

APPROVED BY THE FACULTY:
A STUDY TO DETERMINE THE MOST EFFECTIVE
EMERGENCY MEDICAL SERVICE DELIVERY SYSTEM
AT THE RANDOLPH AIR FORCE BASE CLINIC

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APPROVED BY THE THESIS COMMITTEE:

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CHAPTER I

INTRODUCTION

Within the past five years, a concerted drive has developed to improve emergency medical services (EMS) in the United States. A major contributor to this drive was the increased public awareness of EMS generated by the Viet Nam War. Newspaper headlines heralded the swift, efficient emergency care afforded the American combat troops and their allies in Asia. Casualties were airlifted from the jungle battlefield and flown to a hospital for definitive treatment. They frequently arrived at sophisticated emergency treatment centers in less than 15 minutes after injury.

This effective utilization of emergency medical services on the battlefield led national health planners to the realization that:

- (1) The Armed Forces have proved the number of otherwise fatal combat casualties could be reduced substantially by prompt medical attention,
- (2) The same concepts could be applied effectively to civilian life throughout the nation, and
- (3) Aerospace technology, with some adaptations, could make this a practical undertaking.¹

The policy of the government of the United States regarding emergency medical service is clear. In the State of the Union message to Congress on January 20, 1972, President Nixon said:

We must develop new ways of organizing emergency medical services and of providing care to accident victims by improving communications, transportation, and the training of emergency personnel, we can save many thousands of lives which would otherwise be lost to accidents and sudden illnesses. Such improvement does not even require new scientific breakthrough; it only requires that we apply our present knowledge more effectively.²

President Nixon backed his challenge by allocating \$8 million in fiscal year 1972 and \$15 million in 1973 to develop model systems, training programs, and demonstrations.³

Continued administrative influence and increased public awareness led to enactment of Public Law 93-154 on November 16, 1973. The act, cited as the Emergency Medical Services Systems Act of 1973, amended the Public Health Services Act to provide assistance and encouragement for the development of comprehensive area EMS systems.⁴ It authorized Federal grants for planning, initial operations, expansion, improvement, research, and training. The Secretary, U.S. Department of Health, Education, and Welfare, was delegated the administrative responsibility to review grant

applications.⁵ Approval required concurrence by the areawide planning agency and the state health planning agency. During the ensuing years, EMS systems have shown marked changes. With the continued political pressures of multiple Federal agencies, the availability of grants, and administrative emphasis from the Office of the President to local mayors, rapid changes are certain to continue for several more years.

Historical Background

Randolph Air Force Base (RAFB), San Antonio, Texas, home of the 12th Flying Training Wing was officially dedicated on June 20, 1930. Throughout the history of RAFB its primary function has been pilot training. The mission has varied from basic pilot training to the current mission of training pilot instructors.

The RAFB Clinic provides outpatient medical care for assigned military personnel, their dependents, and other qualified beneficiaries indigenous to the area. Construction of the physical plant, now occupied by the clinic, was completed in 1931 and the RAFB hospital moved into its new home. The hospital reached its zenith during World War II with 400 beds housed in permanent buildings augmented by temporary

structures. The ambulance services provided by the clinic.

Following World War II, the RAFB Hospital went through a series of reductions in bed capacity and services. Concurrently, in San Antonio, the Air Force's Wilford Hall Medical Center (WHMC) and the Army's Brooke Army Medical Center (BAMC) expanded. Therefore, in June 1973, under the Department of Defense regionalization of medical resources concept, the RAFB Hospital was redesignated a clinic with a ten-bed holding capacity. With the loss of hospital status, the spectrum of medical services available at Randolph Air Force Base was significantly reduced. The RAFB Clinic no longer had the medical resources necessary to render comprehensive emergency medical services. Reductions in the physician staff forced curtailment of twenty-four-hour in-house coverage for the emergency room, and since then acute medical and traumatic emergencies have been transported by ambulance to BAMC for definitive treatment.

Conditions Prompting the Study

The RAFB Clinic commander and his administrative staff, cognizant of the standards of EMS care promulgated by P.L. 93-154 and the civilian sector of the health care industry, have begun a program to

modernize the ambulance services provided by the clinic. They have purchased a Life Pack III portable electrocardiograph defibrillator and instituted a training program for their ambulance personnel. Due to the relative isolation of the RAFB Clinic and its reduced treatment capabilities, it is imperative the RAFB service population be provided prompt effective medical care during emergent situations. It has been shown that an effective EMS delivery system reduces morbidity and mortality.

Statement of the Problem

The problem was to determine the most effective emergency medical service delivery system for the Randolph Air Force Base Clinic.

Objectives

The objectives of this study were to:

1. Identify the essential elements of an effective EMS system.
2. Evaluate the present EMS delivery system at the RAFB Clinic.
3. Evaluate alternative delivery systems.
4. Recommend the most effective EMS delivery system for the RAFB Clinic.

Criteria

The EMS delivery system recommended by this study must:

1. Be capable of providing comprehensive emergency medical services for the RAFB Clinic service population both "on" and "off" post.

2. Be consistent with U.S. Air Force policies and standards governing emergency medical services.

3. Make maximum use of existing resources or significantly reduce present personnel and equipment requirements.

Factors Bearing on the Problem

Factors bearing on the problem were:

1. The RAFB Clinic maintains two distinct types of ambulance service: air crash rescue service and conventional EMS service.

2. The RAFB Clinic does not have sufficient resources to maintain a comprehensive emergency medical treatment center. Therefore, acute emergencies are transported to BAMC and non-acute emergencies requiring ambulance service are taken to WHMC.

3. There is no effective communications link between RAFB ambulances and other medical treatment facilities in the area.

4. There is no comprehensive EMS system within the civilian communities which comprise the RAFB service area.

Assumptions

Assumptions made in this study were:

1. RAFB Clinic will continue to operate in its present configuration.
2. RAFB will continue to transport its acute emergency cases to BAMC.
3. The incidence of emergencies and the size of the population base supported by RAFB will remain relatively constant.

Limitations

The limitations of this study are listed below:

1. This thesis was limited to the study of conventional surface transportation of emergency cases.

Review of the Literature

2. The five months of EMS data recorded by the RAFB Clinic were insufficient for statistical forecasting of workloads.

Research Methodology

A review of the literature was conducted to determine the current state of the art, national

policy and standards, educational requirements, and the accepted goals and objectives of an effective EMS system.

RAFB ambulance data were examined to determine historical incidence and frequency of emergency calls.

Principal representatives of BAMC, RAFB Clinic, and the Alamo Area Council of Governments-Bexar County-EMS advisory committee were interviewed to determine the possibility of shared emergency medical resources.

A San Antonio modulance and its Emergency Medical Technician-Ambulance, Advanced (EMT-AA) crew were observed during actual operations.

Training levels of the RAFB ambulance personnel were determined from military records.

The RAFB ambulances and emergency room were surveyed to inventory existing resources.

Review of the Literature

The Emergency Medical Services Act of 1973 became law on November 17, 1973. In its final form, the act:

- (1) Authorized \$30-million in fiscal 1974 and \$60-million in fiscal 1975 for grants and contracts to plan, establish, initially operate or expand area systems of emergency medical care.

(2) Authorized \$70-million in fiscal 1976 for grants and contracts for all of the above purposes except planning.

(3) Provided that grants and contracts could be awarded to a state or local government, regional government entity or private nonprofit agency which developed a plan for a system which would include adequately trained personnel, a communications system, transportation facilities, treatment facilities accessible to all persons in a given area, educational programs and contingency programs to handle natural disasters and mass casualties.

(4) Authorized \$5-million in each of fiscal 1974-76 for grants and contracts to conduct research in emergency medicine.

(5) Authorized \$10-million in fiscal 1974 for grants and contracts to medical and related health schools for training programs in emergency medical care.

(6) Required the secretary of HEW to administer the emergency medical services program within "an identifiable administrative unit" in HEW; required the secretary to prepare an annual report for Congress on the administration of the program.

(7) Directed the secretary to conduct a one-year study of legal barriers hampering the delivery of emergency care because of conflicting state laws.

(8) Established an Interagency Technical Committee on Emergency Medical Services to evaluate and coordinate all federal efforts in the field of emergency medical care.⁶

In response to requirement six listed above, the Secretary of the U.S. Department of Health, Education, and Welfare (DHEW) prepared and published

the booklet, Program Guidelines DHEW Publication No. 74-2009. It outlines eligibility, application procedure, and acceptance criteria for three categories of grants: Section 1202--Feasibility Studies and Planning, Section 1203--Establishment and Initial Operation, and Section 1204--Expansion and Improvements.⁷ Many states, regions, and communities have used the Federal money thus provided to expand the capabilities and improve the quality of their emergency medical services.

Illinois has become a leader in the EMS field. Doctor David R. Boyd, Chief, Division of Emergency Medical Services and Highway Safety, Illinois Department of Public Health, has been instrumental in developing a total EMS system in the state. According to Boyd, the basic philosophy of the Illinois program is that "expert medical care, previously available only in the university medical center, can be effectively and efficiently delivered throughout the state, especially in the rural communities."⁸

State and areawide emergency service councils were established in Illinois to plan for the delivery of emergency care. Initial planning efforts addressed five areas of concern: categorization of facilities,

communications, transportation, personnel and evaluation.⁹

Hospital capabilities were categorized and twenty-five local, eight areawide, and nine regional trauma centers designated.¹⁰ The centers were established in existing general hospitals to make maximum use of available resources. Hospitals were categorized according to criteria developed by the state medical society. The system provided three echelons of care: local, areawide, and regional centers. The range and sophistication of services available increased at each higher category. Local trauma centers performed basic resuscitation and managed the majority of cases. Areawide trauma centers were staffed and equipped to manage more extensive cases and, finally, university hospitals with full treatment capabilities were designated as regional centers.¹¹

The Federal Highway Safety Standards (4.4.11) regarding transportation of the sick and injured and radio communications were adopted.¹² Ground ambulances were employed as the primary mode of transportation. Helicopters, belonging to state, military, or private agencies, were used to transport

selected priority cases.

A statewide communications system was developed to integrate and coordinate the elements of the system. Ambulance dispatch and medical supervision of ambulance personnel were accomplished by two-way, very high frequency (VHF) radios. Motorola's Hospital Assistance Radio System (HEAR) constituted the foundation for the Illinois statewide medical network.¹³

The Illinois plan was developed to utilize trained personnel to the utmost extent. Physicians, nurses, and paramedics provided the basic manpower required. Training programs were established at the regional trauma centers. Courses were developed to train both the Emergency Technician-Ambulance (EMT-A) and Emergency Technician-Ambulance, Advanced (EMT-AA).¹⁴

The Illinois EMS Council developed six broad goals to guide the progress of the Illinois Total Emergency Medical Service System. The goals were:

Goal I. To provide accessibility and emergency medical service to every citizen of Illinois in order that they may receive benefits of emergency and critical care medicine.

Goal II. To develop a comprehensive emergency and critical care system which will fully utilize existing resources while stimulating the development of new care capabilities where these are insufficient or totally lacking.

Goal III. To develop practical and workable solutions to the emergency medical service problem utilizing accepted forms of health care application.

Goal IV. To plan and develop all phases of program utilizing community and areawide planning.

Goal V. To evaluate and monitor programs continuously in order to determine all critical factors to provide for ongoing modification and analysis.

Goal VI. To develop a total system that will be financially and administratively self-supporting without continued subsidization from external sources or reliance on a state or federal bureaucracy.¹⁵

The delivery of emergency medical services can best be understood when viewed as a system. Hyrum Plass of the University of Tennessee has defined two EMS system models:

The conceptual model provides a frame of reference in which EMS can be viewed. It attempts to define the boundaries of the EMS system. Conceptual models also attempt to describe the interaction between EMS systems and other social systems.

Event-based models provide more detail of the EMS system and attempt to deal with the operational aspects. Event-based models (1) look at the EMS system as a sequence of events which an emergent patient can experience and (2) show how the functional elements of the EMS system interact in the common task of processing a patient.¹⁶

Conceptual models

In his "conceptual model," Plass viewed EMS as

a subsystem of the emergency services system (ESS).¹⁷ The emergency medical services, the law enforcement agencies, and the fire department comprise the total ESS. Plass also includes EMS as a subsystem of the health care system.¹⁸ The total health care system is composed of preventive care, primary care and secondary care.¹⁹ Emergency medical care can properly be viewed as a subsystem of primary care since it is the access point to the total health system for the emergency patient. The boundaries between the elements of the health care system are not as identifiable as those of the ESS.

