–315
methods, 315
reactions, 317
diphtheria immunization:
administrative requirements, 331, 333, 359
directives, 332, 359
immunizing agent, 331
reactions, 332, 333
gas grangrene immunization, 337
influenza vaccination:
administrative requirements, 325, 360
development and adoption, 323–324
effectiveness, 325–326
immunizing agent, 324–325
Immunization—Continued
influenza vaccination—Continued
methods, 325
reactions, 326–327
Japanese B encephalitis vaccination:
administrative requirements, 328, 329
development and adoption, 327
directive, TB Med 181, 328
effectiveness, 329
immunization agent, 327–328
methods, 328–329
reactions, 329–331
legality of policy, 340
measles prophylaxis, 335
plague vaccination:
administrative requirements, 318, 357
development and adoption, 313–314
directives, 314, 318
effectiveness, 318–319
immunizing agent, 317–318
methods, 318
reactions, 319
records, 337–338
Rocky Mountain Spotted Fever vaccination:
immunizing agent, 334
policy, 333–334
reactions, 335
scarlet fever immunzation, 336
smallpox vaccination:
administrative requirements, 283, 351–352
development and adoption, 280–281
directives, 282
effectiveness, 284–285
immunizing agent, 281–282
methods, 282–284
reactions, 285–286
supply problems, 338–340
tetanus immunization:
administrative requirements, 292, 293, 353–354
development and adoption, 271, 287–290
directives, 292, 293, 294
effectiveness, 295–299
immunizing agent, 290–292
methods, 292–295
reactions, 294, 299–305
recording, 293

Immunization—Continued
typhoid-paratyphoid vaccination:
administrative requirements, 274, 275, 276, 352–353
development and adoption, 272
directive, 273, 274
effectiveness, 276–279
immunizing agent, 272–273
methods, 273–276
reactions, 279–280
typhus vaccination:
administrative requirements, 321, 349–350, 354–355
development and adoption, 313–314
directives, 314, 321
effectiveness, 322–323
immunizing agent, 319–321
methods, 321–322
reactions, 323
viral hepatitis prophylaxis, 336
yellow fever vaccination:
administrative requirements, 309, 310, 311, 343–345, 358–359
development and adoption, 306–307
directives, 309, 310
effectiveness, 311–312
immunizing agent, 307–309
methods, 309–311
reactions, 280, 312–313
Impregnation of clothing:
against chemical agents and fire, 38, 74, 75
against insects, 38, 42, 57, 58–59
effect on uniform, 53, 56
physiologic effects, 74, 75
processes, 38, 76
toxicity, 49, 57, 74, 75
Indalone, for mite control, 56
India:
cholera, 316, 317
vaccination, 315, 316
nutritional status of civilian population, 141
plague, 318
smallpox, 284
local procurement of vaccine, 282
strains for cholera vaccine, 314
typhoid fever, 273
yellow fever vaccination requirements, 310, 311
See also China-Burma-India theater.
Indiana University clothing studies, 53
Induction:
examiners, 4, 7
limited service personnel, 3
numbers of, 2
physical and mental standards, 1, 2
screening, 1, 2, 7, 185
Industrial Hygiene Section, Office of The Surgeon General, accident prevention program, 267
Industrial medicine, accident prevention, 244
Infantry, nonbattle injury, 258
Infantry Board, clothing field trials, 44
Infantry divisions:
battle and nonbattle casualty studies, 256, 260
3d, tests of socks, 68
9th, bathing facilities, 22
35th, bathing facilities, 22
Infantry Replacement Training Center, mental hygiene service:
administration, 188, 190
intake procedure, 195
lecture program, 213
morale, evaluation, 227, 228
reclassification board, 198
screening, 191, 193
Infectious disease, cause for rejection, 5
Influenza:
Commission on (Army Epidemiological Board), development of vaccine, 323
incidence, 325, 326
vaccination:
administrative requirements, 325, 360
development and adoption, 323–324
effectiveness, 325–326
methods, 325
reactions, 326–327
vaccine, 324
Injury. *See* Accidental injury; Nonbattle injury; Cold injury.
Insect control:
impregnation of clothing for, 38, 56
personal preventive measures, 13, 15
proper wearing of clothing for, 51, 55–61
supplies for, 27
Institutes of Health. *See* National Institutes of Health.
Internal Security Division, Office of The Provost Marshal General, 241

Intestinal disease. *See* Diarrhea and dysentery.
Intestinal parasites, 5, 27
Iron:
  amount in rations, 126
    Chinese ration, 144
  consumed in diet, 85, 103
  deficiency, 166
Italian campaign, rations for, 116
Italy:
  clothing, 36
  cold injury casualties, 65, 79
  diarrhea, 25
  footgear, 79
  laundry service, 25

Japan, Japanese B encephalitis vaccination requirements, 93, 328, 329
Japanese B encephalitis:
  incidence among troops, 329
  vaccination:
    administrative requirements, 328, 329
    development and adoption, 327
    directive, 328
    effectiveness, 329
    methods, 328–329
    reactions, 329–331
  vaccine, 327–328
Jaundice, associated with yellow fever vaccine, 308, 312–313
John B. Pierce Laboratory of Hygiene, clothing research, 46, 74
JOHNSON, G. G., "Manpower Selection," 1–11
Josiah Macy Foundation, nutrition studies, 86
Judge Advocate General, upholds legality of compulsory immunization in Army, 340
Jungle clothing, 48, 51, 52
Jungle ration, 157

KEEN, W. S., nutritional disease studies, 173
KEYS, A., studies in nutritional disease, 169
KIRK, Maj. Gen. N. T., proposal for retraining soldiers, 208
KNIPLING, E. F., research in repellants, 56
Knox, Fort, energy expenditure study, 87
KOEHN, Lt. Col. K. J., nutrition consultant, India-Burma theater, 148

Korea, Japanese B encephalitis vaccination requirements, 328
KRAINES, Maj. S. H.:
  adviser system, 201, 203, 204, 205
  military orientation of psychiatricts, 196
  military value of psychiatrists, 218–219
  psychotherapy in training setting, 199
K ration:
  components, 129
  misuse of, 114, 132
  nutritional adequacy, 17, 133
  palatability, 114, 133, 157
  recommendations, 123
  results of prolonged consumption, 87 120
  stocked in United Kingdom, 129
  suitability for hospital use, 94
  supplementation, 130, 133
  use—
    by Army Air Forces, 118
    in European theater, 131
    in India-Burma theater, 145
    in Tunisian campaign, 116
    restricted, 91, 129

