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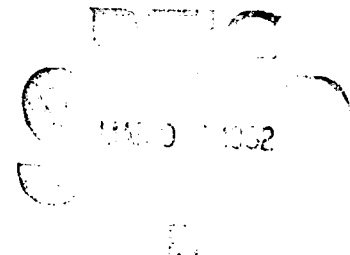
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MORBIDITY RATES DURING A MILITARY COLD
WEATHER EXERCISE: EMPIRE GLACIER 1980

US ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

20 October 1981



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This report describes a survey study conducted during the exercise Empire Glacier '80 which was designed to extend the data base from an earlier study and to improve on the survey methods used. A team of research personnel collected daily medical records, population statistics, climatological data, and responses to interviews during two weeks of the exercise.

The data reveal that nearly a quarter of the reported medical cases involved upper respiratory infections. These cases were evenly distributed over the duration of the exercise. This category would be even greater if it also included the fifth largest category of morbidity, viz., ear, nose and throat problems. Orthopedic injuries and acute traumas were also significantly high, involving 18% and 10% of the cases respectively. Other categories of significance were dermatological and gastrointestinal problems.

Cold injury complaints were relatively infrequent and reflect the relatively mild weather conditions during the exercise. Analyses of these cases reveal that the majority involve problems of the feet (50% of the cases). Most of these were preventable given proper hygiene and care. A tentative prediction model is presented based on the relationship of a 3-day average windchill factor and the number of cold injury complaints.

Three appendices provide greater detail on each medical category, further detail on the cold injury cases, and a brief summary of the interview data.

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NO. T 1/82

MORBIDITY RATES DURING A MILITARY COLD WEATHER EXERCISE:

EMPIRE GLACIER 1980

by

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ABSTRACT

Comprehensive, reliable and descriptive data on the nature and magnitude of various medical problems which occur during military maneuvers in cold weather are not available to commanders, medical personnel, or medical researchers. Only a few studies have approached the problem and even fewer have employed adequate methodology. In addition to collecting medical record data, medical surveys must also obtain population statistics on personnel at risk and data on conditions of exposure.

This report describes a survey study conducted during a cold weather exercise (Empire Glacier '80). The study was designed to extend the data base from an earlier study utilizing improved survey methods. A team of research personnel collected daily medical records, population statistics, climatological data, and responses to interviews during two weeks of the exercise.

The data reveal that nearly a quarter of the reported medical complaints involved upper respiratory infections. These complaints were evenly distributed over the duration of the exercise. This type of complaint is even greater when ear, nose, and throat problems are included. Orthopedic injuries and acute trauma also contributed significantly to the patient load, involving 18% and 10% of the cases respectively. Two other categories of significance were dermatological (8%) and gastrointestinal (6%) problems.

Cold injury complaints were relatively infrequent and reflect the mild weather conditions during the exercise. Analyses of these cases reveal that the majority involved problems of the feet (50% of the cold injury cases), most of which were preventable by proper hygiene and foot care. A prediction model based on the relationship of a three-day average windchill factor and the number of cold injury complaints is presented.

Three appendices provide greater detail for each medical category, further detail on the cold injury cases, and a brief summary of the interview data.

INTRODUCTION

Two recent studies present data on morbidity rates* of military personnel during two separate cold weather exercises (1,2). Given the wide variability in complaint rates between and within these studies, and the low incidence of some illnesses, additional studies are required in order to better understand observed differences. The major goal is to determine the various factors leading to, or contributing to, the incidence of cold weather related injury and illness. The most obvious contributing factors include:

1. Physical Conditions: Weather, shelter, clothing, equipment, and job related tasks;
2. Physiological-Medical: Body dimensions, metabolism, diet and state of health;
3. Behavioral-Psychological: Individual experience, training, motivation, and emotional stability;
4. Military-Organizational: Unit mission requirements, leadership, teamwork, and command emphasis; and
5. Fortuitous Events: Accidental, unpredictable events.

Determining the relative importance of these factors is not an easy task. For example, a large number of cold injuries may suddenly appear in the medical treatment facilities (MTFs) as a result of the coincidental occurrence of a rapid and unexpected onset of severe cold weather coupled with large numbers of exposed personnel having little or no prior experience and who have been required to operate in the field for several days. However, a large proportion of these cases might turn out to be merely mild cases of discomfort reported as injury because of over-concern by those suffering from cold discomfort for the first time or a lightened awareness by the chain of command. Self-inflicted injuries motivated by unpleasant duties would also increase the complaint seen at the MTFs. Under different conditions, many cases of foot injury may be the result of improper care or excessive use of cold weather boots when conditions were unexpectedly mild. In addition, medical complaints, other than frank cold injuries, may occur as an indirect result of climatic conditions. Thus, for example, cases of upper respiratory infection, orthopedic injuries and gastrointestinal complaints may have possible links with climatic changes, icy conditions and water supply problems, respectively.

* A morbidity rate is the frequency of a given illness or injury per unit of the population. In this report, it is the number of newly reported cases (incidence) per day per 1000 population.

When a sufficient number of observations over a number of separate exercises and conditions are obtained, it should be possible to identify important causes of cold related injuries and illnesses. However, since different events or conditions can lead to similar results there is no guarantee that any predictable relationship will ultimately be discovered by field investigations. Timely, systematic recording and reporting of medical problems, particularly cold injury, can allow commanders to take corrective action based on reliable and accurate data.* Systematic compilation of the number and type of medical complaint encountered and the treatments administered will provide a reference source for the Division and Brigade Surgeons of units taking part in such exercises who must not only determine the need for specific medications and supplies consonant with budgetary constraints, but must provide valid information to their commanders.