Currently, in the United States, there are three conceptually different EMS systems: the privately owned fee-for-service system, the hospital-based system, and the Government-owned system.²⁰

Traditionally, EMS-ambulance service has been provided as a public service by funeral homes. Ambulances which doubled as hearses have been ill-equipped for emergency care. Ambulance personnel have received minimal first aid training. Users have been charged a small fee for services rendered.

A recent innovation of the privately-owned EMS-ambulance was designed and operated by "Paramedics

Incorporated," a company in New Mexico. Modern vehicles and equipment were purchased and personnel given intensive training. The ambulances were physician-staffed and served a limited segment of the population on a fee basis. Users paid an annual subscription fee plus a usage service charge.

Hospital-based EMS systems have been common in isolated areas. This concept was used most frequently when a single tax-supported hospital served a community. Ambulance fees were added to the patient's hospital bill. This system makes efficient use of hospital-trained emergency personnel.

The most recent trend in EMS has been the conceptual view that EMS is the responsibility of the local government. Many municipalities have assumed operative control of EMS as a subsystem of their ESS. Two different conceptual models can be identified in municipally owned systems.²¹ Some are based on the Life Emergency Support Unit (LESU). The LESU system uses the rescue vehicle concept. Personnel provide on-the-scene emergency first aid, but the patient is transported to the hospital in another vehicle. Transportation may be provided by a municipally or a privately owned ambulance system. The second, and most

prevalent, municipal system is based on the comprehensive EMS concept. It employs a single vehicle, which is equipped and staffed for both on-the-scene first aid and patient transportation.

"Conceptual planning" continues through all planning levels. Integration of "event-based planning" may begin at the state level or at the regional, area, or community level.

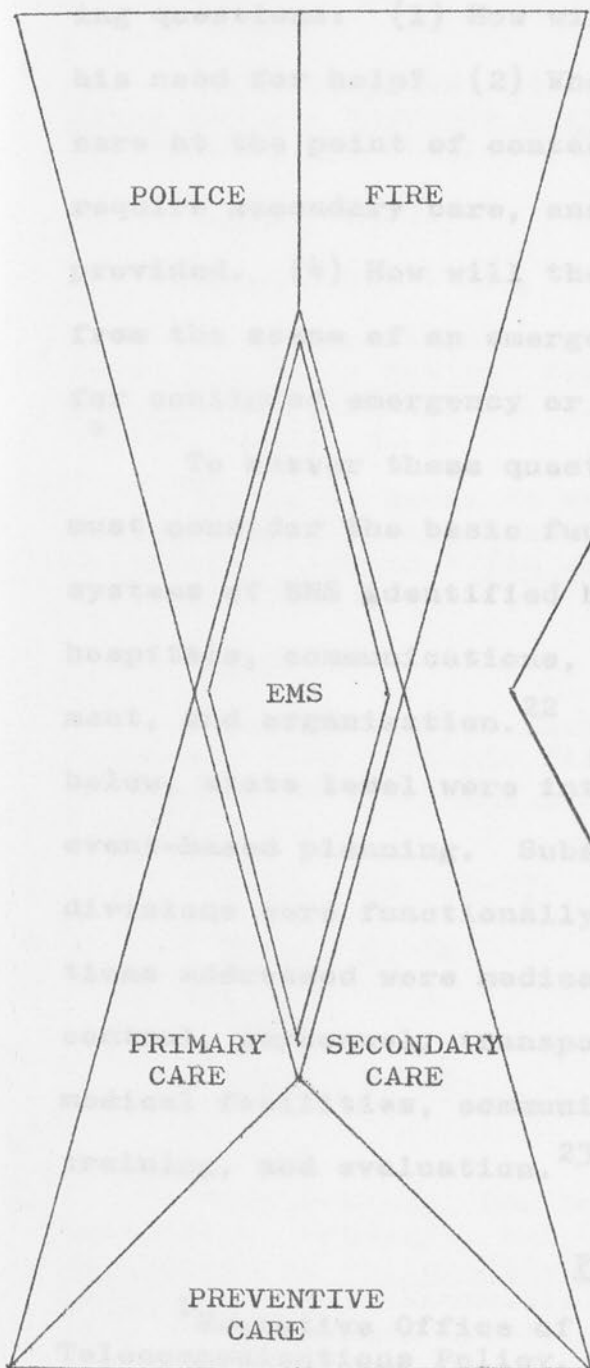
Local planning efforts are primarily "event-based" and deal with the day-to-day operation of the system. Event-based planning is predicated upon the conceptual model and must be congruent with its stated goals and objectives. Conceptual models at each descending planning level further elucidate the stated national goal of reducing morbidity and mortality associated with sudden illness and accidents.

Figure 1 graphically depicts the Plass conceptual system model. EMS, depicted as the diamond-shaped area in the center of Figure 1, overlaps the boundaries of both the health care and emergency services systems.

Event-based model

Event-based EMS models must be based on the needs of the individual communities and their resources.

EMERGENCY SERVICE SYSTEM



MODIFYING FACTORS

1. Laws
2. Environment
3. Topography
4. Demography
5. Public Attitudes
6. Resources
7. Research & Development
8. Education
9. Planning
10. Coordination
11. Management
12. Economics
13. Politics

HEALTH CARE SYSTEM

FIGURE 1. EXAMPLE OF CONCEPTUAL SYSTEM MODEL

However, all event-based plans must address the following questions: (1) How will the patient communicate his need for help? (2) Who will provide emergency care at the point of contact? (3) Does the patient require secondary care, and if so, where will it be provided. (4) How will the patient be transported from the scene of an emergency to a treatment facility for continued emergency or secondary care?

To answer these questions, event-based models must consider the basic functional elements or subsystems of EMS identified by Seale as personnel, hospitals, communications, transportation and equipment, and organization.²² EMS organizations at, and below, state level were intimately concerned with event-based planning. Subsequent organizational subdivisions were functionally oriented. Typical functions addressed were medical supervision, operational control, personnel, transportation and equipment, medical facilities, communication, education and training, and evaluation.²³

Footnotes

¹Executive Office of the President, Office of Telecommunications Policy, Communications in Support of Emergency Medical Services (Washington, D.C.: Government Printing Office, 1973), p. 3.

²Ibid., p. 5.

³Ibid.

⁴U.S. Congress, House of Representatives, Emergency Medical Services Systems Act of 1973, Report No. 93-370, 93d Congress, 1st Sess., 1973, p. 3.

⁵Ibid., p. 2.

⁶Ibid., pp. 1-29.

⁷U.S. Department of Health, Education, and Welfare, Emergency Medical Services Systems-Program Guidelines (Washington, D.C.: Government Printing Office, 1974), p. 1.

⁸David R. Boyd, "A Symposium on the Illinois Trauma Program: A Systems Approach to the Care of the Critically Injured," The Journal of Trauma, XIII, No. 4 (1973), 275.

⁹Ibid.

¹⁰David R. Boyd, Mary M. Dunea, and Bruce A. Flashner, "The Illinois Plan for a Statewide System of Trauma Centers," The Journal of Trauma, XIII, No. 1 (1973), 25.

¹¹Ibid., pp. 25-27.

¹²Ibid., p. 28.

¹³Ibid.

¹⁴Ibid., p. 29.

¹⁵Ibid.

¹⁶Hyrum Plass, Don Dodson, Herschell King, David Pike, Frederick Shipley, Gretchin Beal, The Evaluation of Policy-Related Research in Emergency Medical Service (Knoxville, Tennessee: The University of Tennessee, 1974), p. 16.

¹⁷Ibid., p. 21.

¹⁸Ibid., p. 18.

¹⁹Ibid.

²⁰Ibid., p. 21.

²¹San Antonio/Bexar County Emergency Medical Service Council, Emergency Medical Services Plan (San Antonio, Texas: City of San Antonio, 1973), p. 1-20.

²²Stephen W. Seale, Jr., Planning and Implementing Community and County Emergency Medical Services Systems (San Antonio, Texas: Southwest Research Institute, 1974), p. 3.

²³San Antonio/Bexar County Emergency Medical Service Council, pp. 1-20.

and equipment systems, and the communication system. Effective coordination of the subsystems functions is essential for efficient use of the resources allocated. Two subsystems or elements function as control and coordination centers, the resource control center (RCC) and the medical control center (MCC).² The RCC is the consumer contact point and dispatches appropriate resources to the scene of the emergency. The MCC receives and interprets medical data from the emergency medical technician and directs definitive treatment.

Resource control center

The RCC does much more than dispatch ambulances. It is the nerve system of emergency services. To be effective, RCC must have communication links with all

CHAPTER II

DISCUSSION

An effective EMS system is an integration of five essential elements or subsystems. They are: the resource control center (RCC), the medical control center (MCC), the personnel system, the transportation and equipment system, and the communication system.¹

Effective coordination of the subsystems functions is essential for efficient use of the resources allocated. Two subsystems or elements function as control and coordination centers, the resource control center (RCC) and the medical control center (MCC).² The RCC is the consumer contact point and dispatches appropriate resources to the scene of the emergency. The MCC receives and interprets medical data from the emergency medical technician and directs definitive treatment.

Resource control center

The RCC does much more than dispatch ambulances. It is the nerve system of emergency services. To be effective, RCC must have communication links with all

subsystems of ESS and the health care system which participate in EMS. With adequate communications, the entire system becomes a highly fluid, mobile force. A primary and a "back-up" emergency vehicle can be dispatched to the scene of an emergency. The RCC has immediate access to the police and fire department control centers and can summon help for fire control, forced entry extrication, traffic control and other assistance as needed.³ The physical location of other EMS vehicles can be shifted to meet the needs of the immediate situation. The MCC and health care facilities can be informed of the impending arrival of the emergent patient.

The medical control center

The MCC directs and coordinates the medical activities of the other elements. Undoubtedly, the physician represents the highest level of medical expertise. Under ideal conditions, every patient who suffered a traumatic incident or succumbed to an acute medical emergency would have at his immediate disposal a qualified physician armed with modern medical equipment. In reality, this ideal is neither possible nor practical, because there are not enough physicians to do this. For years, the nation has tried to

transport the patient rapidly to the physician. Many lives have been lost because of inadequate medical care at the point of patient contact and during, or immediately after, transportation to a hospital. The military services have demonstrated the effectiveness of having medical care administered at the scene of an injury by trained paramedical personnel. The military services also have proved that effective communications further extend the physician's capabilities by transmitting pertinent medical data from the scene of the emergency to the medical control center. The physician can then prescribe appropriate therapy for the patient's condition. The MCC should be staffed continuously by physicians who can and will assume responsibility for the direction of EMT activities.⁴ This is more essential in medical than in traumatic emergencies. First aid may be administered without medical advice but, drugs and or electric cardio-defibrillation must be specifically prescribed.⁵ The EMT in Texas is protected by the Good Samaritan Law. However, legal opinion has been rendered that the EMT, when not in the physical presence of a licensed physician, could provide emergency care within the scope of nursing if in direct communication with said

physician.⁶ Therefore, medications and treatments prescribed by a doctor and administered by an EMT are covered under the definition of nursing. The physician is protected by the Good Samaritan act if his services are performed without a demand or expectation of compensation.⁸

Personnel

The emergency medical technician-ambulance and the emergency medical technician ambulance-advanced provide the manpower for the EMS system. The Committee on Emergency Medical Services in cooperation with the National Academy of Sciences--National Research Council (NAS-NRC), developed national guidelines and recommendations for two levels of EMT training. The eighty-one-hour DOT course (Appendix A) is the basic entry level of training and qualifies the trainee for licensing as an EMT-A.⁹ The 480-hour DOT course (Appendix B) is the advanced course and qualifies graduates for licensing as an EMT-AA.¹⁰ The outlines of these two courses shown as Appendices A and B have been published in the Highway Safety Program Manual No. 11. A sample job description for the EMT included in the highway safety manual does not differentiate between the two skill levels.¹¹ Comparing the two

programs, one can surmise that the 480-hour program qualifies the EMT-A to administer medications and to perform advanced cardiac life support measures while the basic course does not.

Transportation and equipment

Three types of EMS vehicles have been developed on the basis of their functional relationships with the rest of the ESS. The first type is the Life Emergency Support Unit (LESU) vehicle, which functions not as an ambulance but as a rapid response rescue vehicle. In this conceptual model, the EMS crew provides on-the-scene first aid, life support measures, and extrication of entrapped victims. Patient transportation is provided by a supporting ambulance system.