Laboratory, 2d Medical, sanitation conference, 25
Labor, Department of, cooperation in safety program, 242
Labor reserve, utilization, 3
Latin America, nonbattle injury, 247, 248
Laundering, loss of impregnates, 57
Laundry facilities:
  improvised, 25, 28, 30
  in European theater, 22, 23
  in North African theater, 25
  in Southwest Pacific Areas, 27, 28
  mobile units, 25
  World War I, 41–42
LAWES, Brig. Gen. H. J., significance of training center psychiatrists, 217
LEBLOND, C. P., study in thyroid response to cold, 32
Ledo Road, river bathing, 29
Lee, Camp:
  clothing field tests, 50, 78
  mental hygiene service, 200–201, 202, 209, 214
  ration tests, 87, 122
LEMKAU, P. V., mental health services, 220

Leonard Wood, Fort:
personnel consultant service, 178
psychiatric caseload, 214
Lewis, Fort, mental hygiene service, 189, 199, 214
Lichen planus, atypical, 86
Life raft ration, 94
Limited service personnel, 2, 3, 4, 6, 8
LINDQUIST, A. W., research in repellents, 56
Liquor, poison, accidental trauma from, 263–264
Local boards. *See* Selective Service local boards.
LOCKE, Lt. Col. R. F., study of Anglo-American ration scale, 115
LONG, Col. A. P., "The Army Immunization Program," 271–360
LONG, Lt. Col. P. H.:
"Nutrition in North African Theater," 113–122
study of Anglo-American ration scale, 115
Louse—
control:
anti-louse powder, 18, 26–27
anti-louse suit, 83
DDT used, 58
impregnation of clothing for, 42, 58–59
in Middle East, 26–27
research, 57–59
training, 15, 17, 18
World War I, 42
infestation, 13, 24, 322
World War I, 14
Low back injury, study, 257, 261, 266

MACARTHUR, Gen. D., jungle clothing comments, 52
MADDEN, A. H., research in repellents, 56
MADIGAN, Col. P. S., importance of psychiatric screening, 181, 183
Maladjustment, symptoms, 223, 224
Malaria:
area control, 27
hospital admissions, 17
in China-India-Burma theater, 20
individual protective measures, 27, 28
in North Africa, 119
prevention, training, 17, 20, 28
Malay States, cholera vaccination requirements, 315
Malnutrition:
epidemiology, 160
incidence, 160
Chinese troops, 143
United States troops, 113
in India-Burma theater, 142
in Pacific theaters, 154
in prisoners of war, 159
research studies, 160
See also Deficiency diseases.
Maneuvers:
accidents, 240
sanitation, 16
Manila, tetanus among civilian casualties, 297
Manpower—
pool, 2, 3
requirements, Armed Forces, 3, 7
selection, xi, 1–11
shortage, 3, 6, 7
utilization, xi, 177, 219
March hygiene, 14, 15
Marine diving, physical standards, 9
Marines, United States, women's branches formed, 2
Master menu, 90, 91, 97, 104. *See also* Menu.
MCCULLOCH, R. N., miticide tests, 57
Meade, Fort, food consumption survey, 110
Meals, hot, morale factor, 91
Measles prophylaxis, 335
Medical Advisory Board, seminar for psychiatrists, 181
Medical Battalion, 5th, clothing tests, 43
Medical Board, clothing field trials, 44
Medical Corps, nonbattle injury, 258
Medical Department:
accidents, reporting system, 239
anti-louse measures, World War I, 13
bathing facilities, inspection, 22
Civil War activities, 173
clothing field tests, 50
dietary, approval for changes, 105
energy expenditure studies, 87
field equipment, tests, 44
food preparation, responsibility, 85
impregnation of clothing, 43
menus, review, 90
nonbattle trauma, data, 267

Medical Department—Continued
personal hygiene activities, 14, 16
prisoner of war food, duties, 108
rations, revision, 87
rebuilt shoes, complaints investigated, 82
safety program, 242
smallpox vaccine, specifications, 281
venereal disease, program for treatment, 6
Medical examiners, for selection and induction, 4
Medical Field Service School, clothing development, 44
Medical Nutrition Laboratory, nutrition studies, 86, 94
Medical Nutrition, National Research Council Subcommittee on, 86
Medical Research Committee, American Red Cross, impregnation of clothing, 42
Medical Research, Committee on, research in:
aviation clothing, 47
gas gangrene immunization, 337
nutrition studies, 86
Medical Sciences, Division of:
cholera, plague, and typhus vaccinations recommendations, 314
clothing, research, 46
shoe sterilization, recommendations, 81-82
Medicine, Committee on, nutrition studies, 86
Mediterranean theater:
accident prevention, 264
accidental injuries, 256
battle casualty rate, 257
burns, hospital admissions, 262–263
clothing, 68–69
cold injury, 66–67
diphtheria, 333
gamma globulin for viral hepatitis, studies, 336
hepatitis, 120
nonbattle injuries, 246, 248, 257, 267
personal hygiene, 24–27
plastic insoles, tests, 78
shoepacs, use, 67–68
typhus fever, 322
MENNINGER, Brig. Gen. W. C.:
clinical psychologists, utilization, 211
military psychiatry, scope and effectiveness, 210, 211
Neuropsychiatric Division, chief, 202
personality factor in accidents, 255
psychiatric disorders, factors, 206, 207
retraining psychoneurotic soldiers, 208, 209
training center psychiatrists, significance, 217
Mental defects, screening for, xi
Mental hygiene:
adviser system, 201, 204–205
clinics, 173, 220
consulation services:
development, 175, 188–204
effectiveness, 225–229
established in replacement training centers, 187, 188
functions, 190
intake procedures, 195
objectives, 188, 215, 216
personnel problems, 189, 214, 215
psychological screening performed, 191, 192, 193
referrals, 190, 191, 192, 193, 194, 195
relationship to reclassification-disposition board, 198
report on overall program, 213–216
space problems, 190
studies on camptocormia and somnambulism made, 201
types of personnel referred, 195, 199
See also under Preventive psychiatry; specific replacement training centers.
definition, 172–173
development of concept, 171–173, 175–176
lecture program, 181, 206–207
directives, 204
evaluation, 211–212, 213
for redployed troops, 213
See also Preventive psychiatry.
Mental Hygiene, National Committee for, 171, 173, 211
Mental Hygiene Branch, Office of The Surgeon General, established, 202
Mental standards for induction, 2