Continued study of cold weather epidemiology may then serve three functions: 1) as a monitor of on-going conditions which may require immediate action; 2) as an expanding data base which may be used in practical planning, and; 3) to provide data that potentially may reveal relationships between important variables. This is analogous to the situation in meteorology in which monitoring and recording weather data allow individuals to make behavioral adjustments and at the same time provide information for analysis of possible relationships between different meteorological variables. In the present case, the major factors to be considered include weather conditions, population characteristics, equipment design and task requirements.

The present report pertains to data collected during a recent cold weather exercise in which the rate of illness and injury was carefully assessed. Special concern is given to direct cold injuries and their various causes. The research team also made efforts to provide timely information on principles of prevention to military personnel during the study.

*Note:

This is not to supplant the work done by the medical support units which also record medical cases. Their record keeping is important since it is useful for detecting problems as they occur. However, their resources are limited, they usually do not include population statistics, do not use a uniform classification system, and may not attempt to elucidate causative factors in the more subtle cases of illness or injury.

The Exercise Empire Glacier '80

Empire Glacier was designed to provide cold weather training to infantry, armor, unconventional warfare, and tactical Air Force units. In 1980, it involved approximately 10,000 Army and Air Force personnel from Active, Reserve and National Guard elements. Approximately 50 fixed wing aircraft, 40 helicopters, 1590 wheeled vehicles, and 587 tracked vehicles were used during the exercise.

The exercise was conducted in three phases:

Phase I.

Jan 3 - 17: Development of intelligence; alert and deployment of forces.

Phase II.

Jan 18 - 23: A Command Post Exercise (CPX) was conducted on January 18 to test communications between the various unit headquarters. The field maneuver began on the 19th and continued through the 23rd.

Phase III.

Jan 24 -Feb 1: Redeployment of forces, field critique, and the restoration of the maneuver area.

The medical survey study reported here covers the period Jan 7 through Jan 24.

Forces for the exercise were selected from the United States Army Forces Command (FORSCOM) and United States Tactical Air Command (TAC), and were under the control of Readiness Command (REDCOM). The major operational units groups of the exercise were the Army Forces (ARFOR), the Opposition Forces (OPFOR), the Corps Combined Support Command (COSCOM) and the Air Force (AFFOR). The exercise simulated a combat environment and provided a wide spectrum of conventional and unconventional warfare scenarios that are likely to be employed by U.S. forces in joint contingency operations.

Method

Daily records of weather conditions were maintained with the help of Air Force personnel at the Wheeler-Sack Air Field, Fort Drum, NY (elevation 687 ft.). A summary of barometric pressure changes (mm), temperature ($^{\circ}$ C), windspeed (KPH), windchill equivalent temperatures ($^{\circ}$ C), precipitation (cm), relative humidity (%) and cloud conditions are presented in Table 1. These data represent averages for a 24 hour period for the dates 7th through the 24th of January. In general, the weather conditions were mild relative to typical conditions for this area at this time of year.

Daily personnel statistics were collected from the Joint Task Force Adjutant's (J-1) Office throughout the study (Fig. 1). Troop strengths were utilized for computation of incidence. Additional data indicating personnel strength by gender were collected on three days: once before, once during, and once after the field training exercise (FTX). Daily troop strengths by gender were then estimated from these sample data.