In the second type of vehicle, extrication is provided by other members of the ESS. The extrication crews may use a LESU vehicle, a standard light-duty fire truck, or any of the variety of other vehicles.

The third type of vehicle combines the functions of extrication and transportation. Under this concept, vehicles need more storage space and are generally classified as medium to heavy duty vehicles.

The DOT developed the national criteria for the design of ambulances. Design criteria of special significance are included as Appendix C.

Two equipment lists, developed by the committee on Trauma of the American College of Surgeons, were adopted by the NHTSA. The two lists, essential medical equipment for ambulances and the access and extrication equipment, are included as Appendices D and E, respectively. Equipment compatible with the functional concept of the vehicle is carried as standard equipment. Supplemental equipment, life support systems, and medications have been added in many localities based on the training and capabilities of the EMTs and operational experience.

Communications

Communications should be the last element of an EMS system to be considered. After the rest of the system has been designed and the need for communications between the subsystems established, selection of the proper hardware to satisfy that need is a much easier task. Care must be exercised to insure compatibility between the hardware components. Many health care providers, including hospitals and EMS operatives, purchased equipment prematurely before adequate

Federal Communication Commission (FCC) regulations were enacted or without a workable plan to integrate the components.¹² In the early 1970s, the FCC issued a limited number of experimental licenses to test radio-telemetry transmissions utilizing VHF radio frequencies. It has recognized that the nation lacked an informed, cooperative linkage of elements for optimum performance and that adequate radio frequency spectrum allocations which facilitated system development were not available. The Interdepartment Radio Advisory Committee (IRAC) established an ad hoc group to study and report on EMS communications. As a result of the IRAC ad hoc committee study, no additional licenses will be issued for the purpose of radio-telemetry in the VHF range.¹³ Current licensees will be permitted to continue VHF radio-telemetry during a phase-out period. When the VHF equipment is no longer functional, it must be replaced with ultra-high frequency (UHF) equipment. As a result of these changes, pioneers in radio-telemetry systems which supported EMS and hospital operations will eventually be forced to change the major components of their network.

The IRAC ad hoc Committee identified eight essential elements of a comprehensive EMS communications system. These elements are as follows:

(1) Citizen access to the response system through the universal emergency telephone number ("911") and a Resource Coordination Communication Center (RCC).

(2) Messages related to reducing response time by efficiently dispatching and controlling the movement of emergency vehicles.

(3) Messages related directly to the patient and his care, medical telemetry and a "doctor's talk" channel.

(4) Extensions of both administrative and medical control from the emergency vehicle to the actual location of the patient.

(5) Ambulance to hospital and hospital to hospital plus RCC to hospital links to coordinate preparedness for patient reception.

(6) Paging systems to mobilize emergency medical personnel.

(7) Interface with police, fire and other local government agencies, and

(8) Provisions for continued communications during disaster situations.¹⁴

The elements identified emphasized the nature of EMS communications. The system's goal is to improve patient care by facilitating medical direction, resource control, and cooperation between subsystems of the emergency service and the health care system.

DHEW recognized that only areas with a high population density would have sufficient resources to fully utilize a comprehensive communications

system as outlined above. Therefore, program guidelines authorized matching fund grants for phased implementation and required statements of cooperative agreement between eligible licensees. Changes in FCC regulations also require areawide cooperation through:

The development of a common approach to the conduct of medical radio operations. This involves a determination of a medical service area--whether it be a county, a city, a geographical region or any combination of these--for development of an areawide communications plan whereby all medical communication activities are integrated through common dispatch or control centers to optimize the area's use of radio spectra and facilities.¹⁵

Radio frequencies in the UHF range, designated for medical communications, are assigned on an areawide basis. Eight contiguous frequency pairs in a "block" are assigned and the licensees must employ multi-channel equipment that is designed to use any or all of these frequencies.

Evaluation

The evaluation of EMS systems is in a state of transition. The measurement of "quality of care" has been debated, dissected, and legislated, but as yet, no one has developed a universally accepted definition of quality care. Since quality care has not

been adequately defined, evaluative efforts have been directed to the measurements of inputs of resources, the efficiency demonstrated by the processing of a patient, and the ability of the system to effectively modify outcomes. The hypothesis is that through the increased commitment of resources--trained personnel and modern equipment--the efficiency of the process will be enhanced and the process efficiency will affect the outcome. Plass has defined each of these measures as listed below:

1. **Input Measures:** These measures serve to describe the system by describing its resources. These resources are measured in terms of inventories of facilities, equipment and personnel and demand for service. Input measures can be thought of as providing a measure of "system potential" though no one knows exactly what that potential is.

2. **Process Measures:** These measures are used to measure the day-to-day operations of the system. Process measures include measures of efficiency, utilization and appropriate functioning of the subsystems.

3. **Outcome Measures:** These measures attempt to relate patient disposition to system performance. A patient disposition classification can be defined as below:

(1) **Patient Dies:** Measured by mortality rates.

(2) **Patient survives with no disability, temporary disability, or permanent disability.**¹⁶

Plass further relates performance measures to the national EMS goals:

The goals of the EMS system are to provide medical services which: a) increase the probability that an emergent patient will survive, and b) if the first goal is successful to reduce the probability of permanent or temporary disability and c) if the first goal is realized to reduce pain and anxiety experienced by the patient.¹⁷

No one who has observed the transition from the old ambulance system to the new EMS system could seriously question the fact that the quality of care has improved. The problem is how do we really measure quality, for until we can measure it, we cannot quantitatively substantiate improvement.

The systems examined by this study were evaluated on the basis of input and process measures as defined above. Input measures were evaluated by comparing the quantity and quality of allocated resources to the standards promulgated by the National EMS Council, DOT, DHEW, AMA and the American College of Surgeons. Process measures were considered to be adequate if the system demonstrated effective utilization of its resources and integration of the five essential subsystems previously enumerated.

Review and Evaluation of Present System

The ambulance section at the Randolph Air Force Base Clinic provided two types of emergency medical

services, conventional EMS and air crash rescue. Conventional services were continuously available to military personnel and eligible civilian beneficiaries residing within the clinic's service area. The service area included the Randolph Sub-Region demarcated by Loop 410 on its west perimeter, Interstate Highway 35 on the north, Interstate Highway 10 on the south, and extending to the Bexar County line on the east side. The area serviced by the air crash rescue team was not limited by any identifiable boundaries. Air crash rescue was continuously available.

Personnel system

The primary source of personnel for the RAFB-EMS system was the Air Force enlisted personnel system. Personnel were assigned to the clinic based on the assigned mission, historical workload data, the military population supported and the total military manpower ceilings. The length of individual tours of duty were varied. In addition, four civilian manpower spaces were authorized and filled by one professional nurse and three vocational nurses.

The RAFB Clinic had eighteen persons assigned to EMS. The following education/skill levels were identified among them: one registered nurse (emergency

room supervisor), four medical service technicians (including the noncommissioned officer-in-charge), one medical service specialist who was also EMT-A qualified (registered in Utah), nine medical service specialists without formal EMT-A training, and three licensed vocational nurses without formal EMT-A training. All eighteen also functioned as emergency room personnel.

Medical/resource control center

The emergency room at the RAFB Clinic functioned as the MCC and the RCC during both conventional and air crash rescue operations.¹⁸ EMS personnel employed in the emergency room received incoming calls for assistance, dispatched and controlled ambulance crews, and relayed medical information to the physician.

All acute emergency cases at RAFB were transported to the BAMC emergency room or directly to BAMC's cardiac intensive care ward as required. The driving time from RAFB to BAMC was 15 to 20 minutes. Although WHMC had an emergency room with full treatment capabilities, it was not used for acute emergency cases because the driving time from RAFB would be extended approximately 15 minutes. Nonacute cases requiring specialty care were transported to WHMC for treatment. During normal duty hours, minor

emergency cases were treated at the RAFB Clinic emergency room. The flight surgeon at the clinic was assigned as the trauma officer and was "on call" from his office to the emergency room from 0700 to 1800 hours on weekdays. In-house physician coverage for the emergency room was provided on a rotational basis by the clinic physician staff from 1800 to 2100 hours. The emergency room was closed from 2100 until 0700 hours the following day. On weekends and holidays, the emergency room was physician staffed and open for patient care from 1000 until 1700 hours. Therefore, the MCC does not have full time physician coverage.

Transportation and equipment system

The RAFB Clinic had four vehicles devoted to EMS which were equipped with two-way radios. Two raised-roof limousines were used for conventional EMS operations and two military field ambulances were used for air crash rescue. In addition to the above, one station wagon was used for routine patient transfers. None of the vehicles met the DOT-National Highway Traffic Safety Administration (NHTSA) ambulance design criteria. The equipment maintained in the ambulances was compared with the list (Appendix C) recommended by the Committee on Trauma of the

American College of Surgeons Bulletin (May 1970) and the Guide for Conducting State and Community Surveys of Ambulance Services (DHEW-HAR 74-3111, September 1973).

The following equipment omissions were noted: sterile aluminum foil; traction splint; lower extremity hinged half-ring with commercial limb-support slings; padded ankle hitch and traction strap; spine boards, long and short, with accessories; bandage scissors; obstetrical kit; and restraint equipment. Three additional items recommended in the DHEW publication, but not included on the two other equipment lists, were cervical collars, emesis basins, and urinals.¹⁹

The American College of Surgeons' Committee recommended the inclusion of two oxygen therapy systems in each ambulance. One system, with a humidifier, should be permanently installed in the vehicle and a second portable system should be available for use outside the ambulance.²⁰ The two RAFB ambulances used for primary EMS service had an oxygen system permanently installed but did not have a humidifier. They were not equipped with portable oxygen therapy equipment.

Extrication of accident victims trapped in automobiles was done by fire and police department

personnel, therefore, no extrication equipment was carried in the RAFB ambulances.

Communications system

The primary mode of communications used by the RAFB-EMS was the telephone. Standard telephone service was used by the emergency consumer to call for help. "Hot line" telephones connected the emergency room-ambulance dispatch center with strategic command elements and the flight line control tower. Supplementary radio communications were also used. The radio network consisted of two base stations, one at the hospital emergency room and one in the post communications center. All vehicles were equipped with two-channel VHF radios. Assigned radio frequencies were 173.5375 mega-Hertz (MHz), used for ambulance dispatch and medical control, and 173.5875 MHz, for the air crash rescue network. The air crash rescue service radio frequency was shared with other elements of the ESS at Randolph and Kelly Air Force Bases. All of the existing radio equipment was from seven to ten years old and operated at a radio frequency (RF) output of 15 watts. Due to a low lying ridge between RAFB and Brooke Army Medical Center (BAMC), radio contact could not be maintained between ambulances dispatched to BAMC and the RAFB-RCC/MCC. The existing

equipment did not have radio-telemetry capabilities.

In summary, analysis of the EMS system at the RAFB Clinic revealed the following deficiencies: (1) the level of training of assigned personnel was inadequate, (2) the medical control center was not physician staffed continuously, (3) existing radio equipment inadequately supported the resource control center, the medical control center, and could not be used for radio-telemetry of biographical data, and (4) the vehicles which comprise the transportation system did not meet national standards.

The lack of EMT-AA qualified personnel was the most critical issue at the RAFB Clinic. Without qualified technicians, the clinic could not make efficient use of the most modern communications, transportation, or medical equipment. To meet minimal national standards, at least 50 percent of the staff must be trained EMT-A's for routine emergency medical services. In addition, if an EMS delivery system is to develop effective cardiopulmonary resuscitation (CPR) capabilities, each ambulance must be staffed by one fully trained EMT-AA.

RAFB's deficiency of the second magnitude was lack of a functional medical control center. An MCC

must be staffed continuously by experienced physicians who can immediately interpret biographical data and will direct EMT-AA administered definitive treatment.

Past experience has proven that the raised-roof limousine, currently used for conventional EMS by RAFB, does not provide adequate space for personnel and equipment during CPR.

Due to the above deficiencies, the EMS delivery system at the RAFB Clinic only met the criteria for a basic emergency treatment facility and, therefore, could not provide comprehensive emergency medical care for its supported population.²¹

Alternatives

The Randolph Air Force Base Clinic is faced with three viable alternative EMS delivery systems: (1) to improve the current system by utilizing resources of the total San Antonio military health care system, (2) to negotiate with the civilian communities for an integrated system composed of both civilian and military elements, or (3) to curtail all EMS operations and negotiate with civilian communities for a total system of civilian elements.