Menu:
expeditionary, 93, 143, 145, 146, 147, 148, 151
for patients with hepatitis, 121
hospital, 89, 94
master, 90, 91, 97, 104
monthly, 89
plan, 89, 90, 121, 122
prisoner of war, 106, 108–109
use—
in India-Burma theater, 148
in North Africa, 121, 122
in United Kingdom, 124, 125, 127
Mess operation and practices, 103, 122, 135
Mess personnel, personal hygiene regulations, 15
Metabolism, relation to wound healing, 86
Methyl alcohol, nonbattle injury, 252, 254, 264
Methyl bromide:
for louse control, 42, 57, 81
Metropolitan Life Insurance Co., accident data, 236
Mexican War, nonbattle trauma, 233
MEYER, A., value of preventive psychiatry, 171
Middle East theater:
bathing facilities, 25
miliaria, 62
nonbattle injury, 247, 248
personal hygiene, 25–27
typhus, 322
MIKESELL, Lt. Col. H., surgeon, 37th Division, 155
Miliaria, relation to clothing, 62
Military Police, Corps of:
low back injury, 261
survey of dietary of small units, 136
Military psychiatry. *See* Preventive psychiatry.
MILLER, O. N., nutrition study, 162
MILLER, P. A., research in tetanus toxoid, 291
Mineral(s):
in rations, 85, 89
requirements, 89
Mines, Bureau of, cooperation in safety program, 242
Minnesota, University of, experiments in vitamin requirements, 105
Mississippi Ordnance Plant, Flora, Miss., mental hygiene report, 214
MITCHELL, S. W., specialist in neurology, 173
Mite control, repellents and impregnates, 56, 77, 78
Mobilization Regulations, MR 1–9, 3, 4, 5, 9
Monmouth, Fort:
energy expenditure studies, 87
mental hygiene services, 179, 180, 183
Morale:
index to, 228
psychoneurotic traits as factor, 7
value of hot meal, 92
MOREHOUSE, C. R., neurologic studies, 173
Mosquito control, individual protective measures, 15, 27
MUELLER, J. H., research in tetanus toxoid, 291, 298
Multivitamins, as ration supplement, 116, 130, 143
MURLIN, J. R., nutrition survey, 97, 104
MYL powder for louse control, 42, 58

National Association for the Protection of the Insane and the Prevention of Insanity, 173
National Bureau for Industrial Protection, cooperation in safety program, 242
National Bureau of Standards, research in clothing, 47
National Committee for Mental Hygiene, 171, 173, 211
National Conservation Bureau, cooperation in Army safety program, 242
National Institutes of Health:
cholera vaccine:
requirements, 314
strains studied, 314
clothing, research, 47, 74
Japanese B encephalitis vaccine, requirements, 328
Rocky Mountain spotted fever vaccine supply, 334
smallpox vaccine requirements, 281
tetanus toxoid:
requirements, 291
study, 293

National Institutes of Health—Cont
typhus vaccine:
new preparation method, 320, 321
requirements, 319
studies, 320
National Research Council:
cholera vaccination, recommendations, 314
clothing, research and investigations, 35, 45, 46, 47, 65, 74
dietary allowance recommendations, 86
nutrients in diet, guide for, 104
plague vaccination, recommendations, 314
screening standards, recommendations, 5
tetanus toxoid, recommendation for adoption, 288
typhus vaccination, recommendations, 314, 320, 321
National safety congresses, Army participation, 243
National Safety Council, cooperation in Army safety program, 242, 243
Naval Medical Research Institute, nutrition studies, 87
Navy, United States:
clothing, research, 47
energy expenditure studies, 87
immunization, cooperation in program for Armed Forces, 271
physical standards for enlistment, 3
ration, emergency, 87, 95
ration, money value, 88
registrants allotted, 3
safety program, 242
tetanus immunization, 288
tetanus, report on cases among prisoners of war, 296
typhoid-paratyphoid vaccination, 273
women's branches formed, 2
Neurology, specialty, 173
Neuropsychiatric casualties. *See* Psychiatric disorders.
Neuropsychiatric Screening Adjunct, 7
Neuropsychiatrists, at replacement training centers. *See under* Preventive psychiatry.
Neuropsychiatry, 171, 174. *See also* Preventive psychiatry.
Neuropsychiatry Division, Office of The Surgeon General:
Neuropsychiatry Division—Continued
evaluation of program, 212
meeting of replacement training center psychiatrists, 216
mental hygiene lecture program, 202
organization, 171, 174, 181, 202
orientation for replacement center psychiatrists, 188
preventive psychiatry, development of concept, 171, 174, 207
professional supervision of mental hygiene consultation services, 180, 215
social work personnel approved, 211
Neurotic patients, rehabilitation, 208
Neurotropic Virus Commission, study of Japanese B encephalitis vaccine, 329
NEWBURGH, L. F
clothing studies, 45
studies in physiological adaptation to heat and cold, 35
New Caledonia, plague, 318
Newfoundland Base Command, investigation of tetanus toxoid reactions, 301
New Guinea:
combat feeding, 92
impregnation of clothing, tests, 57
laundry facilities, 28
personal hygiene, 27
rations, 157
shorts, use of, prohibited, 61
Newport News Port of Embarkation, louse infestation, World War I, 14
Niacin:
amount—
consumed in diet, 103
in rations, 126
Chinese rations, 144
deficiency in troops, 161, 162, 165
Night blindness, symptom of nutritional deficiency, 143
Nonbattle casualty:
definition, 236
rates, comparison with battle, 256–257, 260
Nonbattle injury:
by branch of service, 258–259
causes and causative agents, 250, 251, 252, 253
classification, 236–237
deaths from, 247–248, 249, 251, 252, 253
rates, 235, 244–245

Nonbattle injury—Continued
definition, 236
directive, 236
disposition of patients, 249, 261, 262
hospital admissions, 242, 244, 246, 248, 250
in—
China-Burma-India theater, 247, 248
European theater, 245, 247, 248, 249
Latin America, 247, 248
Mediterranean theater, 267
Middle East theater, 247, 248
North America, 247, 248
Pacific Ocean area, 247, 248
South Pacific area, 247, 249, 250
Southwest Pacific area, 246, 247, 248, 267
manpower loss from, 246, 248–249
peacetime problem, 233–235
rates, 233, 235, 256, 260, 267
seasonal variation, 255
wartime problem, 233
World War I, 233
See also Accidental injury.
Noneffective, from disease and injury, 248–249
Normandy invasion, briefing on typhus, 18
North African Disciplinary Training Center, nutritional study, 119
North African theater:
accidental deaths, 253
accidental eye injuries, 261–262
accident prevention program, 266
bathing facilities, 25
burns, 262–263
DDT impregnates, field test, 58
diphtheria immunization, 333
diphtheria, study of immunity to, 331
hepatitis, 120
laundry service, 25
malaria, 119
MYL powder, for louse control, 58
nurses' uniforms, shortage, 68–69
nutrition, 113–122
personal hygiene, 24–27
rations, 113–122
supply lines, 113
tetanus, 295
training in anti-louse measures, 18
typhus, 322
North America, nonbattle injury, 247, 248
North Camp Hood, mental hygiene service:
adviser system, 201, 204, 205
attitude conditioning program, 203
caseload, 219
intake procedures, 196
psychotherapy, 199
Nurses, nonbattle injury, 259
Nurses' uniforms, 41, 68
Nutrients, loss in food preparation, 85, 149
Nutrition:
deficiencies in troops, 117, 118, 142, 164–167
Chinese troops, 141, 143
in China-Burma-India theater, 141–153
in European theater, 122–140
in North African theater, 113–122
in overseas theaters, 112–158
in Pacific theaters, 153–158
in Persian Gulf Command, 140–141
in World War I, 85
level of, 116
rehabilitation after inadequate diet, 117
rehabilitation of recovered Allied military personnel, 123, 137
relation to prevention and cure of disease, 86
requirements of troops, 86, 87, 89, 90, 93, 101–104, 123
standards, policies for prisoners of war, 108
status of troops, xi, xii, 87, 91, 93, 96, 155, 157
surveys, 87, 91, 95–105
in European theater, 136
prisoners of war, 107–108, 140
in India-Burma theater, 145, 150, 151
in Pacific theaters, 157–158, 161–163, 167
of prisoners of war, 108, 137
value of rations, 126, 157
Chinese ration, 144
Nutritional deficiency disease:
in recovered prisoners, 167–169
minor disturbances in troops, 114, 117, 118, 160–164
research, 169–170
See also Malnutrition.
Nutrition and Home Economics, United States Department of Agriculture, Bureau of, method of determining nutritive values, 101