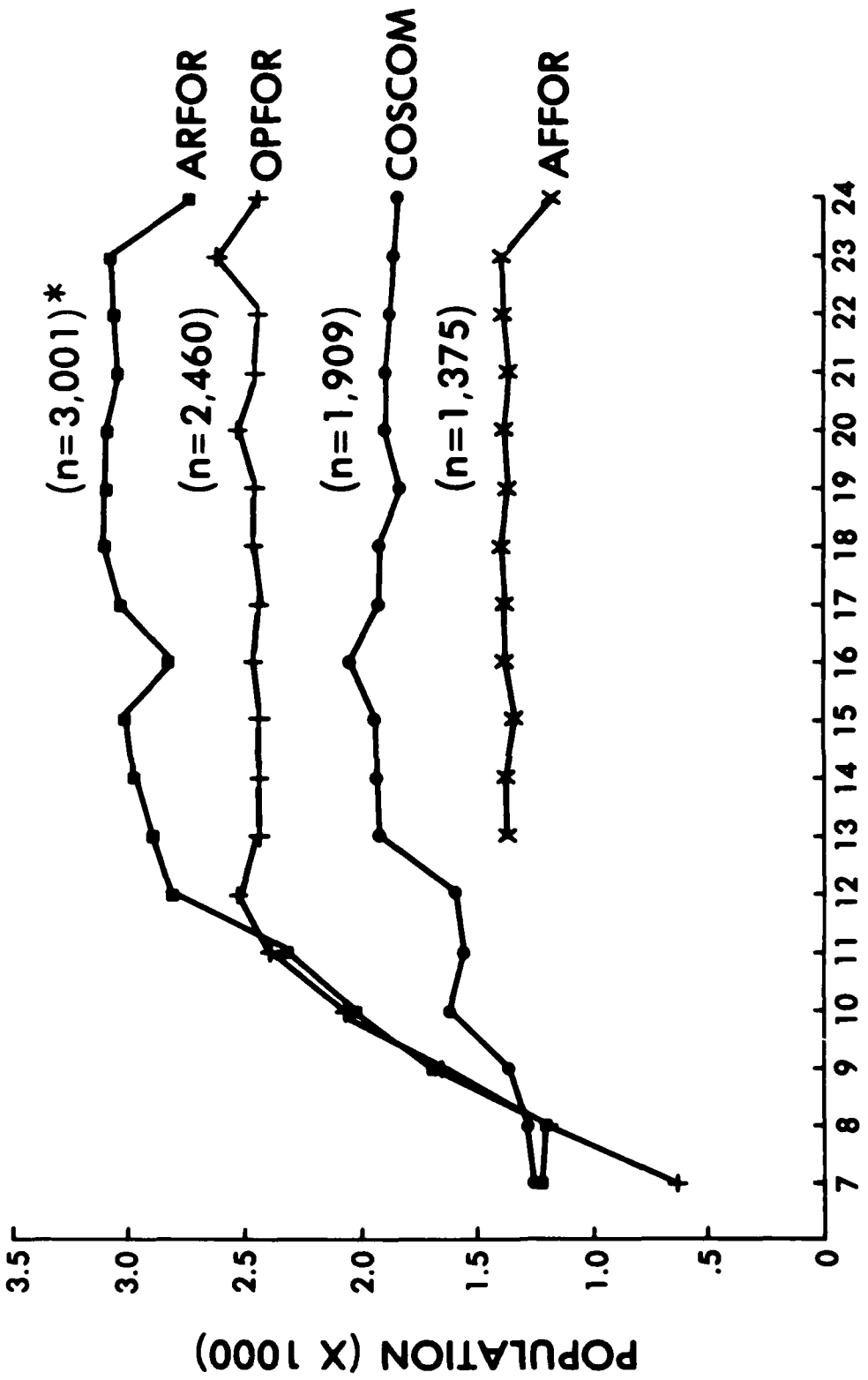
The research team was composed of one Medical Corps officer, one Medical Service Corps officer, one civilian research psychologist, and six medical technical specialists. One specialist was assigned to each of the five medical treatment facilities daily for the purpose of collecting interview data on a sample number of those reporting to the MTF. Each of the major groups (ARFOR, OPFOR, COSCOM, and AFFOR) operated their own outpatient medical treatment facility (MTF) in their cantonment area. In addition, both ARFOR and OPFOR each maintained a division clearing station and battalion aid stations (BAS's) in the field during the FTX phase. Only a few of the field facilities could be visited by the research personnel. The fifth MTF which was regularly monitored was the field hospital. It maintained a 24h/day emergency room (ER) and 0630 to 1630 h out-patient clinic (OPC), as well as its inpatient services. The hospital served all units either directly or via MTF referral.

Although the Army Medical Department uses a standard format for recording and computer-filing basic information about all patients who are inpatients in hospital facilities for greater than 24 h, there is no standard means for compiling outpatient cases. Most of the MTF's normally maintained simple log books in which only the patient's name or initials, social security account number (last 4 digits), unit, and perhaps (but not always) chief complaint and disposition were noted. To achieve standardization each MTF used the Medical Record Log designed by the USARIEM research team. This log provides for the entry of the following information on each patient: Time In, Time Out, Sex, Service Branch, Rank, Duty MOS, Unit, Age, Duty Status, Complaint, Diagnosis, and Disposition. A copy of this form is included in this report (See Incl). The field hospital maintained a combined log for the ER and the OPC. The ARFOR and OPFOR division clearing stations maintained separate logs from their respective dispensaries in the cantonment area. Unfortunately, few cases seen in the BASs were recorded in the logs; therefore, there were no reliable estimates of the total number of cases treated in the field which were not evacuated to the rear.

Table 1.
Summary of the meteorological data

DATE (JAN)	PRESSURE (CHG. mm)	TEMPERATURE (°C)*	WINDSPEED (KPH)*	WINDCHILL (°C)	HUMIDITY (Rel. %)	PERCIPITATION (Snow/Rain)	CLOUDINESS
7	↑ 1	- 1.1	40	-17.5	65	light snow	overcast
8	↑ 4	- 6.1	21	-20.8	74	light snow (depth 5cm)	overcast
9	↑ 1	- 8.2	9	-13.3	81	light snow (depth 14cm)	overcast
10	↓ 2	-10.2	13	-19.6	69	none (depth 15cm)	prtly cldy
11	↓ 13	4.4	37	- 8.4	--	light rain	overcast
12	↑ 11	- 7.2	40	-26.8	--	light snow (trace)	prtly cldy
13	↓ 6	- 5.9	16	-17.2	--	none	prtly cldy
14	↑ 3	2.4	11	- 2 8	--	none	overcast
15	↑ 2	- 1.7	13	- 8.9	--	none	overcast to clear
16	0	- 4.4	14	-14 1	--	none	scattered to clear
17	↑ 11	4.2	21	- 4.1	--	light rain	overcast
18	↓ 1	2.9	13	- 2.1	82	none	overcast
19	↑ 2	- 0.4	19	-10.1	--	light snow	overcast
20	↓ 1	- 4 3	16	-14.7	72	none	scattered to clear
21	0	- 7.1	16	-17.2	--	none	prtly cldy to clear
22	↓ 8	- 2.2	16	-11.8	85	none	overcast
23	↑ 1	- 9.5	19	-18.2	80	none	prtly cldy
24	↓ 1	-17.2	16	-32.8	68	light snow (depth 5cm)	overcast to clear

*Note: Temperature and windspeed are averages over a 24 hour period.



DATES: JANUARY 1980

NOTE: TWELVE DAY AVERAGE

Figure 1.
Daily population statistics for major
military elements.