Alternative one

The RAFB Clinic commander and his staff have determined that continuation of the present EMS system without significant improvements leaves the clinic in an untenable position due to their isolation and reduced treatment capabilities. They have expressed a preference to continue providing EMS within a military health care system. Therefore, the EMS system of the San Antonio military community was reviewed and evaluated to determine whether or not RAFB might reasonably expect to receive increased military EMS support. The commanders of the three military medical treatment facilities in the area provided ambulance service within limited geographical boundaries based on available resources. Wilford Hall's service area included Lackland Air Force Base and the area within a three mile radius around the base. RAFB provides EMS within the Randolph Sub-Region. BAMC's service area included all of the greater San Antonio area. However, it became immediately evident that EMS in the military community had not resulted from a coordinated plan.

Due to budgetary and manpower constraints, BAMC had decided to temporarily curtail off-post emergency services. This decision was prompted by the realization

that the BAMC-EMS was inferior to the existing civilian system. BAMC lacks fully trained EMT-AA's, vehicles which meet DOT standards, and a functional medical control center. Routine patient transportation was continued by the ambulance section, but only upon written request of a physician. Off-post EMS may be restored at some future date if enough resources are allocated to modernize the service.

RAFB Clinic purchased a "Life Pack III" portable electro-cardiograph-defibrillator and planned to develop a radio-telemetry system. The system would have employed an encoder to convert electrocardiographic (ECG) data into radio frequency emissions and a decoder to convert the radio signal back to ECG data. The existing radio equipment would have been converted to the frequency used by BAMC and the ECG decoder located in the BAMC-MCC. However, BAMC's radio net was antiquated and overloaded. BAMC's decision to curtail EMS operation adversely affected this plan. When BAMC curtailed its EMS operations, the need for a MCC was eliminated.

One advantage of an all military EMS system is the retained control of medical resources. Military commanders always have been reluctant to relinquish

control of their resources. If the system remains entirely military, commanders could direct the level of resource allocation and the activities of the service. This gives the commanders greater flexibility. EMS personnel and equipment may be used to perform other functions. For example, the personnel may also be assigned emergency room duty. The vehicles may be used for routine patient transportation and other essential medical missions. Operating an all-military system may cost less than partial or total civilian services. Finally, the commanders may use EMS resources to support field exercises and training activities.

The primary disadvantage of the military EMS system was that it had not kept pace with the state of the art. Training of EMS personnel in the military has fallen far behind the civilian community. The mobility of enlisted military personnel and the lack of a military occupational specialty skill identifier for the EMT rendered local training programs ineffective. Areawide systems have not been planned, funded, or initiated. Vehicular design and equipment have not kept pace with existing technology. Budgetary constraints prohibit intensive modernization efforts.

capital planning for the AACOM-EMS system, conducted by Southwest Research Institute (SRI) was funded under

When the military EMS system in the area was reviewed and evaluated, it became apparent the RAFB Clinic could not anticipate increased support in the near future. In addition, further budgetary and manpower reductions within the military appeared imminent. Therefore, the RAFB Clinic could not hope to provide significantly improved EMS services to its supported population utilizing a totally military EMS system.

Alternative two

Two EMS systems operational within the San Antonio area were reviewed to evaluate the second alternative which was to negotiate with the civilian communities for an integrated system composed of both civilian and military elements.

The Alamo Area Council of Governments (AACOG) emergency medical service system incorporated eleven EMS systems which may be viewed as area systems. The composite regional system was the second largest in the nation.

The regional EMS system included all eleven county members of the AACOG. It covered 11,000 square miles and served more than 1.25 million people. Conceptual planning for the AACOG-EMS system, conducted by Southwest Research Institute (SRI) was funded under

the Regional Medical Program of Texas (planning grant no. 5G03RM0007-04).²² The study emphasized both conceptual and event-based models for the San Antonio/Bexar County area. The resultant plan served as the nucleus for the AACOG Regional EMS plan.

The Health Coordinating Committee (HCC) of the AACOG, formed in response to Public Law 89-749, served as a planning body to integrate, coordinate, and validate the planning efforts of its subcommittees. The Emergency Medical Services Council was formed as a subcommittee of the HCC.²³

The EMS Council was assigned the task of further elucidating and implementing the plan which resulted from the SRI study.²⁴ Council members were selected from community leaders representing Bexar County, Texas Medical Society, the Emergency Service System, the Health Care Delivery System, the American Hospital Association, legal counsel, local government, and health-related civic organizations. In congruence with the SRI study, four task forces were established to address the functional areas of personnel, transportation, communications, and hospital emergency facilities. Two other task forces were formed to coordinate grant support, funding, and intergovernmental relations. The

EMS council identified the community needs, established specific goals and objectives, and formulated a specific phased implementation schedule. Initially, the San Antonio/Bexar County area system was developed and improved. After the San Antonio/Bexar County system was fully implemented, attention was then focused on the area EMS systems of the other member counties.

A more detailed review of the San Antonio/Bexar County EMS system, one of the area subsystems of AACOG's regional system, was conducted because: (1) it was the only comprehensive EMS system in the area and (2) it has been nationally recognized as a model system.

In the Bexar County system, EMS was provided as a subsystem of the San Antonio, Texas, Fire Department (SAFD). Administrative and operative authority were delegated to the assistant fire chief for emergency medical services. The SAFD was authorized additional manpower slots and EMS personnel were selected and trained from the SAFD manpower pool. The average response time in the San Antonio metropolitan area was 3 to 5 minutes. During the first nine months of operation, April 1 to December 31, 1974, the San Antonio EMS responded to more than 33,000 emergency calls. Utilization during the first quarter of 1975 exceeded

8,000 calls. The unincorporated areas of Bexar County were served by the area system with an average response time of 20 minutes.

Personnel requirements of an EMS system include three categories: professional medical supervision, administrative supervision, and emergency medical technicians. With the pledged support of the Bexar County Medical Society and the delegation of administrative and operative control authority to the assistant fire chief for EMS, the personnel task force was left with the difficult job of providing adequately trained, technically competent EMT-A's. Available manpower resources were surveyed. Two possible sources of manpower were identified and evaluated--the military-trained paramedic and the engineer-level fireman of the SAFD. A decision was reached to use the fireman because of his training and experience in emergency first aid, extrication procedures, and demonstrated performance of assigned responsibilities under emergency conditions. However, the engineer-level fireman did not have the 480 hours of instruction recommended by the committee on EMS, National Academy of Science-National Research Council. Therefore, the task force for personnel organized an intensive training program

with Bexar County Medical Society and Bexar County Hospital (BCH). Teaching personnel were drawn from the physician community and BCH employees.²⁵ By April 1, 1975, the system employed 101 fully trained advanced EMT-A's. The content and length of the training program has been expanded to 549 hours and 45 minutes of intensive medical training. Periodic training sessions are conducted to replace personnel lost through normal attrition. Planning for refresher courses has also been instituted by the personnel task force.

The "Modulance" was selected as the vehicle of choice for EMS. The body of the vehicle is manufactured by the Modular Ambulance Corporation of Dallas, Texas. Its functional design meets or exceeds all Federal specifications listed in the DOT-NHTSA pamphlet, Ambulance Design Criteria.²⁶ The advantageous features of the selected model (SA-138) include adequate space to transport two patients, ample equipment storage cabinets, individual environmental controls for patient comfort, and built-in oxygen and suction equipment. The large, roomy patient compartment is separated from the driver's compartment. The system was designed to be installed on a light truck chassis which conforms to the Federal Motor Vehicle Safety Standard 18.

Twenty Modulances were purchased and equipped with modern communication and medical equipment. Twelve Modulances are continuously available for service. Eight vehicles are held in reserve for use during disasters. They also facilitate routine and major maintenance by a direct exchange system.

The operational vehicles have been strategically located at fire stations to provide the best coverage possible based on a mean response time of less than 5 minutes. Each vehicle is staffed by two advanced EMT-A's.

EMS communications followed a phased implementation schedule. The SAFD had two assigned VHF radio frequencies. During initial EMS operations, one of the channels was utilized for ambulance dispatch and control. EMS physicians used hand-carried transceivers which permitted the dispatcher to relay medical information from the EMT to the physician and to return treatment instructions to the EMT. Leased equipment permitted the transmission of the bio-medical data from the patient to the hospital through stationary telephones only.²⁷

Plans for a comprehensive EMS communication system were completed and a contract with the Atlantic

Research Corporation was consummated in December 1974, with a projected completion date of June 30, 1975. The \$825,000 system will be composed of: (1) a resource control center at its present location in the San Antonio, Texas, Police Department Building, (2) two microwave radio towers to connect the system with Bexar County Hospital, (3) a medical control console at Bexar County Hospital, (4) direct two-way communications between the EMT and the physician, and (5) radio-telemetry of biomedical data (electrocardiograms) from portable units through mobile repeaters and the microwave radio tower to the medical control console. The system will use assigned UHF radio frequencies.²⁸

Communication centers for all three ESS subsystems are housed in the San Antonio Police Department building. This arrangement permits common use of radio towers and promotes inter-departmental cooperation. Each of the three departments operates independent dispatch and control centers. Additionally,

The San Antonio/Bexar County EMS system has become a recognized model. It has validated the regional planning process.²⁹ The system consisted of: (1) a well trained personnel system, (2) a RCC which effectively integrates elements of the emergency service system

and the health care delivery system, (3) a MCC staffed by skilled physicians, (4) the most modern transportation and equipment system available and, (5) an efficient emergency communications network.

Other EMS systems operational within the Randolph Sub-Region were also evaluated. Incorporated communities and political sub-districts within the AACOG region could subscribe to the AACOG EMS system or could make other arrangements for emergency services. The Randolph Sub-Region voted to provide EMS with its own resources. A fragmented EMS system has continued in the area. All three conceptual models were operational within the sub-district. Universal City, the community closest to RAFB, employed the LESU concept as a sub-system of the fire department. Patients were transported either by privately owned fee-for-service ambulances or by the Schertz Area Facility for Emergency Service (SAFES). The SAFES system was a municipally owned volunteer operated ambulance service. Additionally, RAFB Clinic provided EMS for eligible citizens of the Sub-Region.

The Randolph Sub-Region did not join the AACOG Bexar County sub-system because of a required capitation tax levy and perceived excessive response times

by Modulances based in the City of San Antonio. Political pressures, citizen demands for improved services and limited capital resources have forced the Randolph Sub-Region to reconsider its decision not to join the areawide EMS system of Bexar County.

(2) The RAFB Clinic could negotiate with the Randolph Sub-Region collectively or with one or more of its EMS sub-systems for a partial civilian augmentation of the RAFB-EMS system. However, this course of action would be inappropriate at this time because: (1) the Randolph Sub-Region EMS system is fragmented and cannot provide comprehensive EMS services, and (2) the future of the Sub-Region's EMS system as a free standing entity is at best tenuous. Conversely, an agreement between the RAFB and the Randolph Sub-Region would strengthen their position in negotiations with the AACOG for an area-based modulance and crew.

Negotiations with the local governments of Randolph Sub-Region and officials of the AACOG San Antonio/Bexar County EMS system must address two critical issues, the location of a modulance and finances. First and foremost is a strategic location of the Modulance which would service the area. A base of operations would have to be established either on RAFB

a service fee of \$35.00 was charged for each service

or near enough to the main gate to provide a mean response time of less than 10 minutes. Ideally, response time should be less than 5 minutes. Any one of three existing facilities could serve as a base of operations and a medical equipment supply point: (1) the RAFB Clinic, (2) the RAFB Fire Department, or (3) the Universal City Fire Department.

Second, a portion of the financial support for the Modulance system must come from the civilian communities of the sub-region. Previous studies of the sub-region, exclusive of the RAFB Clinic service population, indicated there was an insufficient workload to financially support a Modulance crew. Therefore, since the RAFB Clinic service population is not significantly greater than the civilian population, it is apparently too small to efficiently utilize a Modulance crew. However, the total population in the sub-region would generate both sufficient workload and financial support.

Funds for the AACOG-EMS systems design, equipment acquisition, and initial operations were obtained through Federal grants under the Texas Regional Medical Program and the Emergency Medical Services Act of 1973. Operational funds are obtained from an annual capitation tax of approximately three dollars per person. In addition, a service fee of \$35.00 was charged for each service

call which resulted in the patient being transported to the hospital. If the patient's condition did not require transportation, there was no service charge. It was reasonably expected that Randolph would be required to pay a service fee and possibly a capitation tax if it joins the AACOG system.