Nutrition Division, Office of The Surgeon General, appraisal of dietary, 95, 105, 108
Nutrition Foundation, studies in flight crew diets, 93
Nutrition Laboratory, Pentagon Restaurant Association, studies in nutrient cooking loss, 86

OAKLEY, C. L., study of reactions to tetanus toxoid, 301
Occupational Health Division, Office of The Surgeon General:
  accident prevention activities, 243–244
  clothing, research, 49
Office of Scientific Research and Development:
  clothing, research, 47, 52
  gas gangrene immunization, studies, 337
  nutrition studies, 85, 86, 96
Office of The Surgeon General. *See* Surgeon General, Office of The.
Officer candidate schools, course in personal hygiene, 16
O'FLAHERTY, F., method of rebuilt shoe sterilization, 82
Okinawa, Japanese B encephalitis vaccine used in, 327, 328, 329, 330
OLINICK, Maj. S. L., report on indirect group therapy, 209–210
Oral hygiene, rules for, 16
Oran, laundry service in, 25
Ordnance Department:
  low back injury, 261
  nonbattle injury, 258
  safety program, 241, 242
Ordnance Replacement Training Center:
  consultation service, 216
  mental conditioning program, 181, 202, 203, 204
  retraining program, 209
Orlando laboratory, research:
  DDT, 58
  mite control, 56
  protective clothing, 51
OSRD. *See* Office of Scientific Research and Development.
Osteomalacia, symptom of nutritional deficiency, 143
Overcoat, 39
Overshoes, 40, 70
Oxygen consumption studies, 86

Pacific theaters:
  jungle clothing tests, 50
  nonbattle injury, 247, 248
  nutrition, 87, 104, 153–158, 161–162, 166
  recovered prisoners, 167, 168, 169
  plague, requirement for vaccination, 318
  prickly heat, prevalence, 62
  tetanus in civilian populations and Japanese troops, 296
  See also Southwest Pacific area.
Panama Canal Department:
  jungle clothing, field tests, 45, 50, 51
  yellow fever vaccination requirements, 306, 310
Parachute duty, physical standards for, 9
Parachute injury, study, 257
Parachute ration, 94
Paratyphoid fever, incidence, 276, 277, 278
  See also Typhoid-Paratyphoid fever.
PARISH, H. J., study of reactions to tetanus toxoid, 301
Parkas, for protection against cold, 39
Pellagra, in recovered prisoners, 154, 165, 168
PENNELL, Maj. Gen. R. H., significance of training center psychiatrists, 217–218
Pentagon Restaurant Association Nutrition Laboratory, nutrient cooking loss studies, 86
Peptones, in tetanus toxoid, 291–292, 303, 304, 305
PERKINS, M. E., "Preventive Psychiatry," 171–232
PERSHING, Gen. J. J., clothing recommendations, 39, 40
Pershing shoe, 40
Persian Gulf Command:
  accidental trauma, 257
  accident prevention program, 266
  diphtheria immunization, 333
  nutrition, 140–141
  smallpox, 284
  vitamin supplementation of rations, 140
Personal hygiene:
  definition, xi, 13
  directives, 10, 14
  in China-Burma-India theater, 28–30
  in combat and field conditions, 16, 25, 28

Personal hygiene—Continued
in European theater, 20–24
in Mediterranean theater, 24, 25, 26
in Middle East theater, 25, 26, 27
in North African theater, 24, 25
in Southwest Pacific Area, 27–28
minimum standards of proficiency, 17
policy, 14–15
supplies, 24
training, 15–20, 26
Personality factor in accidents, 253
Philippine Islands:
bathing facilities, 28
tetanus toxoid requirements, 289
training program in disease prevention, 27
Phosphorus, consumed in diet, 103
Physical aptitude, for aircrew training, 9
Physical defects, disqualifying for military service xi 4, 5, 6
See also Physical standards.
Physical examination:
induction, 2, 253
separation, 5
Physical inspection of troops, 16, 27
Physical Profile Serial System, 8–9
Physical screening. *See* Screening.
Physical standards—
for induction, 1, 2, 3, 4, 5, 9
for special categories, 9
Physical Standards Division, Office of The Surgeon General, 1
Physiologic studies, relation to—
clothing requirements, 31–35, 42, 45–50
diet requirements, 105
Pierce Laboratory of Hygiene, New Haven, Conn., clothing research, 46
Plague—
control measures, 319
incidence, 318
vaccination:
administrative requirements, 318, 357
development and adoption, 313–314
directives, 314, 318
effectiveness, 318–319
methods, 318
reactions, 319
vaccine, 317–318
Plant Protective Division, Office of Under Secretary of War, accident prevention program, 241
Plastic insoles, 78
Plauche, Camp, 214
PORTER, Col. W. C., practical psychiatry, 182
Post exchange, supplies for personal hygiene, 24
Posttransfusion, hepatitis, 336
Postvaccinal encephalitis, 286–287
Postvaccinal jaundice, 312–313
Postvaccinal tetanus, 287
Preventive Medicine Service, Office of The Surgeon General:
accident prevention program, 243–244, 267
biologicals, responsibility, 339
clothing studies, 45
Health Education Unit established, 17
louse control, research, 58
physical requirements, research, 253
research laboratory initiated, 48
safety program, 242, 243
sterilization of shoes before reissue recommendation, 82
Preventive psychiatry:
adviser system, 201, 204–205
classification phase, 176–186
consultation service(s):
Aberdeen Proving Ground:
consultation service, 216
mental conditioning program, 181, 202, 203, 204
retraining program, 209
Camp Abbot:
altitude conditioning program, 203
consultation service, 189, 199–200
Camp Blanding, 213, 214, 215
Camp Callan, 180, 188, 203
Camp Claiborne, 226–227
Camp Croft:
intake procedure, 195
mental screening, 191, 192, 193
outpatient psychiatry, 214
reclassification board, 198
Camp Crowder, 194–195
Camp Lee, 200–201, 202, 209, 214
Camp Roberts:
administration, 188, 190
caseload, 214
intake procedure, 195
personnel adjustment lectures, 212–213
therapy, 199