The total number of log entries (cases) obtained during the 14 days of the study was 3,748. The rates reported in this document exclude duplicates in the records where an individual case was recorded in more than one location. A "case" refers to each independent medical complaint even though in some cases the same individual may have had several complaints. Approximately 6% of the individuals reporting had two or more complaints, and 2% had more than two complaints. Individuals returning for a follow-up or for the same complaint were included under the category "follow-up".

Interviews were conducted with 16 suspected cold injury cases who were sent to the field hospital for observation. Brief background histories of these cases are included in the report (Appendix B). Four hundred thirty-two interviews were also conducted with non-cold injury cases for comparison and a summary of these data is included (Appendix C).

Research team personnel worked closely with the MTF personnel daily to clarify unclear entries and to fill in missing data. Table 2 presents the coding system used to classify complaints and diagnoses. Although attempts were made to verify the official diagnosis of every case, this was not always possible. Thus, we refer to the cases here as reported complaints and not as confirmed diagnoses. Classification of complaints at the MTFs are usually not uniform and, therefore, for improved reliability, we recommended that "presenting complaints" be entered in descriptive form to be classified later in a uniform manner by the research team.

Table 2.
Description of diagnostic categories

CODE	ABBREVIATION	EXAMPLES
A.	<u>URI</u>	UPPER RESPIRATORY INFECTION includes: Common cold, cough, bronchitis, asthma, pneumonia, chest congestion, tonsillitis, pharyngitis.
B.	<u>G.I.</u>	GASTROINTESTINAL includes: Nausea, upset stomach, vomiting, flu, stomach-abdominal pain & pressure, gastritis, gastroenteritis, peptic ulcer, diarrhea, constipation, hemorrhoids, intestinal cramps, colitis, hepatitis, food poisoning.....
C.	<u>DERM</u>	DERMATOLOGIC includes: Skin rashes, shaving profile, jock itch, blisters, cysts, warts, calluses, athlete's foot, boils, lice, dermatitis, skin infections, cellulitis, dry flaky skin INCLUDE ACUTE TRAUMA SUCH AS SKIN LACERATIONS OR BURNS UNDER "ACUTE TRAUMA" BELOW (GEN. SURGICAL).
D.	<u>N.P.</u>	NEUROPSYCHIATRIC includes: Headache, dizziness, fainting, convulsions, concussions, head trauma, anxiety reactions, anger reactions, depression, moodiness, malaise, mental fatigue, drug or alcohol abuse, behavior problems
E.	<u>G.U.</u>	GENITO-URINARY includes: Venereal disease (V.D.), kidney infection, kidney stones, testical infection, urinary tract infection (UTI), urethral discharge, epididymitis, urethritis, hematuria
F.	<u>MISC.</u>	MISC. MEDICAL includes: Complaints not easily classified into the other categories; physical exam, side pain (source unknown), chest pain (unknown), B/P check, shots, cardiovascular, hematologic, metabolic, endocrine problems, diabetes, fever of unknown origin and all follow-up action such as changing bandages, re-examination of injuries
G.	<u>A.I.</u>	ACUTE TRAUMA (GEN. SURGICAL) includes: Contusions, bruises, lacerations, burns, splinters, abdominal pain due to acute injury, appendicitis, or any injury to hands, wrists, knees, etc. requiring surgical treatment
H.	<u>ORTHO</u>	ORTHOPAEDIC includes: Lower back pain (LBP), pulled muscles, dislocations, strains, sprains, and fractures to feet, ankles, knees, legs, fingers, hands, wrists, arms, shoulders, neck, hips & joints, swollen sore feet, arthritis, bursitis, tendonitis
I.	<u>ENT</u>	EAR, NOSE & THROAT includes: Infections/injuries to ears, nose or throat, nose bleed (epistaxis), ear infection, sore throat, sinusitis, nasal congestion without cold, nose trauma, ear trauma INCLUDE COLDS, TONSILLITIS, ETC. UNDER "URI" ABOVE.
J.	<u>OPT</u>	OPHTHALMOLOGIC includes: Eye injury or infection, vision problems, need for glasses, eye trauma
K.	<u>GYN</u>	GYNECOLOGIC includes: Menstrual cramps, menstrual irregularity, suspected pregnancy, pregnancy, yeast infection, vaginitis, breast problems, contraception
L.	<u>AWI</u>	ADVERSE WEATHER INJURIES includes: Cold weather complaints: cold-numb hands, feet, frostbite, chil-blains, cold exposure, dry flaky skin, dehydration, hypothermia, chilling, shivering, trench (immersion) foot; hot weather complaints: heat stroke, exhaustion, sunburn, windburn, dehydration; other environmental complaints: smoke inhalation, dust inhalation
M.	<u>DENT</u>	DENTAL includes: Injury or infection to teeth, gums, all routine dental work, toothache, cavities
X.	<u>SUPL</u>	SUPPLY includes: Requests for medical supplies and over-the-counter medication such as bandages, aspirin, throat lozenges, cold packs, chap sticks, foot powder, lotions

Results: Morbidity Rates

The cumulative record of each of the diagnostic categories (Table 2) was tabulated daily and is presented in Figure 2. These data represent the totals for all clinics during the exercise. A detailed break-down of each category is presented in the tables of Appendix A, which also gives the average number of cases per day.