The successful resolution of the above critical issues through the negotiation process would facilitate the selection of alternative two.

An integrated system composed of military elements for air crash rescue and civilian elements for conventional EMS through a cooperative agreement with the San Antonio/Bexar County system would offer many short-range advantages. The chief advantage would be an immediate modernization of services. In addition, a civilian delivery system would diminish the requirements for military personnel and equipment. It would make more efficient use of the personnel, trained for hospital care, who provide the current manpower for the EMS system. Off-post response times would be reduced. In the long run, the total cost of providing EMS would be reduced. Cost reductions would result from improved operational efficiency and from the savings realized by avoiding the duplication of expensive equipment.

Special consideration must be given to the air crash rescue mission of the clinic. While the Modulance is an ideal vehicle for EMS operations, it does not possess all-terrain operational capabilities. The clinic would have to maintain at least one all-terrain vehicle (ATV) ambulance for air crash rescue operations. The clinic would also be required to maintain "on-call" personnel for this vehicle. The Modulance system would provide an excellent "back-up" capability to transfer the patient from the all-weather road closest to the crash site to the hospital. Additional Modulances could be provided from the city if needed. The Assistant Fire Chief for EMS of the SAFD has indicated this service is currently available to the RAFB air crash rescue service. He has further indicated that the system will respond to any on-post emergency which exceeds the capabilities of the RAFB Clinic system. The retention of one or more field ambulances for air crash rescue would also retain some flexibility for the RAFB commander. Air crash vehicle(s) could be used to support military training exercises. Radio equipment could be purchased and installed which would interface with the AACOG area system.

Disadvantages of this delivery system include

further reductions of military manpower and operating funds. If conventional EMS were deleted from the missions of the military treatment facilities, higher headquarters would make proportionate reductions in the resources allocated. The commander would lose control of this element of health care and, therefore, lose some of his flexibility. Costs associated with this delivery system would exacerbate some existing problems. The local government charges a \$35.00 service fee for all patients transported by the EMS system plus a per capita tax levy, payable with other county taxes. The tax for the military who reside off post presents no problem since they are already paying county taxes either by direct property assessment or as a portion of their domicile rent. However, if EMS service is extended to the on-post population, Bexar County may require an annual capitation contribution.

The service charges are a different matter.

For the active duty military, reimbursement from operating funds is authorized. However, military dependents, retired military, and other beneficiaries would have to file under Civilian Health and Medical Uniformed Services (CHAMPUS) for reimbursement. The CHAMPUS system recently has restricted the claims it will honor

for ambulance service to those associated with hospital admission. The impact of these service charges on the CHAMPUS system would be difficult to estimate without an extensive study to determine the number of persons who have exceeded the annual deductible requirement and who subsequently use EMS. Undoubtedly, CHAMPUS costs would increase. The increased CHAMPUS costs would occur when the program is under close scrutiny by Congress.

An agreement between RAFB and the Alamo Area Council of Governments will not be accomplished easily. It is apparent that RAFB must first reach an agreement with the local governments of the Randolph Sub-Region. In addition, the RAFB Clinic staff must convince the Randolph Wing Commander that their course of action will result in a delivery system which is medically efficient and cost effective. Without his support an agreement could not be consummated.

Alternative three

The selection of alternative three, which was to curtail all EMS operations and negotiate with the civilian communities for a total system of civilian elements, would offer several advantages. First, a large capital investment to modernize transportation and communication equipment would not be required.

6. The principal disadvantage of this delivery

Duplication of expensive equipment would be avoided. The personnel requirements at the clinic would be reduced. The clinic's total expenditures would be reduced. The provision of emergency care under this delivery system would be comprehensive and effective. Ambulance response times for "off-post" patients would be reduced. The total capabilities of the EMS system would be expanded.

Most of the disadvantages of this alternative have been discussed under alternative two. The discussion will not be repeated here, however, the disadvantages will be enumerated for the sake of clarity. They were as follows:

1. CHAMPUS costs would be increased.
2. Since most incorporated residential areas of the Randolph Sub-Region do not subscribe to the Bexar County EMS system, RAFB would probably be required to pay an annual subscription fee to obtain EMS.
3. Negotiations for a satisfactory agreement would be difficult to accomplish.
4. The clinic commander would not have operational control of a civilian EMS system and would lose some flexibility.
5. The total cost of this delivery system is unknown.
6. The principal disadvantage of this delivery

system is that it does not provide adequate air crash rescue capabilities. The Modulance transportation system does not have all-terrain vehicles. The probability of an air crash in an area inaccessible to standard vehicles cannot be ignored. Therefore, total civilianization of the EMS system without all-terrain vehicles is not acceptable.

Footnotes

¹San Antonio/Bexar County Emergency Medical Services Council, Emergency Medical Services Plan (San Antonio, Texas: City of San Antonio, 1973), p. 1-20.

²Ibid., pp. 11-13.

³Executive Office of the President, Office of Telecommunications Policy, p. 10.

⁴Charles L. Weigel, "Texas Law and Emergency Medicine," South Texas Law Journal XV (1974), p. 147.

⁵Ibid.

⁶Ibid., p. 148.

⁷Ibid., p. 149.

⁸Ibid., p. 154.

⁹Department of Transportation, National Highway Traffic Safety Administration, Highway Safety Program Manual No. 11 (Washington, D.C.: Government Printing Office, 1974), H-1.

¹⁰Ibid., H-15.

¹¹Ibid., K-1.

¹²American Hospital Association, A Guide for Hospital Participation in an Emergency Medical

- Communications System (Chicago, Illinois: American Hospital Association, 1973), p. 1.
- ¹³Executive Office of the President, Office of Telecommunications Policy, p. 3.
- ¹⁴Ibid., p. 9.
- ¹⁵Federal Communications Commission, "Medical Communications," Federal Register XXXIX, No. 137 (1974), 26116.
- ¹⁶Plass and others, "Research in Emergency Medical Service," p. 26.
- ¹⁷Ibid., p. 27.
- ¹⁸Department of the Air Force, USAF Clinic (ATC), "Clinic Regulation 160-24," (1974), paragraph 1.
- ¹⁹Department of Transportation Manual No. 11, pp. IV 58-59.
- ²⁰Department of Health, Education, and Welfare, Surveys of Ambulance Services and Hospital Emergency Departments (Washington, D.C.: Government Printing Office, 1973), p. 11.
- ²¹Ibid.
- ²²San Antonio/Bexar County Emergency Medical Services Council, ii.
- ²³Ibid., p. 1.
- ²⁴Ibid., p. 3.
- ²⁵Ibid., p. 14.
- ²⁶Department of Transportation, National Highway Traffic Safety Administration, Ambulance Design Criteria (Washington, D.C.: Government Printing Office, 1973).
- ²⁷Reyes Lopez, Deputy Fire Chief for EMS, San Antonio, Texas, interview, March 7, 1975.

²⁸City of San Antonio, Department of Public Works, Specifications for EMS Communications (San Antonio, Texas: Department of Public Works, 1974).

²⁹"San Antonio EMS Area Nation's Largest," San Antonio Express, October 21, 1974, p. 4.

Many emergency medical service systems across the nation have been significantly improved within the past five years. The two principle factors responsible for the rapid change were an increased public awareness of all health care delivery systems and the availability of Federal funds to plan, implement and operate expanded emergency services. The Emergency Medical Services Systems Act of 1973, administered by the Department of Health, Education, and Welfare, authorized matching Federal grants to improve old systems or to design new ones.

Historically, the military forces of the United States have demonstrated, in combat, that an effective, rapid response and system reduces the mortality and morbidity associated with trauma or sudden acute illness. Unfortunately, the experience and skill gained on the battlefield has not been effectively utilized by the military at home. The level of personnel training and the quantity and quality of physical resources

devoted to military EMS systems has fallen far behind the civilian sector of

CHAPTER III

CONCLUSIONS AND RECOMMENDATIONS

Many emergency medical service systems across the nation have been significantly improved within the past five years. The two principle factors responsible for the rapid change were an increased public awareness of all health care delivery systems and the availability of Federal funds to plan, implement and operate expanded emergency services. The Emergency Medical Services Systems Act of 1973, administered by the Department of Health, Education, and Welfare, authorized matching Federal grants to improve old systems or to design new ones.

Historically, the military forces of the United States have demonstrated, in combat, that an effective, rapid response EMS system reduces the mortality and morbidity associated with trauma or sudden acute illness. Unfortunately, the experience and skill gained on the battlefield has not been effectively utilized by the military at home. The level of personnel training and the quantity and quality of physical resources

devoted to military EMS systems has fallen far behind the civilian sector of our economy. Innovative, dedicated commanders of many military medical treatment facilities who attempted to keep pace with nationally recognized EMS standards have been thwarted by significantly reduced resources.

The Randolph Air Force Base Clinic Commander is deeply concerned about the quality of emergency care provided for his service area population. A reduced physician staff, a smaller operating budget, antiquated communications equipment, substandard transportation equipment and a dearth of trained emergency medical technicians has not only subverted modernization attempts, but has also reduced the clinic's emergency treatment capabilities. Similar resource reductions throughout the military threaten the integrity of a military EMS system in the San Antonio area. This study was conducted to evaluate the present and alternative EMS delivery systems for the Randolph Air Force Base Clinic. Three alternatives were evaluated. They were: (1) the continuation of a military delivery system, with improvements, (2) an integrated delivery system composed of both military and civilian elements, and (3) a totally civilian EMS system. The military and the

4. The RAFB Clinic commander cannot hope to

civilian EMS systems operating in the San Antonio area were evaluated by comparing input measures and selected process measures of the above systems with national standards. The Randolph system was viewed as a subsystem of the military EMS system. The Alamo Area Council of Governments EMS system and the Randolph Sub-region EMS system were viewed as the civilian EMS system.

Conclusions

The following conclusions were drawn from this study:

1. An effective areawide military EMS system was nonexistent. Plans to integrate the essential elements of a comprehensive EMS system had not been formulated nor implemented. Both input measures and process measures did not meet national standards.
2. The RAFB Clinic EMS subsystem was also substandard. The quantity and quality of input resources have prevented effective integration of the operational elements.
3. The San Antonio/Bexar County areawide EMS subsystem of the AACOG's regional EMS system meets or exceeds the national standards and has been recognized as a model system.
4. The RAFB Clinic commander cannot hope to

significantly improve the quality of emergency care within the military system due to the reduction of available resources and the nonexistence of a military EMS system. Additional recommendations are as follows:

5. A totally civilian EMS system does not satisfy the requirements of the clinic's air crash rescue mission. A system will be replaced.

2. A study be conducted under the aegis of the

Recommendations

Therefore, it is recommended that the RAFB Clinic initiate negotiations with the AACOG-San Antonio/Bexar County EMS system for the provision of conventional EMS by a locally based Modulance. Close coordination with the governments of the Randolph Sub-Region is mandatory. Successful negotiations would improve the quality of emergency services available to the RAFB service area population. Additional support, from the reserve capacity of the San Antonio/Bexar County system, would be available during air crash rescue operations and other disasters. The retention of one or both of the four-wheel-drive field ambulances would retain the all-terrain capabilities of the air crash rescue team, support field training exercises and provide some flexibility for clinic operations. It is recommended

that the field ambulance(s) be equipped with communications equipment compatible with the AACOG communications network.

Additional recommendations are as follows:

1. Local training efforts should be continued by the clinic until it is apparent the present conventional system will be replaced.

2. A study be conducted under the aegis of the Tri-Service Military Medical Region Commander to contrast the cost effectiveness of an areawide military EMS system with the cost of an integrated civilian-military system.

DEVELOPING THE BASIC TRAINING
OF AMBULANCE PERSONNEL
(35 HOURS)

GUIDELINES FOR BASIC TRAINING
OF AMBULANCE PERSONNEL
(81 HOURS)

SECTION ONE - EMERGENCY CARE

I. ANATOMY AND PHYSIOLOGY

- A. Musculoskeletal System
- B. Nervous System
- C. Respiratory System
- D. Circulatory System
- E. Genitourinary System

APPENDIX A

GUIDELINES FOR BASIC TRAINING
OF AMBULANCE PERSONNEL
(81 HOURS)

- F. Gastrointestinal
- G. Abdomen
- H. Skin
- I. Eye
- J. Topographic Anatomy

II. VITAL SIGNS AND THEIR SIGNIFICANCE

Normal ranges of vital signs and abnormalities related to injuries and other emergencies to include pulse, respiration, blood pressure, skin temperature, color of skin and mucous membranes, pupils, states of consciousness, paralysis, and reaction to pain.