Preventive psychiatry—Continued
consultation service(s)—Continued
Camp Wheeler, 198
Camp Wolters:
administration, 188, 790
intake procedure, 195
lecture program, 213
morale, evaluation, 227–228
reclassification board, 198
screening 191, 193
Fort Belvoir, 180, 188, 204, 209–210
Fort Bragg, 192
Fort Francis E. Warren, 226
Fort Leonard Wood:
personnel consultant service, 178
psychiatric caseload, 214
Fort Lewis, 189, 199, 214
functions:
diagnosis in terms of military service, 196–198
evaluation of cases, 190
followup of patients, 190
North Camp Hood:
adviser system, 201, 204, 205
attitude conditioning program, 203
caseload, 219
intake procedures, 196
psychotherapy, 199
referrals, 180, 190, 191, 193–194, 195
reports and recommendations, 190
development in World War II, 175
directives, 186
historical background, 171–173
in training centers, 175–229
mental hygience phase, 204–219
needs of group, 219–220
neuropsychiatrists, functions, 182, 183–184, 189
psychiatric screening, 186–204
psychiatrists, function, 219
rehabilitation of psychiatric patients, 224
statistical approach, 228
treatment phase, 198
Prisoners of war:
dietary and rations, 105–109, 119, 139–140
directives, 106, 107, 108
in Zone of Interior, 105–109
nutritional disease, 159
Prisoners of war—Continued
Rocky Mountain spotted fever, vaccination, 334
tetanus, 297
Professional Service, Office of The Surgeon General, interest in cold injury, 65
Protective clothing. *See under* Clothing.
Protein:
amount—
consumed, 103
in hepatitis diet, 120–121
in rations, 126
deficiency, in recovered prisoners, 168
metabolism, relations to wound healing, 86
requirements, 89, 93
Provost Marshal General, Office of the:
accident information collection, 243
Geneva Convention, interpretation, 106
prisoner of war feeding, conference, 107
safety program, 241, 242, 243
Psychiatric consultation, 180. *See also* Preventive psychiatry, consultation services.
Psychiatric disorders:
causes, 206
factors in military service, 8, 223, 224
diagnosis, 174, 223, 224
disposition of patients, 1, 174
hospital admissions, 7
incidence, 221
preventive measures, 219, 222–224
rehabilitation of patients, 211
symptoms, 223, 224
treatment, 224
World War I, 1
Psychiatric screening—
at induction stations, 1, 2, 7, 8, 187
at training centers, 174, 191
in World War I, 1
Psychiatric Social Work, War Office of, 211
Psychiatric social workers, utilization of, 175, 180, 195, 210, 211
Psychiatrists, tilization
induction centers, 7
replacement training centers, 171, 173, 175, 181, 186, 187, 188, 189
World War I, 174
Psychiatry, military. *See* Preventive psychiatry.

Psychiatry, preventive. *See* Preventive psychiatry.
Psychological screening, 189, 192
Psychologists, clinical:
  need for, 189, 211
  utilization, 175, 176, 177, 211
Psychometric evaluation, 192
Psychoneurotic disorders:
  directives, 7
  factors producing, 207
  rejection from military service, 7
  retraining of patients, 208–210
Psychosomatic medicine, 172
Psychotherapy in training setting, 199
Public Health Service, U. S. *See* United States Public Health Service.
Puerto Rico, yellow fever vaccination requirements, 306
PULHEMS, Canadian system of physical classification, 8
PULHES, system of physical classification, 8, 9

Quartermaster Board:
  clothing tests, 50, 53, 78
  energy expenditure studies, 87
Quartermaster Corps:
  clothing:
    conference, 71
    development, 35, 44
    surveys of use, 50, 71
  food procurement, 20, 121
  fumigation and bath companies, 22, 58
  laundry service, 23, 28, 30, 80
  low back injury, 261
  nonbattle injury, 258
  shoepac recommendations, 66
  shoes, investigation of complaints, 82
  shower points operation, 22
  subsistence, issue, 20, 87
Quartermaster fumigation and bath companies, allocation, 22
Quartermaster General, Office of The:
  clothing, development, 35, 49, 50, 60, 63, 73
  combat boot, changes, 71
  dietary standards, 86
  food service program, 92
  footgear development, 62, 63
  Geneva Convention, interpretation, 106
Quartermaster General—Continued
  menus planned:
    hospital, 96
    master, 90, 97
    prisoner of war, 107
  nutrition surveys, 104
  prisoner of war—
    food conference, 107
    nutrition survey, 109
  research in—
    climatic conditions, 46
    clothing, 40, 45, 47, 81
    laundry methods, 80
    rations, 95
  subsistence, procurement, 91, 95, 102, 121
  tests in—
    combat clothing, 53
    flameproof treatment for clothing, 75
Quartermaster Laundry Company, 487th, 25
Quartermaster Replacement Training Center, mental hygiene service, 200–201, 202, 209, 214
Quartermaster School and Depot, clothing development, 35, 44
Quartermaster Subsistence Research Laboratory, 86
Quartermaster Technical Committee, development of clothing, 35
  Subcommittee on Combat Winter Clothing, 44, 71
Queensland, University of, skin physiology research, 62
Quotas, for enlistments and induction, 3, 4, 6

Ration(s):
  A. *See* A ration.
  acceptability, 91, 113, 138
  accessory kits, 24
  adequacy, 88–89, 117
  aid station beverage pack, 94
  allowances, 133
  amount consumed, 87, 97–105
  augmentation, 112, 133, 134–137
  B. *See* B ration.
  battle, 91
  C. *See* C ration.
  caloric content, 89, 127, 145
  caloric requirements, 91