Twenty-four percent of the cases reporting to clinics during the exercise involved problems of upper respiratory infection (URI). Nearly 60 percent of these were recorded as being the "common cold" but it is estimated, based on the other subcategories, that over 90 percent involved the primary symptoms of a cold. This was the largest single category of all reported complaints and affected approximately 10 percent of the military population of the exercise over the course of this study. Another four percent of the total population could be considered similarly if ENT complaints are included. ENT comprised the 5th largest category, with nearly 9% of all medical complaints. Since there is a great deal of overlap between symptoms of URI and ENT, combining them would be reasonable. The ENT category primarily consisted of complaints of sore throat (59% of all ENT reports).

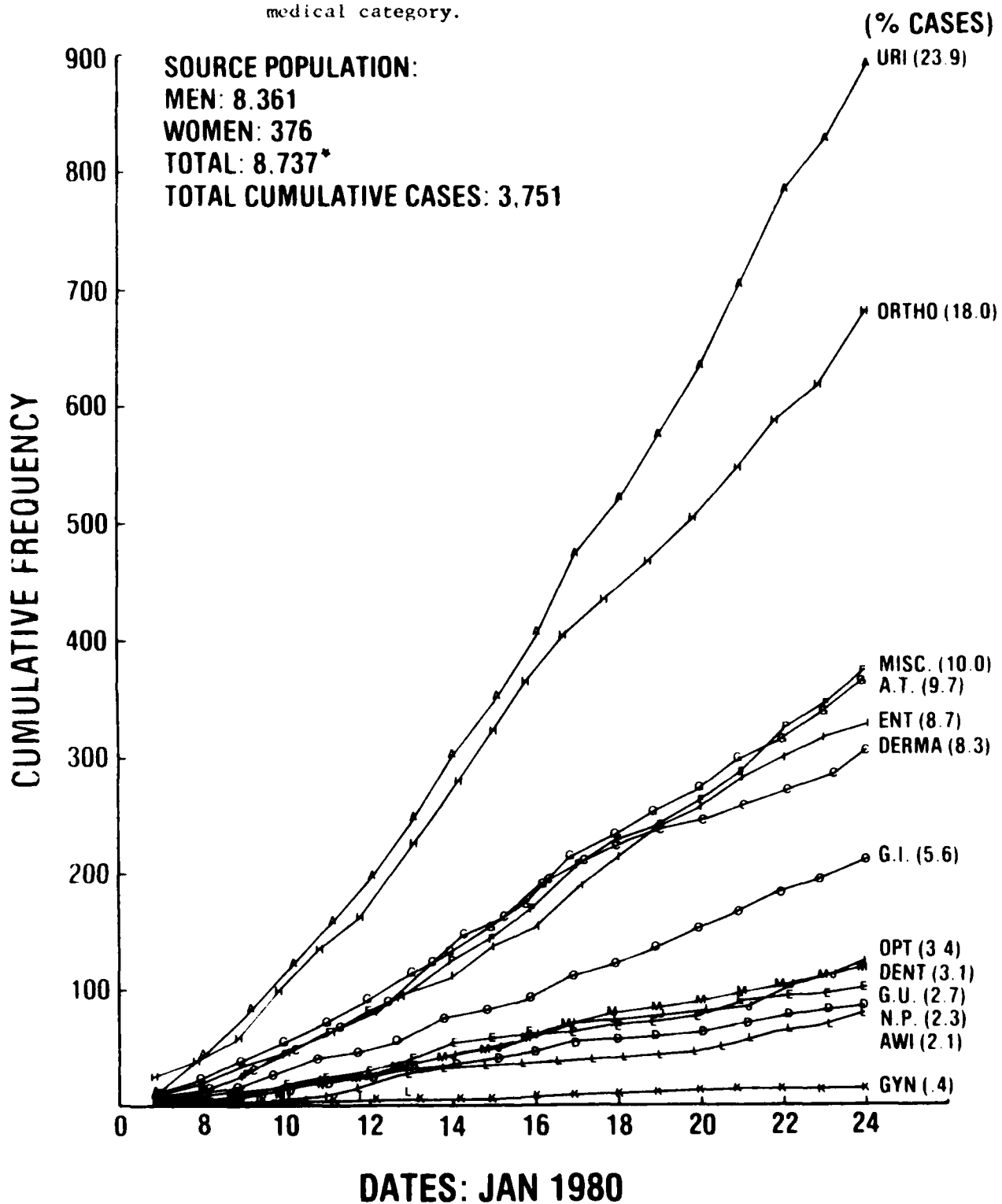
The second most frequent type of medical complaint was orthopedic injury (ORTHO) comprising 18% of all reported cases and nearly 8% of the total population. The vast majority of these were complaints of back pain (over 25%). Ankle pain or strain, and/or injuries to the knee or foot were also high as were hand, wrist, thumb or finger injuries. These numbers increase if acute trauma (AT) complaints are included, which contain many similar complaints. Acute trauma was the fourth largest category, being 9.7% of the total reported cases and approximately 4% of the total population. Forty percent of these complaints involved the hand, wrist, thumb, or fingers. Another 17% involved the knee, leg, foot, or ankle.

The sixth category was dermatological complaints (DERMA), making up 8.3% of the entries and involving approximately 3.7% of the personnel of the exercise. Twenty-two percent were recorded as simply skin rashes or irritation, 14% were face rashes or shaving profiles and 8% were listed as unspecified skin problems. The remaining 55% were given more specific identification either by type or body location and are listed in Appendix A.

Gastrointestinal (GI) complaints were 5.6% of the total number of cases and involved 2.5% of the personnel. Most of these were nausea, stomach upset, or pain and hemorrhoids. Flu constituted 9.6% of the GI cases (although more appropriately might have been included with URI).