III. LIFE-THREATENING EMERGENCIES

- A. Airway Maintenance, Artificial Ventilation, and Oxygenation.
- B. Cardiac Arrest and Cardiopulmonary Resuscitation. Instruction as prescribed by the American Heart Association.

47

C. Bleeding. Pressure dressings, pressure points; emphasis on strict limitation on use of tourniquets.

D. Shock. Shock. Administration of intravenous fluids.

**GUIDELINES FOR BASIC TRAINING
OF AMBULANCE PERSONNEL
(81 HOURS)**

SECTION ONE - EMERGENCY CARE

IV. INJURIES

I. ANATOMY AND PHYSIOLOGY

- A. Musculoskeletal System
- B. Nervous System
- C. Respiratory System
- D. Circulatory System
- E. Genitourinary System
- F. Gastrointestinal Tract
- G. Abdomen
- H. Skin
- I. Eye
- J. Topographic Anatomy

II. VITAL SIGNS AND THEIR SIGNIFICANCE

Normal ranges of vital signs and abnormalities related to injuries and other emergencies to include pulse, respiration, blood pressure, skin temperature, color of skin and mucous membranes, pupils, states of consciousness, paralysis, and reaction to pain.

III. LIFE-THREATENING EMERGENCIES

- A. Airway Maintenance, Artificial Ventilation, and Oxygenation.
- B. Cardiac Arrest and Cardiopulmonary Resuscitation. Instruction as prescribed by the American Heart Association.

- C. Bleeding. Pressure dressings, pressure points; emphasis on strict limitation on use of tourniquets.
- D. Shock. Includes administration of intravenous fluids.

IV. INJURIES

A. Wounds - General.

1. Definition - Open, closed; abrasion, puncture, incision, avulsion; penetrating, perforating.
2. General Effects - Interference with function; shock.
3. Local Effects - Hemorrhage, external, internal; interference with blood supply; destruction; foreign bodies; contamination.

B. Injuries of Bones and Joints.

Under each heading, instructions as appropriate on techniques of handling extremities, methods of moving victim, dressings, splinting traction, positioning during transport; emphasis on treatment of sprains, and strains as if they were fractures or dislocations.

1. Fractures and dislocations of upper extremities.
2. Fractures and dislocations of lower extremities.
3. Fractures and dislocations of spine.
4. Fractures of pelvis.

C. Injuries Other Than of Bones and Joints.

Under each heading, instructions as appropriate on airway obstruction, cardiac arrest, hemorrhage, techniques of moving, release from impalement, dressings, splints, positioning, preservation of avulsed parts

(ear, nose, digits, extremities) and possible complications during transport.

1. Scalp and skull
2. Brain
3. Eye, ear, nose
- IX. 4. Face and jaws
- X. 5. Neck
6. Chest
7. Abdomen, pelvis
- XI. 8. Genitalia
9. Back
10. Extremities

V. BURNS

VI. ENVIRONMENTAL EMERGENCIES

Instruction as appropriate on prevention of additional injury, methods and hazards of removal from environment, initial care, contamination, possible cardiopulmonary complications during transport.

- A. Exposure to Cold.
- B. Exposure to Heat.
- C. Exposure to Radiation.
- D. Electrical Injuries.
- E. Near-Drowning.
- F. Explosions.

VII. ACUTE POISONING

VIII. MEDICAL EMERGENCIES

Fainting; stroke, heart attack; convulsions; acute alcoholism; diabetic states; perforated viscus; hemorrhage; asthma; emphysema; nose bleed; shock; unconscious states; allergic reactions; urinary retention; strangulated hernia; protracted vomiting; drug withdrawal; spontaneous pneumothorax; communicable disease. (Special emphasis on pediatric emergencies).

IX. EMERGENCY CHILDBIRTH

X. MANAGEMENT OF EMOTIONALLY DISTURBED AND UNRULY

SECTION TWO - AMBULANCE SERVICES

XI. PERSONNEL

Effective service requires proper attitudes and conduct in work; show of responsibility; skills obtained by experience and training; acting within limitations of capabilities.

Both attendants and drivers must be equally trained in each other's duties and responsibilities so that they may function interchangeably or independently in caring for multiple casualties.

A. Duties as an Attendant.

Personal Attitudes and Conduct:

1. Professional Manner - Definition; ethical standards required; control of emotion; courtesy; tone of voice; refrains from smoking while engaged in duties related to care of patients; uses appropriate topics of conversation.
2. Personal Appearance - Hygiene and grooming; proper wearing of uniform; identifying insignia.
3. General Conduct - Shows interest in job; concern for injured; "common sense" care; teamwork efficiency; prevents embarrassment

to injured; gives reassurance to injured; uses injured's resourcefulness in helping himself; shows responsibility for his safety, self, others; cooperation.

4. Response to Injured's Need for Religious Comfort in Fact of Death - Obligation to notify clergyman when requested.
5. In Cases of Apparent Death or Deaths - Definition of death; examines for signs of death; where death is certain, moves body in accordance with local ordinances or regulations; for ethical and humanitarian reasons, remains with deceased until arrival of police, a medical examiner or coroner; shows courtesy, respect and consideration in handling and exposure of the deceased.
6. Disclosing Bad News - Creates proper atmosphere; displays attitude to mitigate bad effects; demonstrates sympathetic air.

Responsibilities to the Ill or Injured:

7. Prompt and Efficient Care - Performs life-saving measures; provides for safety and protection; gives all possible emergency care when extrication is delayed; undertakes extrication to permit emergency care; avoids undue haste and mishandling; searches for medical identification emblems.
8. Preparation for Transport to Hospital - Immobilizes injured parts; prevents disturbance and exhaustion before transport; makes sure of the cooperation of the person being transported; ensures optimal preparation before decision to transport; protects his valuables.
9. Continuing Care En Route and Delivery to Hospital Emergency Department in Best Possible Condition - Rides in compartment with the ill or injured; continually observes and protects; administers fluids

and other measures as instructed or indicated; reports changes in condition during transport.

10. Skill in the Use of Ambulance Equipment and Supplies - Cooperation - When a physician or a paramedical person is present at the scene of the crash, assumes subordinate role and gives full cooperation; in their absence, carries out functions which are the usual responsibilities of police officers, firemen, other ambulance personnel, public utilities personnel, clergymen; cooperates fully with hospital emergency department staffs.

B. Duties as the Driver.

1. Personal Attitudes and Conduct - The same standards of professional manner, personal appearance and conduct as pertains to the attendant are applicable to the driver.
2. Responsibilities to the Injured - Transports the injured in such a manner that it minimizes disturbance to affected part and ensures comfort, prevents shock, allows freedom of breathing, avoids further danger to the injured; knows and abides by laws and traffic regulations pertaining to ambulances.
3. Vehicle Operation - Practices "defensive driving"; exercises emergency privileges properly; prevents crashes; engages in safe driving practices; knows and uses proper operating speeds; knows importance of gentle driving, starting and stopping; knows the relationships of speed to "reaction distance," "braking distance," and "stopping distance"; makes proper use of lights and sirens.
4. Transportation of Mass Casualties - Drives along assigned routes cleared by police; does not alter routes unless directed by police or central dispatcher; proceeds only

to designated areas or hospitals; cooperates in a coordinated, constantly flowing effort.

5. Maintenance of Vehicle - Understands principles of engine and can make minor repairs; routinely inspects and services mechanical parts; checks safety equipment; cleans debris from vehicle; decontaminates inside after transport with contagious infections or radiation exposure.

XII. EMERGENCY VEHICLES

A. Ambulances.

Regardless of the degree of injury or illness for which the ambulance is dispatched, the ambulance and its equipment must be adequate to cope with the most serious emergencies.

B. Helicopters.

In helicopters cruising at low altitudes, the medical problems pertaining to transport in a fixed-wing aircraft are not pertinent. At altitudes under 1,000 feet, the indications for oxygen administration are the same and the problems encountered in case of vomiting, sucking wounds of the chest, and injuries to the sinuses, ears, and brain are dealt with in the same manner as during ambulance transportation.

1. Criteria for Use - Accessibility to the injured; speed in transport of attendants to the crash scene, and of the injured to initial emergency care facility, or in transfer to a medical center.
2. Special problems - Dust requires covering of all open wounds; moving rotor blades dictate pattern in approaching and leaving helicopter; air turbulence requires special attention to securing of litter and the injured; noise interferes with communication and evaluation of vital signs; vibration may make procedures such as intravenous administration or intubation difficult.

C. Rescue Vehicles.

The space requirement for personnel and equipment in rescue vehicles designed for medium and heavy precludes their use as ambulances. Light rescue equipment should be carried on ambulances as well as on rescue vehicles and ambulance personnel trained in its use.

XIII. THE USE OF EQUIPMENT AND SUPPLIES

Thorough familiarity with the theory of any particular device, indications for its use, the desired effects when it is used, its capabilities and limitations and its malfunctional problems.

Maintenance, exchange, and periodic inventory.

Efficiency in use, as prescribed in the section on emergency care.

A. Emergency Care.

1. Airway Maintenance, Artificial Ventilation, and Oxygenation - Suction apparatus, installed and portable; catheters,* air-mouth gags; bag-mask resuscitation unit, installed and portable,* oxygen tanks and masks,* manually triggered oxygen-powered ventilation apparatus.*
2. Control of Hemorrhage - Compression dressings; touniquets (emphasis on strict limitations in their use).
3. Immobilization of Spine and Extremities - Backboards; half-ring splints; padded boards; inflatable splints; triangular bandages.
4. Dressings - Large universal dressings; pads; bandages; pins; tape; shears.
5. Fluids - Intravenous fluids and administration sets.

* Appropriate sizes for adults, children, and infants.

6. Emergency Childbirth - Obstetrical kits.
 7. Acute poisoning - Medicinal charcoal; syrup of ipecac.
 8. Lighting - Flashlights; floodlights; generators.
- B. Safe and Efficient Transport.
- Warning devices; lights; temperatures and humidity controls; restraining devices for litters and occupants; litters; blankets; pillows; neck rolls.
- C. Safety Equipment.
- Warning flags and flares; fire extinguishers; helmets; rubber gloves.
- D. Light Rescue Tools.
- Lifting, prying, cutting and battering tools; backboards; ropes; straps.
- E. Communication
- Radio equipment
- F. Elective Equipment - For Use by Physicians or Other Persons Trained in Its Use.
- Tracheal intubation kits; mechanical external cardiac compression machine; radiation detection equipment; tracheotomy or cricothyrotomy set; equipment for monitoring of vital signs; cardioscope/defibrillator; pleural drainage set for tension pneumothorax.

XIV. COMMUNICATION

Instruction and demonstration by communication experts on use, regulations, limitations, and maintenance of equipment; and by physicians or paramedical personnel on coordination of care and delivery of the injured. Emphasis on importance of day-to-day use as prerequisite to efficient operation in disaster.

A. Uses of Communication Equipment.

Dispatch and control movement of ambulances; clear traffic lanes; mobilize rescue equipment; dispatch professional personnel and supplies; advise ambulance personnel on care of those injured at scene and during transport; alert emergency departments of expected arrival and condition of the injured; distribute the injured to appropriate medical facilities; coordinate with local government and civil defense officials and with backup ambulance services.

B. Design of Communication System.

1. Radio Communication - Twenty-four hour capability; central dispatching; area to be served; terrain features; flexibility of cross-communication with other systems; system not in parallel with, or isolated from, other networks; compatibility with radio or video transmission of vital signs.
2. Auxiliary Communication - "Walkie-talkie"; telephone messengers.

C. Limitations on Use of Equipment.

Federal Communications Commission regulations; stand-by power essential at fixed installations; telephone systems may be blocked.

XV. RELATIONSHIPS WITH HOSPITAL EMERGENCY DEPARTMENTS

Thorough familiarity with care rendered in emergency departments to ensure adequacy of measures taken by ambulance personnel.

A. Problems for Ambulance Personnel.

1. Delays in Delivery of Injured - Blocked access; traffic control; inconvenient location of facilities.
2. Delays in Continuation of Care -

Unavailability of emergency department personnel; inadequacy of examining or treatment facilities; lengthy history taking; lack of triage.

3. Delays in Return or Exchange of Equipment and Supplies.

B. Rapport.

Mutual courtesy and understanding of each other's problems; efficiency of reporting by ambulance personnel; willingness to cooperate and to assist on request.