Ration(s)—Continued
canned, 122
captured, 116
characteristics needed, 87
Chinese troop, 144
combat, emergency, 96, 129–131
complaints of troops, 114, 145
components, 88, 89, 91, 94, 97, 135, 137–138
D. *See* D ration.
deficiencies in, 114
dehydrated, 94, 138
directives, 89, 101, 105, 127
emergency, 94–95, 133
evaluation, 101
excess permitted, 118
field, 89, 90, 140
field trials, 123, 129, 161
Camp Carson, 87, 104
Camp Lee, 87, 122
five-in-one. *See* Five-in-one ration.
flight lunch, 92, 94
for casualties, 130–131
for training camps, 87–93
garrison, 87–93, 97
hospital. *See under* Hospital.
hospital supplement, 94, 131, 151
increase in allowances, 148
issue, 89–90
jungle ration, 157
K. *See* K ration.
life raft, 94
monetary value, 87, 88
number drawn, 96, 103
nutritive value, 87, 117
packaged, 91, 94, 112–113
parachute, 94
prisoner of war, 119, 139–140
reduction in allowances, 116, 118, 133, 134–137, 139, 150–151
scale, 127
supplements:
D chocolate bar, 94, 131, 155
vitamins, 136–137, 143
India-Burma theater, 145, 151–152
Persian Gulf Command, 140
supply, 112–113, 129, 133, 136, 141–153
ten-in-one. *See* Ten-in-one ration.
twelve-in-one, 129
types issued, 132
use overseas:
China-Burma-India theater, 141–153
European theater, 122–140
North African theater, 113–122
Pacific theater, 153–158
Persian Gulf Command, 140–141
Vitamin content, 89, 95
World War I, 87–88
RAY, I., definition of mental hygiene, 172
Reclassification board, 198
Recovered Allied military personnel, nutritional status, 137, 167–169
Registrants:
classification, 2, 3
number, 2
quotas, 3
rejected for physical reasons, 6
Rehabilitation feeding, 92
Rejection for military service, 4, 5, 7
Remedial defects, deferment, 6
Repellents, for insect control, 20, 27, 56
Replacement training centers, consultation service at. *See under* Preventive psychiatry.
Research in—
clothing, 45, 47, 50
emergency rations, 95
energy expenditure, 86–87
high altitude feeding, 92–93
malnutrition, 160
nutrition, 85–87
typhoid-paratyphoid vaccination, 272
Respiratory infection, individual preventive measures, 18
Riboflavin:
amount—
consumed, 103
in rations, 126, 151, 157
Chinese ration, 144
deficiency in troops, 161, 162, 163, 165 157, 158
deficiency in troops, 161, 162, 163, 165
Riley, Fort, clothing field test, 43
Roberts, Camp, mental hygiene service:
administration, 188, 190
caseload, 214
intake procedure, 195
personnel adjustment lectures, 212–213
therapy, 199

346336 O—55— 26

ROBINSON, S.:
clothing research, 47, 54
skin infections, report, 61, 62
sweating mechanism, studies, 34
Rochester Desert Laboratory, clothing research, 47
Rockefeller Foundation, 173
psychiatric problems, studies, 173
yellow fever vaccine production, 306, 307, 308, 309
Rocky Mountain Laboratory:
Rocky Mountain spotted fever vaccine production, 307
yellow fever vaccine production, 307, 308
Rocky Mountain spotted fever:
incidence, 334
preventive measures, 334
vaccination:
policy, 333–334
reactions, 335
vaccine, 334
Roentgenogram of chest, for tuberculosis screening, 5
Roer campaign, bathing facilities, 22–23
Ross, Mrs. E. H., recruiting for psychiatric social workers, 211
Royal Air Force, clothing research, 47
Royal Indian Army Service Corps, procurement of food for—
Chinese troops, 149
United States troops, 145
RUSH, A., nutrition study, 162
Russia, Japanese B encephalitis, vaccination development, 327
Rutgers 612, repellent for mite control, 56
Ryukyu Islands, Japanese B encephalitis vaccination requirements, 329

Safety—
program, 241–243
publications, 242
training, 243
Safety Council, War Department, 242, 243
Saipan:
rations for, 155
tetanus among civilian casualties, 297
SALMON, Maj. T. W.:
preventive psychiatry, value, 171
psychiatric problems, report, 173–174
Salmonella paratyphi, in vaccine, 273
Salmonella schottmuelleri, in vaccine, 273
Salmonella typhosa, in vaccine, 272, 273
SANDLER, Lt. Col. S. A., aims of psychiatric treatment program, 200–201
Sanitary Corps, utilized in accident prevention program, 246, 264
Sanitation Division, Office of The Surgeon General, studies in—
climatic conditions, 46
clothing, 46, 46
cold weather clothing, 64
Saran insoles, 78
Scabies, prevention, 16
Scarlet fever immunization, 336
SCHACHNER, H. E., study in thyroid response to cold, 32
SCHECHTER, M. S., nutrition study, 162
Schick test, for diphtheria, 331, 332, 333
Schistosomiasis:
cause for rejection, 5
incidence, 27
prevention, training, 17, 27
protective clothing, 59
SCHREIBER, Lt. Col. J.:
mental hygiene program, 180
mental hygiene unit, report, 188
SCHWARTZ, E. R., clothing studies, 47
Scientific Research and Development, Office of:
clothing, research, 47, 52
gas gangrene immunization, studies, 337
nutrition studies, 85, 86, 96
Screening:
against tuberculosis, 1, 5
against venereal disease, 6
induction, 1, 2, 7, 185–186
mental, 1, 7
objectives, 1, 2
physical, 1, 2
psychiatric, 1, 2, 7, 8, 174, 181, 191
replacement training centers, 184, 185, 191, 192, 193
World War I, 174
Scrub typhus, prevention:
area control, 27
impregnation of clothing, 57
training, 17
Scurvy, hospital admissions, 160
Second Air Force, nutrition study, 92–93
Second Army, sanitation during maneuvers, 16

Secretary of War, advisory board on fire and accident prevention, 243
SEIDENFELD, Lt. Col. M., selection of clinical psychologists, 211
Selectees, screening for physical and mental defects, xi, 1, 2, 7
Selection of manpower, xi, 1–11
Selective Service System:
  local boards, 2, 4, 6
  policies and procedures, 2, 3
  regulations, 4
  seminar for psychiatrists, 181
Selective Training and Service Act, 3, 4
SELYE, H., study in body reaction to stress, 32
Serum protein, deficiencies noted, 1(
Service Command, Fifth, nutrition studies, 86. *See also* Corps areas.
Service Forces. *See* Army Service Forces.
Services of Supply:
  mental hygiene services, 183
  safety program, 241
  See also Army Service Forces.
Seventh Army, clothing report, 69–70
SHEPHERD, L. B., report on combat boot, 71
Shoe(s):
  design, 49
  dubbin, 76
  fitting, 40, 49
  for arctic wear, 38
  for aviators, 47
  reissue, 81–82
  safety program in industrial plants, 49
  sizing, 79–80
  sterilization before reissue, 81–82
  tariffs, 40, 70
  waterproofing, 40
Shoepac:
  development, 65, 66, 67, 68, 70
  relation to cold injury:
    Attu, 66–67
    European theater, 69, 70, 71, 72
    Mediterranean theater, 67, 68
Shorts, 60, 61
Sicilian campaign:
  laundry facilities, 25
  rations for, 115
Signal Corps, Army:
  energy expenditure tests, 87
  nonbattle injury, 259
SIMMONS, Brig Gen. J. S., immunization program, 271, 306
SIPLE, P. A., study of clothing in relation to climate, 46
Sixth Army, personal hygiene, 28
Skin—
  disease:
    prevention, 16
    relation to clothing, 61–62
  irritation, from fire retardant, 75
  lesions, associated with laundry methods, 30
Smallpox:
  incidence, 283, 284
  revaccination, 284, 285
  vaccination:
    administrative requirements, 283, 351–352
    development and adoption, 280–281
    directives, 282
    effectiveness, 284–285
    immune reactions, 283, 284
    methods, 282–283
    reactions, 285–286
      postvaccinal encephalitis, 286–287
    vaccinia, 283, 284
    vaccinoid, 283, 284
  vaccine:
    local procurement, 282
    not administered with yellow fever vaccine, 309
    shipment, storage, and care, 281–282
    specifications, 281
    specificity of action, 282
Smoky Hill Airbase, flight crew diet studies, 92
Social workers, in mental hygiene service, 173, 189, 211
Socks:
  for cold weather operations, 38, 40–41, 66, 67, 69, 70, 72, 73
  sizing, 80
  tests, 68
  World War I, 40–41
Solar radiation, protective clothing, 35
South America:
  yellow fever, 311
  yellow fever vaccination requirements, 306
SOUTHARD, E. E., value of preventive psychiatry, 171