The remaining categories, reported less frequently, include: ophthalmological (OPT) (3.4% of the cases), dental (DENT) (3.1%), genito-urinary (GU) (2.7%), neuropsychiatric (NP) (2.3%), adverse weather injuries (AWI) (2.1%), and gynecological (GYN) (0.4%). The number of recorded dental complaints is probably lower than the actual number since a separate, independent dental clinic was in operation and not all these complaints were recorded in the clinical logs.

Figure 2.
Plot of daily cumulative frequencies by
medical category.



* AVERAGE PER DAY
18 DAYS

Figure 3 shows the complaint rate of each diagnostic category by military group. The numbers indicate the average number of cases per 1000 population per day. Thus to find the approximate number of URI cases which occurred over a 12 day period for the Air Force (AFFOR) clinic, for example, one would multiply 8.9 times 1.387 (the number of thousands in the population of 1,387) times 12 (days) equals 148 estimated cases in 12 days (actual number was 149). The categories are roughly ranked by order of overall incidence rate (Figure 3).

Comparisons between groups can be made by ranking each category across groups. Thus, using 1 as the lowest rank (lowest case rate) and 4 as the highest, we find that AFFOR ranks highest on URI, then Opposition Forces (OPFOR), then Corps Support Command (COSCOM), and finally, Army Forces (ARFOR), the lowest number of URI complaints. This comparison is made for each medical category for each military group with the following results: Based on the mean rank order values, ARFOR had the lowest rates across all categories (mean rank order = 1.82), COSCOM was next lowest (mean = 1.84), then AFROR (3.07) and finally, OPFOR with the highest overall rank order average of 3.25. OPFOR and AFFOR both had significantly higher overall incidence than ARFOR and COSCOM clinics ($p < 0.01$). Thus, the two field units were significantly and consistently different from each other as were the two support units, which is contrary to what might be expected.

Although we have insufficient information to explain these differences, one can offer suggestions based on anecdotal information. The ARFOR were generally resistant to using the medical treatment facilities and appeared reluctant to go to the field hospital. Since the field hospital personnel were from the same post as the OPFOR, tactical considerations could have influenced ARFOR command emphasis on "frivolous" use of medical facilities. The reason for the high rates for the OPFOR is less clear, but may also be related to the association of some of the medical elements with OPFOR's home station. The relatively high rate for the AFFOR is not easy to understand since they had less field exposure, but might be related to their physical set up. The AFFOR group was on post and their medical facility was centrally located within their area of operations. Furthermore, the medical personnel were non-Air Force, Army Reserve personnel who appeared to be quite eager to provide good medical services to Air Force personnel. However, since these explanations are not based on systematic observation they remain speculative.