C. Cooperation.

1. By Emergency Department Personnel - Assistance in clearing way and moving victim; avoidance of delay; return or exchange of equipment; replacement of supplies; constructive criticism of inadequate or improper care rendered; credit for use of good judgment and proper care; priority of emergency department attention to life threatening situations; periodic critiques of quality of emergency care.
2. By Ambulance Personnel - Optimal emergency care and efficient and safe transport in advance of delivery to emergency department; advance notification of arrival; identification of victims whose conditions might warrant high priority of reception and resuscitation; assistance as needed or requested; compliance with hospital regulations; rendering of reports to hospital personnel and to police, if indicated; retrieval of equipment and supplies; prompt departure from emergency department; participation in disaster drills and critiques.

XVI. CONTROL OF THE CRASH SCENE

Immediate attention to life-threatening emergencies supersedes any action to control the scene

by ambulance personnel.

A. Needs for Control.

To permit access, prompt care, extrication, protection from further hazards; clear lanes for departure.

B. Actions at Scene.

Anticipate, en route, possible hazards posed by location and type of emergency.

Prevent further crashes or hazard by: precaution in parking ambulance; removal from situations threatening to lives of the injured and ambulance personnel, such as spilled gasoline or chemicals, escaping gases, downed power lines, spreading fire, flooding water; warning devices to divert traffic.

Restrain bystanders from crowding, mishandling of the injured. Obtain assistance of volunteers and specify tasks.

Manage relatives by allaying hysteria; reassurance; questioning and informing away from presence of the injured; prevent mishandling of the injured.

Avoid assuming functions of police or other authorities when they are present. Do not permit their actions to compromise care of injured.

XVII. RESCUE PROCEDURES APPLICABLE TO AMBULANCE PERSONNEL

In urban areas, when specially equipped rescue vehicles may not be readily available, and in rural areas, where such vehicles are nonexistent, or valuable time might be lost in calling from the scene of the crash for equipment, ambulance personnel must be provided such light rescue equipment as may be carried on the ambulance, and they must be trained in its proper use.

When rescue from entrapment or confinement, or removal from poles, water, or other hazardous environments may be delayed, emergency care for life-threatening conditions must be carried out to the extent that access to the injured permits.

Short-distance removal from immediate hazards may be necessary before emergency care can be rendered.

A. Short-Distance Removal.

Drags; manual carriers; litters, improvised or standard; backboards; chair carry; ladder rescue; rope sling.

B. Extrication Procedures.

From vehicles; building debris; electrical lines and equipment; water; vats and tanks; caissons, tunnels, wells, and caves; heights; farm and industrial machinery; locked or blocked living or working areas.

C. Light Rescue Equipment and Its Use.

Lifting, prying, battering and cutting tools for release from entrapment or for forcible entry; backboards, ropes, straps for removal; portable lighting and firefighting equipment.

XVIII. MEDICOLEGAL PROBLEMS

Ambulance attendants must be thoroughly informed by appropriate local legal authorities of Federal laws, State statutes, and local government ordinances regulating operation of ambulance services and communication systems, and standards of personnel, vehicles, and equipment.

A. Operation of Ambulance Services.

1. General - Levels of responsibility as applicable to a local government operation, a commercial enterprise, or a voluntary organization; subsidy; liability coverage.

A. Purpose Served.

2. Vehicles - Licensure; safety inspections; use of warning devices; traffic regulation compliance and exemptions; sanitation.
3. Communication - Violations of FCC regulations; coordination with other networks.

B. Personnel Standards.

Qualifications for employment; training requirements; certification and licensure; liability insurance; compliance with traffic laws; acts within limits of training and ability; protection under "Good Samaritan" law; abandonment.

C. Vehicles and Equipment.

Warning devices; identification symbol; safety specifications; safety devices.

D. Ill or Injured Care Situations.

Mentally disturbed or unruly; accompaniment of females; use of restraining devices; requirements for police escort; management of alcoholics; reporting of animal bites and disposition of animal carcass; management of attempted suicide, including search, protection of records and evidence; dying declaration; disposition of dead, including assurance of death, authorization for movement, notification of authorities; reporting of crashes involving felonies.

XIX. RECORDS AND REPORTS

Adequate reporting and record keeping are essential duties of ambulance personnel in transferring responsibility for the ill or injured's care to the personnel in medical facilities, in complying with the requirements of law enforcement and health departments, and in fulfilling administrative needs of the ambulance operator.

A. Purposes Served.

Further continuity of care; basis for correction of infractions; source of information for determining quality and adequacy of ambulance services; provides data for analysis of causes, types, and degrees of injuries and illnesses requiring emergency care; provides legal evidence.

B. Procedure.

Must not take priority over victim care. Interrogate victim, relatives or bystanders; note pertinent statements of those not available later for full interrogation; collect suicide notes or related papers for legal authorities; note voluntary dying statement; search for emergency medical identification devices; safeguard weapons which may be or may have been involved in suicide or homicide.

C. Information Desired.

1. Medical Facilities - Identification of ill or injured, type of crash or nature of illness; location of person when first seen; rescue measures preceding emergency care; care given at site and during transport; crashes and mishaps during transport; disposition of valuables.
2. Law - Information gained in absence of, or ancillary to needs of, officials: circumstances in suicide, homicide, or rape; animal bites; dying statements; statements that may serve as testimony.
3. Health - Requirements of coroner or medical examiner in case of death at scene or during transport; animal bites; radiation, chemical, or gas hazards.
4. Ambulance Operator - Administrative records required by ambulance owner, including time intervals of crash, dispatch, arrival at scene, departure, and delivery to emergency department.

SECTION THREE - IN-HOSPITAL TRAINING PROGRAM

In-Hospital training consists of observation, demonstration, and participation to the extent permitted by the professional staff. Instruction is designated (1) to demonstrate the importance and benefits of optimal emergency care, efficient transport, and adequate reporting; (2) to emphasize the penalties of inadequate care or improper procedures; (3) to familiarize the student with the equipment used, staffing, operating policies, and procedures of the department; (4) to have ambulance personnel observe procedures in and develop skills in resuscitation, handling the unconscious, management of the mentally disturbed and unruly, and techniques of delivery and care of both the infant and the mother; (5) to keep ambulance personnel abreast of new developments in equipment and emergency care; and (6) to have ambulance personnel engage in disaster drills.

Two consecutive hours of training are required at any one period in order to receive credit toward completion of a course in the assigned department.

Responsibility for conduct of this program should be assigned to the staff of the emergency department. Training areas include the emergency department, operating and recovery rooms, the intensive care unit, the obstetrical department, and the psychiatric department.

GUIDELINES FOR ADVANCED TRAINING
OF AMBULANCE PERSONNEL
(480 HOURS)

RECOMMENDED COURSE CONTENT

The advanced emergency medical technician-ambulance (EMT-A) candidate already has the educational foundation provided by basic EMT-A training. Much of his additional training will be repetition of basic anatomy, physiology, pharmacology, and bacteriology covered during the basic course, but with emphasis now directed to pathophysiologic changes and their correction, rather than symptom treatment. Practice in basic emergency care must be carried out until response is not only correct but instinctive.

APPENDIX B

Training is through classroom demonstration, laboratory experience, and clinical care in the various areas of the ambulance. The student should understand the pathophysiologic reasons for the type of treatment and how this treatment alters the disease process, and autopsy findings in instances where the patient does not survive.

GUIDELINES FOR ADVANCED TRAINING
OF AMBULANCE PERSONNEL
(480 HOURS)

In addition to the procedures that the student is authorized or directed by a physician to perform, he will observe and become familiar with many procedures now performed only by physicians. Life-saving procedures must be thoroughly learned by all students, whether or not local regulations would currently allow them to carry out such acts independently; and trained in one jurisdiction and well function in jurisdictions where laws regulating their activity are not so limiting. As more emergency medical technician-ambulance are trained, as their capabilities are recognized, and as good ambulance-to-hospital communication develops, greater use of their skills under the direction of the physician will evolve.

The curriculum should include in-depth study of such

caliber and extent as to qualify the emergency medical
technician
allied health
in hospitals and
areas.

Subjects of the

**GUIDELINES FOR ADVANCED TRAINING
OF AMBULANCE PERSONNEL
(480 HOURS)**

RECOMMENDED COURSE CONTENT

The advanced emergency medical technician-ambulance (EMT-A) candidate already has the educational foundation provided by basic EMT-A training. Much of his additional training will be repetition of basic anatomy, physiology, pharmacology, and bacteriology covered during the basic course, but with emphasis now directed to pathophysiologic changes and their correction, rather than symptom treatment. Practice in basic emergency care must be carried out until response is not only correct but instinctive.

Training is through classroom demonstration, laboratory experience, and actual patient care in the various areas of the hospital. Emphasis is on the anatomic and pathophysiologic basis of a disease process, reasons for the type of treatment rendered, how this treatment alters the disease process, and autopsy findings in instances where the patient does not survive.

In addition to the procedures that the student is authorized or directed by a physician to perform, he will observe and become familiar with many procedures now performed only by physicians. Life-saving procedures must be thoroughly learned by all students, whether or not local regulations would currently allow them to carry out such acts independently; men trained in one jurisdiction may well function in jurisdictions where laws regulating their activity are not so limiting. As more emergency medical technicians-ambulance are trained, as their capabilities are recognized, and as good ambulance-to-hospital communication develops, greater use of their skills under the direction of the physician will evolve.

The curriculum should include in-depth study of such

caliber and extent as to qualify the emergency medical technician to carry out procedures now applied by allied health assistants under physician supervision in hospitals and by military medical corpsmen in combat areas.

Subjects of the curriculum are as follows:

I. ANIMAL LABORATORY EXPERIENCE

A. Signs, symptoms, correction of:

1. Airway obstruction, asphyxia, hypoventilation, hypoxia.
2. Ventricular fibrillation, premature ventricular contractions, ventricular standstill.
3. Pneumothorax:
 - a. Tension.
 - b. Open.
 - c. Simple (hazard of converting to tension pneumothorax by administering positive pressure ventilation).
4. Hemothorax.
5. Cardiac tamponade.

B. Expertise in:

1. Endotracheal intubation.
2. Endotracheal suction.
3. Assisted and controlled ventilation.
4. Venipuncture.

II. CLASSROOM AND LABORATORY

- A. Anatomy-didactic, anatomy laboratory, morgue.
- B. Advanced physiology.

1. Normal.
2. Abnormal:
 - a. Hypoxia, asphyxia, hypoventilation, complications of oxygen inhalation, decompensated chronic obstructive lung disease.
 - b. Hypovolemia.
 - c. Shock.
 - d. Cranial injuries.
 - e. Drug overdose.
 - f. Burns.
 - g. Coronary occlusion or insufficiency.
 - h. Stroke.
 - i. Diabetes.
 - j. Drowning.
 - k. Electrocution.
 - l. Masked organ damage.
- C. Bacteriology - principles of infection, asepsis, decontamination.
- D. Pharmacology:
 1. Acid/base concepts.
 2. Common resuscitative drugs, vasoactive agents, antiarrhythmics, alkalizing agents, balanced electrolyte solutions, blood volume expanders.
 3. Actions of and reactions to common drugs.
 4. Contraindications for some drugs.

- E. Fluid Volume - Relationship to blood pressure, pulse rate, urine output.
- F. Use and interpretation of cardiac monitor-lead placement, use of lead pad, common artifacts.
- G. Defibrillation-associated equipment dangers.
- H. Hypodermic injections - as different from intravenous.
- I. Intravenous injections - syringe, tubing, needle sizes, dynamics of flow, site selection, volume indications and restrictions.
- J. Pacemakers.
- K. Sterile techniques.
- L. Isolation techniques.
- M. Use and maintenance of approved mechanical equipment.
- N. Common problems and pitfalls associated with the use of equipment (understanding of tank color coding, pin indexing, reducing yoke installation).
- O. Unacceptable equipment and why - respirators, airways, etc.
- P. Personnel management.
- Q. Logistics management.
- R. Concepts of coordinated disaster response.
- S. Protection - from noxious liquids and gases, radiation, mechanical and electric hazards.
- T. Communication techniques - radio, telephone, verbal and written reports, telemetry of physiologic data.
- U. Teaching techniques and methods - lecture, audiovisual, examinations.