South Pacific Area, accidental deaths and nonbattle injury, 247, 249, 253
See also Pacific theaters; Southwest Pacific Area.
Southwest Pacific Area:
accidental deaths, 251, 253
accidental injury, 256, 258–259
accident prevention program, 264
atypical lichen planus, 86
bathing and laundry facilities, 27
disease control measures, 27
food in combat, 92
fungus infections, 28
jungle clothing, tests, 51, 54
mosquito control, 27
nonbattle injury, 246, 248, 249, 267
personal hygiene, 27–28
skin diseases, relation to clothing, 61–62
training in disease prevention, 17, 27
Spanish-American War:
dietary, 86
nonbattle trauma, 233
typhoid fever, 276
Standards, National Bureau of, research in clothing, 47
STANNARD, Capt. P. F., study of Anglo-American ration scale, 115
State, Department of, negotiations with India re yellow fever vaccination requirements, 310
Station hospital:
54th, admissions for burns, 262
73d, admissions for nonbattle casualties, 262
STONE, Col. W. C., Chief Sanitation Division, Office of The Surgeon General, 45
STRONG, R. P., studies in cholera immunization, 316
Submarine Center (Conn.), energy expenditure studies, 87
Subsistence, supply problems, 141, 148–149
See also Food; Ration(s).
Subsistence Division, Office of The Quartermaster General, food procurement, 95, 102
Subsistence Research Laboratory, Quartermaster, research, 86
Surgeon General, Office of The:
accidental injury, report, 239
accident prevention, 243–244, 264, 267
Surgeon General, Office of The—Continued
cholera vaccination, recommendation, 314
dietary standards, opinion, 86
food preparation, responsibility, 85
Geneva Convention, interpretation, 106
immunization program, 271
limited and general service classifications, summary of changes, 197
mental hygiene program, 202
morbidity reports program, 242
neuropsychiatrists, assignment recommendations, 183
nonbattle injury report, 238
nutritional status of troops, responsibility, 96
physical standards, responsibility, 1
plague vaccination, recommendation, 314
prisoner of war food, conferences, 107
rations, recommendations, 89, 109
research and tests in—
clothing, 35, 44, 45, 47, 65, 81–82
emergency rations, 95
gas mask for hospital patients, 76
heat regulation, 51
mite repellents, 56
nutrition and nutritional disease, 86, 109–110, 169
tetanus toxoid reaction, 301
typhus control, 57
retraining of psychoneurotic soldiers, meeting, 209
safety program, 83, 242, 243
sterilization of shoes, opinion, 81–82
tetanus, reports, 296
tetanus toxoid, recommendation, 288
typhoid-paratyphoid vaccine, recommendation, 273
typhus vaccination, recommendation, 314
yellow fever vaccination, recommendation, 306
yellow fever vaccine, lot discontinued, 312
Surgeon General, United States Navy, studies in aviation clothing, 47
SWEETSER, W., meaning of mental hygiene, 171, 172
SWPA. *See* Southwest Pacific Area.
Syphilis, affecting induction, 6

Table waste, amount, 97
TALBOTT, Col. J. H., medical research in clothing, 46
Tank Destroyer Replacement Training Center, mental hygiene service:
  adviser system, 201, 204, 205
  attitude conditioning program, 203
  caseload, 219
  intake procedures, 196
  psychotherapy, 199
Ten-in-one ration:
  acceptability, 129
  availability, 129
  caloric value, 117, 130
  deficiencies, 133
  hospital diets from, 94
  misuse, 132
  recommendations, 123
  results of prolonged consumption, 87, 120
  use in Europe, 131
  use planned, 91
Tests, as classification aids, 179
Tetanus:
  antitoxin, 288, 293
  immunization:
    administrative requirements, 292, 293, 353–354
    antitoxins produced, 298
    development and adoption, 271, 287–290
    directives, 292, 293, 294
    effectiveness, 295–299
    methods, 292–295
    reactions, 299–305
    recording, 293, 337
    studies in degree of protection, 297–299
  incidence, 295, 296, 297
  postvaccinal, 287
  prophylactic antitoxin, 298
  toxoid:
    administration, 287, 292, 293, 294
    agent chosen, 290–292
    booster dose, 298, 299
    for emergency protection, 293
    hydrolysate media, 291, 298, 303, 304, 305
    peptones, 291–292, 301, 302, 303, 304, 305
    procurement authority, 289
Textile, research, 65
Textile Foundation, clothing studies, 47
Textile Research Institute, clothing research, 47
THACHER, J., accidental injury report, 237–238
Thiamine:
  amount—
    consumed in diet, 103, 157
    in rations, 126, 133, 151
      Chinese ration, 144
  deficiency—
    in dietary, 142, 150, 158
    in recovered prisoners, 167, 168, 169
    in troops, 150, 161, 163, 164
  requirement, 104
Thiamine hydrochloride, therapy, 150
Third Army:
  accident prevention program, 256
  capture of enemy beef, 131
  clothing, report on, 72
Toilet facilities, in North Africa and Italy, 25
Training—
  aids, for personal hygiene, 15, 17
  directives, 16
  for men unable to assimilate basic training, 179
  for personnel for mental hygiene services, 189
  in disease prevention, 18, 27
  in personal hygiene, xi, 14, 15–20
  in proper use of uniform, 69
  in safety, 243
Training center psychiatrists. *See under* Preventive psychiatry.
Training Division, Office of The Surgeon General:
  clothing, tests, 43, 44
  training aids provided, 17
Trains, food on, 92
Transportation, Chief of, responsibility in safety program, 242
Transportation Corps, survey of dietary of small units, 136
Treesdale Laboratory, manufacture of flameproof treatment, 75
Trenchfoot:
  classified as nonbattle injury, 236
  disability, 13