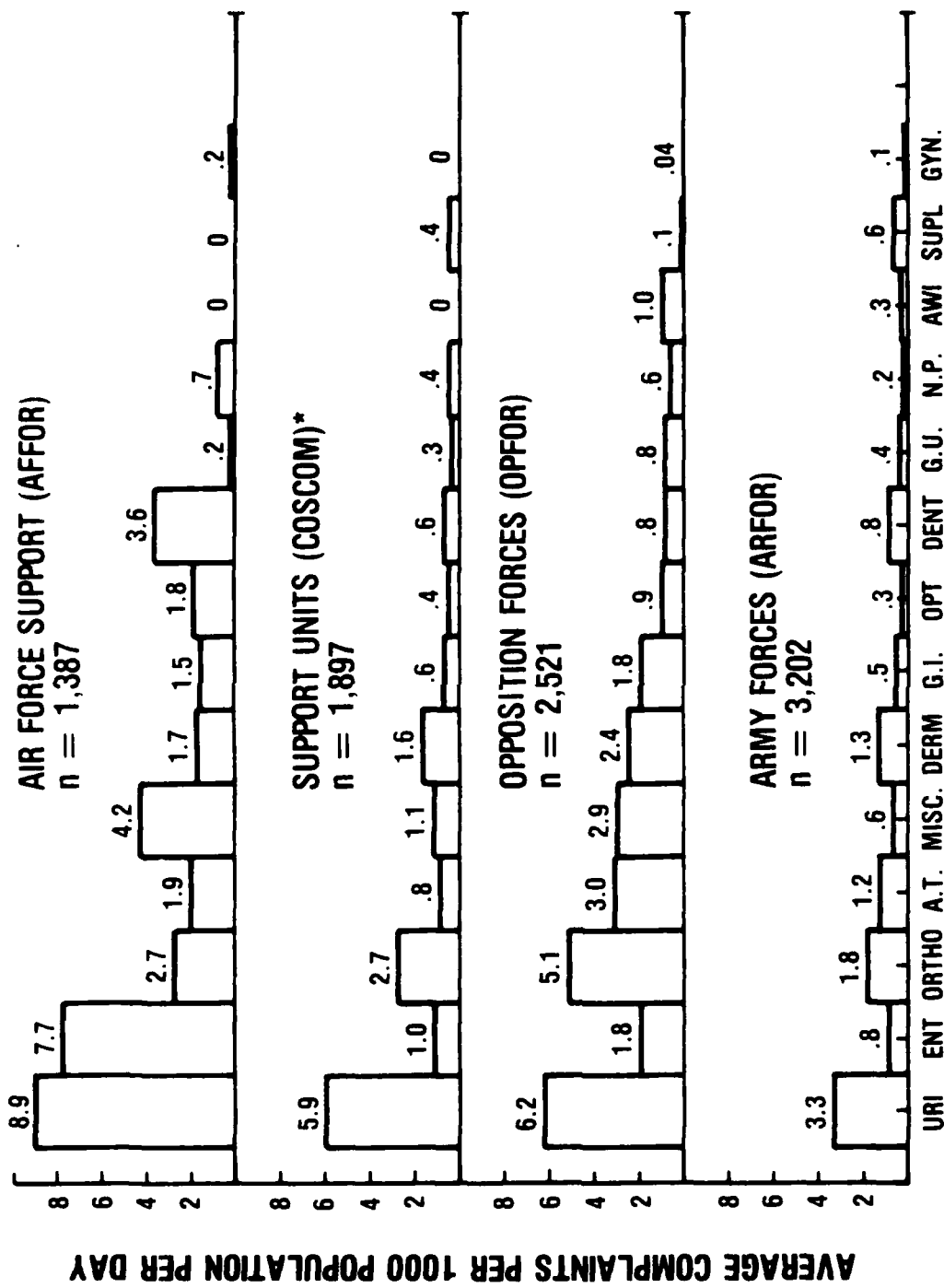


Figure 3.
Average number of medical complaints per thousand population per day by type of unit.
*EXCLUDING FIELD HOSPITAL CASES

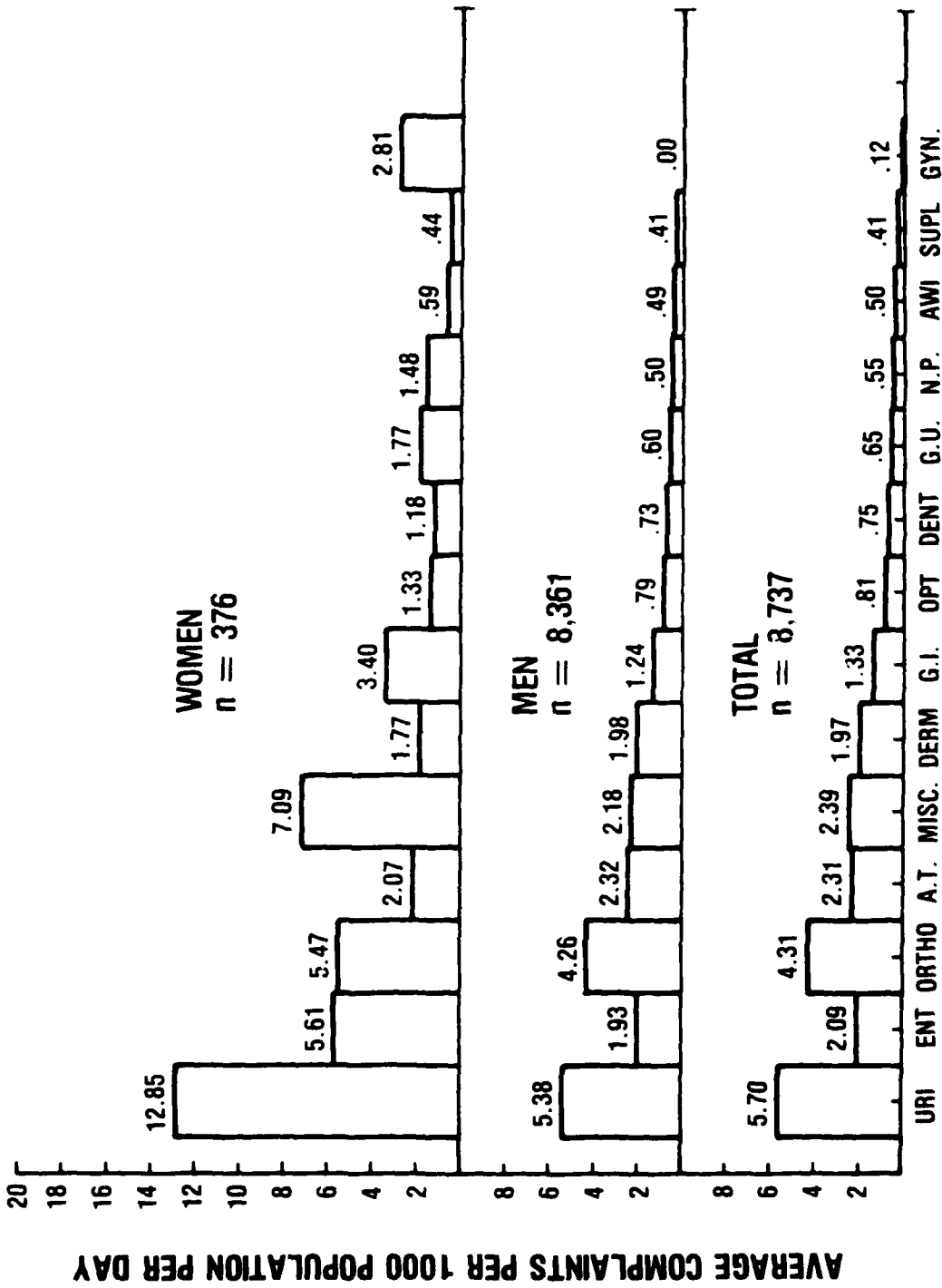
Figure 4 presents the case rate of each medical category for women, men, and the combined cases. The rates are given as cases per thousand population per day. The average population per day is estimated to have been 8,737 (376 women, 8,361 men). It should be noted that while the rate for women on URI, for example, was 12.85/1000/day the actual average number of cases per day was 5, since the population was below 1000 ($12.85 \times .376 = 4.83$). For the men, the mean number of URI cases per day was 45 ($5.38 \times 8.36 = 44.98$). Data in the form of cases per 1000 population per day allow comparisons between groups of unequal numbers and estimates for future case rates on populations of different sizes.