V. Principles of extrication and patient handling.

III. HOSPITAL DEPARTMENTS - EXPERIENCE TO BE GAINED IN:

A. Anesthesiology.

1. Vital and diagnostic signs - recognition and significance.
2. Airway control techniques in apneic and breathing patients, tracheal intubation, suctioning.
3. Positive pressure ventilation devices - manual and mechanical.
4. Injections - intravenous, intramuscular, subcutaneous.
5. Intravenous fluids.
6. Electrocardiogram and electroencephalogram patterns.
7. Loss of protective reflexes.
8. Management of unconscious patient.

B. Recovery Room.

1. Management of unconscious patient.
2. Respiratory care, including airway control, oxygenation, ventilation, airway humidification techniques.
3. Vital and diagnostic signs.
4. Central venous pressure monitoring concepts.
5. Drainage systems - gastric, bladder, pleural.
6. Nursing skills, such as transfer of patients with dressings and drains.

C. Intensive care and coronary care.

1. Monitors - cardioscope, others.
 2. Defibrillation.
 3. Pacemakers.
 4. Intravenous fluids and medications.
 5. Long-term ventilation problems, intermittent positive pressure breathing (IPPB), care and maintenance of equipment.
 6. Vital and diagnostic signs.
 7. Use of drugs.
 8. Electrocardiogram-basic patterns.
 9. Cardiopulmonary resuscitation.
 10. Equipment hazards.
 11. Electroencephalograph-brain death, possible organ donor.
 12. Fluid intake, output.
- D. Surgery.
1. Sterile techniques.
 2. Anatomy and physiology.
 3. Wound care.
 4. Dressings.
- IV. E. Orthopedics.
1. Immobilization techniques.
 2. Wound care.
- F. Neurosurgery.
1. Unconsciousness.
 2. Paralysis.

3. Wound care.
 - G. Obstetrics, nursery and pediatrics.
 1. Delivery and postdelivery care.
 - a. Placenta.
 - b. Hemorrhage.
 - c. Perineal damage.
 - d. Monitoring of fetal heart tones.
 2. Care of newborn.
 - a. Handling of the infant-head support, etc.
 - b. Airway ventilation and oxygenation problems.
 - c. Umbilical cord.
 - d. Temperature control.
 - e. Cardiopulmonary resuscitation.
 - H. Emergency department.
 1. Application of principles of emergency care.
 2. Critique for evaluation of good and poor emergency care at the scene with follow-up in hospital.
- IV. MORGUE - OBSERVATION OF AUTOPSIES FOR:
- A. Basic topographic anatomy.
 - B. Conditioning to open wounds, trauma.
 - C. Anatomic basis of endotracheal intubation.
 - D. Cause of death from trauma.
 - E. Complications of cardiac compression.

- F. Fractures and associated injuries - emphasis on nerve and vessel damage.

V. PRACTICE IN SIMULATED AND REAL EMERGENCIES

- A. Extrication - light, heavy.
- B. Triage (sorting).
- C. Disaster exercises.
- D. Group Management.
- E. Stop-action demonstrations.
- F. Ambulance design adaptation and future needs.
- G. Ambulance maintenance - repair of equipment, use of common tools.
- H. Transport over difficult terrain.
- I. Helicopter transportation.
- J. Water transportation.
- K. Review of patient care situations.
- L. Driving review - emergency driving, defensive driving.

DESIGN CRITERIA OF SPECIAL SIGNIFICANCE

Explicit and complete recommendations of the Committee on Ambulance Design Criteria are found among the more than one hundred criteria presented in Part II of Ambulance Design Criteria, U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, D.C. It is not the purpose here to summarize all of Part II, but rather to identify some of the more significant criteria, and to highlight the principal implications that may be drawn from the complete set of Committee recommendations.

APPENDIX C

1. DESIGN CRITERIA OF SPECIAL SIGNIFICANCE

1. Ambulances should be designed primarily for medical care in transit, including external cardiac compressor, and should be unencumbered by equipment not essential to patient care.

2. Regardless of local circumstances which may influence the extent to which optional equipment may be employed, the manufacturer's product should be sufficiently standardized to provide the space not only for required installed and portable equipment and supplies, but also for optional items now available and for adaptation to more advanced equipment.

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1. The patient compartment should be designed primarily for medical care in transit, including external cardiac compression, and should be unencumbered by equipment not essential to patient care.

2. Regardless of local circumstances which may influence the extent to which optional equipment may be employed, the manufacturer's product should be sufficiently standardized to provide the space not only for required installed and portable equipment and supplies, but also for optional items now available and for adaptation to more advanced equipment

that will become available.

3. Principal environmental requirements for medical care include sustained environmental control and ventilation that minimizes contamination from outside air.

4. Communications requirements include two-way radio, walkie-talkie, intercom, and public address.

5. External identification, lights, colors, and markings should be standardized on a national basis.

6. Privacy and efficiency would be enhanced by the omission of windows in the patient compartment.

7. Acceleration capability should assure that the ambulance is capable of rapid response, that it can avoid hazardous situations by maintaining its position in traffic or move faster than traffic when advisable because of the patient's condition. The vehicle should be capable of smooth performance at maximum speed limits on interstate highways. The criteria of maximum acceleration and speed specified in this report are designed to ensure performance consistent with ambulance operation in traffic patterns on interstate highways. These high performance capabilities should not be interpreted to condone unsafe operation at any time.

8. Depending upon whether the ambulance is built on a passenger car chassis or on a truck chassis, general Federal Motor Vehicle Safety Standards for ambulances should be those applicable to the chassis employed.

APPENDIX B

ESSENTIAL EQUIPMENT FOR AMBULANCES

ESSENTIAL EQUIPMENT FOR AMBULANCES

1. RUBBER SUCKER ASPIRATOR, with wide-bore tubing and rigid plastic suction tip.
2. RESPIRATOR SYSTEM WITH SUIT, hand-operated, with adult, child, and infant-size masks. Clear masks are preferred. Suits must operate in cold weather, and only used by means of use with oxygen supply.
3. OROPHARYNGEAL AIRWAYS, adult, child, and infant sizes.
4. MOUTH-TO-MOUTH VENTILATION AIRWAYS, for adults and children.
5. PORTABLE OXYGEN EQUIPMENT, with adequate tubing and masks in adult, child, and infant sizes.

APPENDIX D

ESSENTIAL EQUIPMENT FOR AMBULANCES

6. MOUTH BLINDERS, tongue blades together and padded.
7. STERILE ANESTHETIC AGENTS, preferably in plastic bags, with administration kits.
8. UNSTERILE BANDAIDS, approximately 10 inches by 36 inches, separately folded and packaged in convenient size.
9. STERILE GAUZE PADS, 4" x 4".
10. BANDAGES, soft roller, self-adhering type, 6" by 5 yards.
11. ALUMINUM PADS, roll, 18" x 35", sterilized and wrapped.
12. ADHESIVE TAPE, two rolls, 3" wide.
13. GUM SHEETS, two, sterile.
14. TRACTION SPLIT, lower extremity, hinged half-ring (ring 9" diameter, overall length of splint 43").

ESSENTIAL EQUIPMENT FOR AMBULANCES

1. PORTABLE SUCTION APPARATUS, with wide-bore tubing and rigid pharyngeal suction tip.
2. BAG-MASK VENTILATION UNIT, hand-operated, with adult, child, and infant-size masks. Clear masks are preferable. Valves must operate in cold weather, and unit must be capable of use with oxygen supply.
3. OROPHARYNGEAL AIRWAYS, adult, child, and infant sizes.
4. MOUTH-TO-MOUTH ARTIFICIAL VENTILATION AIRWAYS, for adults and children.
5. PORTABLE OXYGEN EQUIPMENT, with adequate tubing and semi-open, valveless, transparent masks in adult, child, and infant sizes.
6. MOUTH GAGS, either commercial or made of three tongue blades taped together and padded.
7. STERILE INTRAVENOUS AGENTS, preferably in plastic bags, with administration kits.
8. UNIVERSAL DRESSINGS, approximately 10 inches by 36 inches, compactly folded and packaged in convenient size.
9. STERILE GAUZE PADS, 4" x 4".
10. BANDAGES, soft roller, self-adhering type, 6" by 5 yards.
11. ALUMINUM FOIL, roll, 18" x 25', sterilized and wrapped.
12. ADHESIVE TAPE, two rolls, 3" wide.
13. BURN SHEETS, two, sterile.
14. TRACTION SPLINT, lower extremity, hinged half-ring (ring 9" diameter, overall length of splint 43"),

with commercial limb-support slings, padded ankle hitch, and traction strap.

15. PADDED BOARDS, two or more, 4-1/2 feet long x 3 inches wide. PADDED BOARDS, two or more, 3 feet long, of material comparable to 4-ply wood for coaptation splinting of leg or thigh.
16. PADDED WOODEN SPLINTS, two or more, 15" x 3", for fractures of the forearm. (By local option, similar splints of cardboard, plastic, wireladder, or canvas slotted lace-on may be carried in place of the above 36" and 15" boards).
17. INFLATED SPLINTS, uncomplicated, in addition to Item 16 above, or as substitute for the short boards.
18. BACK BOARDS, short and long, with accessories. (adult and child).
19. TRIANGULAR BANDAGES.
20. SAFETY PINS, large size.
21. SHEARS, for bandages.
22. OBSTETRICAL KIT, sterile.
23. POISON KIT.
24. BLOOD PRESSURE MANOMETER, CUFF, AND STETHOSCOPE.

This list was prepared by the Committee on Trauma of the American College of Surgeons and was printed in The American College of Surgeons Bulletin (May 1970).

ACCESS AND EXTRICATION EQUIPMENT FOR AMBULANCE USE

1. WRENCH (1), 18" with adjustable open end.
2. SCREW DRIVER (1), 12", with regular blade.
3. SCREW DRIVER (1), 12", Phillips type.
4. HOOKS (1) with 12 wire (carbide) blades.
5. WRENCH (1), 12" vice-grip.
6. WRENCH (1), 12", with 15" handle.
7. PINS (2) (1), with 24" handle.
8. JACKING BAR (1), 24". (Bar and two preceding items are either to separate or combined as a forcible entry tool.)

APPENDIX E

ACCESS AND EXTRICATION EQUIPMENT FOR AMBULANCE USE

9. WRENCH (1), 12 inches, with pinch point.
10. JAW BUCK (1), with 1-1/4" jaw opening.
11. POWER JACK AND SPREADER TOOL (1), portable.
12. SCISSOR (1), 27 inches, with pointed blade.
13. DOUBLE-ACTION TIN-SNIP (1), stainless 8".
14. RIGID ROPES (2), each 50' long x 3/4" diameter. A power winch is optional. A front-mounted winch with a maximum capacity of two tons is recommended, particularly in areas where it would not otherwise be readily available. In addition to rated rope, ambulance should carry a 15-foot rated chain with one grab hook and one running hook.

List as published in The American College of Surgeons Bulletin (May 1978).

ACCESS AND EXTRICATION EQUIPMENT FOR AMBULANCE USE

1. WRENCH (1), 12", with adjustable open end.
2. SCREW DRIVER (1), 12", with regular blade.
3. SCREW DRIVER (1), 12", Phillips type.
4. HACKSAW (1), with 12 wire (carbide) blades.
5. PLIERS (1), 10" vise-grip.
6. HAMMER (1), 5-point, with 15" handle.
7. FIRE AXE (1), with 24" handle.
8. WRECKING BAR (1), 24". (Bar and two preceding items can either be separate or combined as a forcible entry tool.)
9. CROWBAR (1), 15 inches, with pinch point.
10. BOLT CUTTER (1), with 1-1/4" jaw opening.
11. POWER JACK AND SPREADER TOOL (1), portable.
12. SHOVEL (1), 49 inches, with pointed blade.
13. DOUBLE-ACTION TIN-SNIP (1), minimum 8".
14. MANILA ROPES (2), each 50' long x 3/4" diameter. A power winch is optional. A front-mounted winch with a minimum capacity of two tons is recommended, particularly in areas where it would not otherwise be readily available. In addition to rated cable, ambulance should carry a 15-foot rated chain with one grab hook and one running hook.

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He entered active duty with the Army Nurse Corps on June 22, 1960, and graduated from the U.S. Army Anesthesiology Nursing Course at Fitzsimons General Hospital in 1962. He received his Bachelor of Science in Nursing Degree from the University of Omaha in 1968.

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[REDACTED]

[REDACTED]

Lieutenant Colonel Barrington attended the U.S. Army-Baylor University Program in Health Care Administration from 1974 to 1976, and served his administrative residency at the U.S. Darnall Army Hospital, Fort Hood, Texas.