Trenchfoot—Continued
incidence, 13, 67, 68
World War I, 42
prevention, 17, 18, 20, 65, 71, 72–73, 79
See also Cold injury.
Trichophytosis, relation to footgear, 62, 82
Troopships, feeding on, 92
Tropical Diseases, National Research Council Committee on:
typhus vaccine, conference, 320
yellow fever immunization recommendation, 306
TRUDEAU, Brig. Gen. A., significance of training center psychiatrists, 217
Trypanosomiasis, cause for rejection, 5
Tuberculosis:
discharge from service, 1
discovered at separation, 5
incidence, 5
World War I, 1, 5
rejection for service, 5
screening process, 1, 6
screening standards, 5
Tuberculosis, National Research Council Subcommittee on, recommendations, 5
Tunisian campaign, ration for, 115–116
Turner's Lane Hosp (Penna.), study of nervous disorders, 173
Twelve-in-one ration, 129
Twentieth Air Force, nutrition study, 93
Typhoid fever:
immunization status patients, 279
incidence, 273, 276, 277
investigation of outbreak, 25
Typhoid-paratyphoid—
vaccination:
administrative requirements, 274, 275, 276, 352–353
development and adoption, 272
directives, 273, 274
effectiveness, 276–279
methods, 273–276
reactions, 279–280
revaccination, 275
vaccine:
changes, 272–273
dosage, 273, 275
not administered with yellow fever vaccine, 309
Typhoid-paratyphoid—Continued
specificity, 273
strains used, 273
Typhus fever, epidemic:
incidence, 322
prevention and control, 17, 27, 57, 322
vaccination:
administrative requirements, 321, 349–350, 354–355
development and adoption, 313–314
effectiveness, 322–323
methods, 321–322
reactions, 323
vaccine, 319–321
dosage, 321
supply, 319
Typhus, scrub. *See* Scrub typhus.

Ulcers, decubitus, relation to nutrition, 86
Undernutrition, 116, 120. *See also* Malnutrition; Nutrition deficiency; Deficiency diseases.
Uniform. *See* Clothing.
United Kingdom:
bathing facilities, 20, 22
prisoners of war, 139–140
smallpox vaccine, local procurement, 282
training in personal health measures, 18
troop rations, 124–131
United States Department of Agriculture. *See* Agriculture, Department of.
United States Military Academy:
course in personal hygiene, 16
physical standards for entrance, 9
United States Public Health Service:
commercial biologic laboratories licensed, 291
immunization, cooperation, 271
tetanus immunization, cooperation, 288
tetanus toxoid recommendations, 288
typhoid-paratyphoid vaccination, cooperation in, 273
typhus vaccine supply, 319
yellow fever vaccine production, 307, 308, 309
Universities:
Cincinnati, rebuilt-shoe sterilization studies, 82
Harvard, study of cold injury and clothing, 63
Indiana, clothing studies, 53

Universities—Continued
Minnesota, studies in—
nutritional disease, 169
vitamin requirements, 105
Queensland, research in skin physiology, 62
Upton, Camp, shoe size study, 40

Vaccination. *See* Immunization.
Vaccinia. *See under* Smallpox.
Vehicle accidents, 245, 251, 252, 253, 265
Venereal disease, affecting induction, 5, 6
Viral hepatitis, prophylaxis, 336
Visual acuity, induction requirements, 4, 5
Visual aids, training in personal hygiene, 17
Vitamin(s):
A:
amount—
consumed in diet, 103
in rations, 126
Chinese ration, 144
deficiency in troops, 86, 161, 162, 165–166
sources, 126
B:
deficiency in troops, 164
requirements determined, 105
C:
amount in ration, 89
deficiency in troops, 142, 162, 165
need for, 117
concentrates issued, 116
D, deficiency noted, 166
deficiencies:
in recovered prisoners, 168, 169
in troops, 155, 161–162, 164, 165, 166
in ration, 89, 95
loss in preparation of food, 96
requirements, 85, 89
supplementation of ration, 136–137
in India-Burma theater, 145–152
in Persian Gulf Command, 140
Von Steuben, Maj. Gen. F., first Army regulations, 237

Wakeman General Hospital, nutrition studies, 86
Walter Reed General Hospital, hospital diet studies, 94
War Department:
cholera vaccination requirements, 315
clothing, issued for nurses, 41
diphtheria immunization program, 333
directives relating to—
clothing, 79
dietary, 89
induction physical requirements, 3, 4, 7, 9
mobilization, 3, 4
personal hygiene, 14, 17
psychoneurosis, 7
rations, 89, 100, 101, 105
immunization requirements, 337
Japanese B encephalitis vaccination requirements, 327
master menu, 91
plague vaccination policy, 318
prisoner of war, food policies, 106
tetanus toxoid requirements, 288, 289, 290
yellow fever, concern over introduction into Hawaii, 311
yellow fever vaccination requirements, 307
War Department Safety Council, 242, 243
War Manpower Commission, cooperation in safety program, 242
War Office of Psychiatric Social Work, 211
War Production Board:
cooperation in safety program, 242
survey of footgear in European theater, 71
Warren, Fort Francis E., mental hygiene service, 226
Waste, edible, 97, 98
Water discipline, 20, 23, 25
Wechsler Individual Mental Abilities Scale, 195
Weight loss, 91
Western Europe:
climate in relation to clothing, 36
incidence of cold injury, 66
Whayne, Col. T. F., "Introduction," XI, XII, "Clothing," 31–83
Wheeler, Camp, mental hygiene service, 198
White, W. A., value of preventive psychiatry, 171
Whittingham, H. E., study of reaction to tetanus toxoid, 301

WICKERSHAM, Maj. F. P., personnel consultant service, 178
Witte's peptone, in tetanus toxoid, 291, 292, 301, 302, 303, 304, 305
Wolters, Camp, mental hygiene service:
  administration, 188, 190
  intake procedure, 195
  lecture program, 213
  morale, evaluation, 227–228
  reclassification board, 198
  screening, 191, 193
World War I:
  clothing, 38–42
  cold injury, 64
  diarrhea and dysentery, 277
  laundry facilities, 41–42
  louse infestation, incidence of, 13
  neuropsychiatric casualties, 1
  nonbattle trauma, 233
  nutrition, 85, 93, 95, 97
  personal hygiene, rules for, 13
  preventive medicine, xi
  preventive psychiatry, 173–174
  psychiatric screening, 1
  rations, 87
  smallpox, 284
  tetanus, 296
  tuberculosis, 1, 5
  typhoid and paratyphoid fevers, 276, 277
Wright Field, studies in oxygen requirements of pilots, 86

X-ray, examination for tuberculosis, 5

YAGLOU, C. P., research in clothing, 47
Yellow fever:
  cases, 311
  exposure of troops to, 311
  vaccination:
    administrative requirements, 309, 310, 311, 343–345, 358–359
    associated with jaundice, 308, 312, 313
    contraindications for administration of, 309
    development and adoption, 306–307
    effectiveness, 311–312
    methods and requirements, 309–311
    period of immunity, 310, 311
    reactions, 280, 312–313
  vaccine, 307–309
    directives for handling, 309
    dosage, 309
  virus, 307
YOUMANS, J. B.:
  "Malnutrition," 159–170
  "Nutrition," 85–112
YOUNG, Col. E., study of Anglo-American ration scale, 115

U. S. GOVERNMENT PRINTING OFFICE: 1955 O— 346336

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. Price $3.25 (Buckram)