The women show higher rates for all complaints except acute trauma and dermatological problems. Women's rates were at least three times greater than men's on ENT, GU, NP, and MISC. Women were at least twice as high on URI and GI and generally higher on ORTHO, OPT, DENT, and AWI than men. Men were slightly higher in cases of AT and DERM. These findings are consistent with similar research findings which show that women tend to report medical problems more frequently than men (3). It should be noted, however, that although the differences between men and women in terms of "true" number of cases (i.e., to include unreported cases) will probably remain unknown, future preparation and planning can only be based on the known utilization of medical services and therefore these data are important regardless of their cause.

Given the variability within the unit and in the data by gender it is most reasonable to base future estimates on the total or averages across all subgroupings. The lower panel of Figure 4 presents the total population data, arranged approximately in order of frequency, indicating the relative importance of each category.

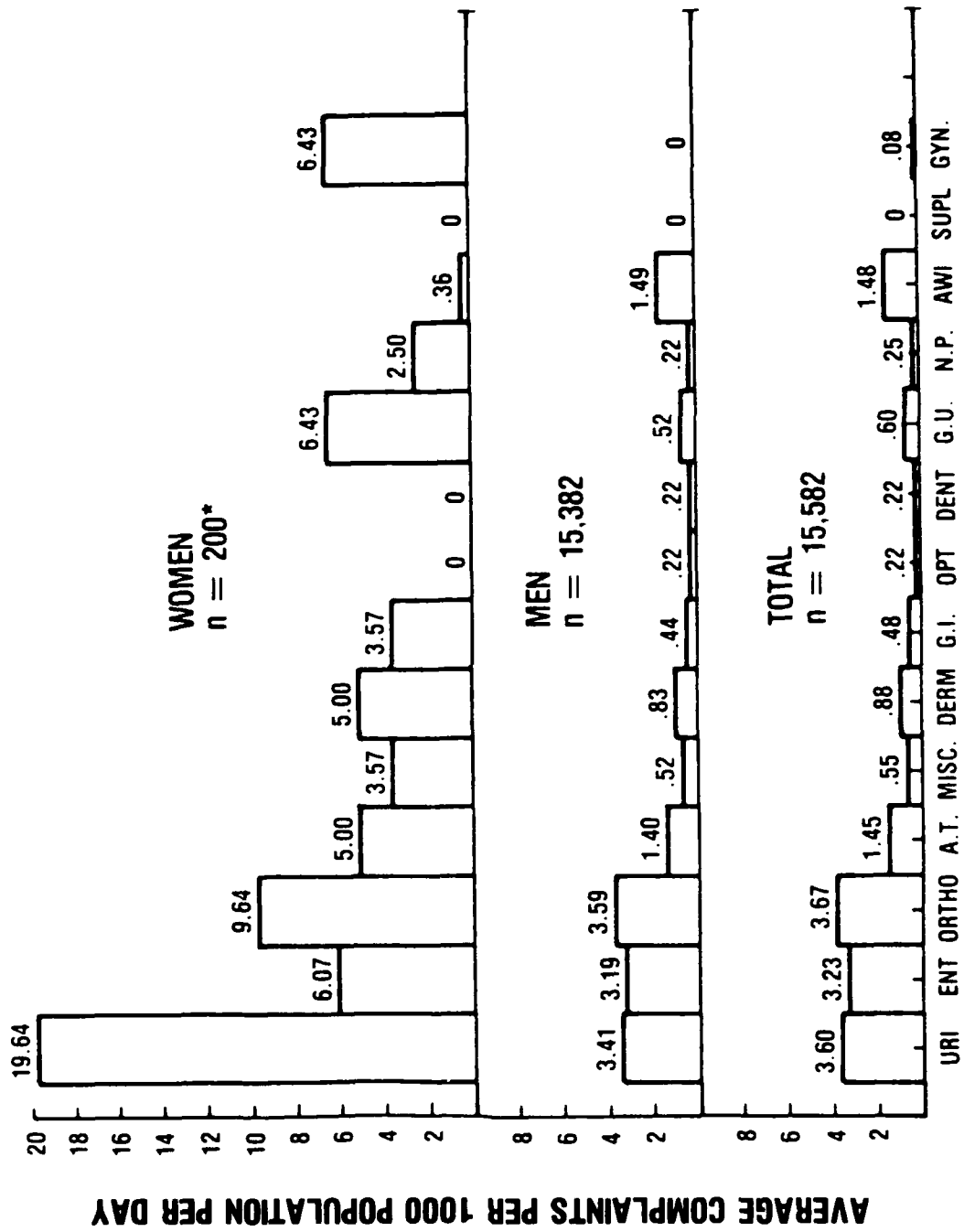
For comparison, data from a previous Empire Glacier (1978) is presented in Figure 5. Estimates here are less accurate, since the original data were not available in all cases, and the procedures for collecting and processing the data were not exactly the same. However, the comparisons are helpful and meaningful, particularly in the case of the overall totals. Correlation between total case rates of the two studies (1978 and 1980) show a correlation of .833 which is highly significant ($df=12, p .01$). In other words, the pattern of case rates by category is similar in both studies. The difference in case rates of men and women also show the consistent differences, with women having proportionately higher rates over-all. However, we have less confidence in these rates since the exact size of the female population in 1978 was not known but could only be estimated (see reference 1).

The total rates, which are more reliable, show an interesting contrast between the two studies. In nearly every case, except the adverse weather injuries, the 1980 study found higher values. The MISC category was four times greater, OPT and DENT, three times greater and DERM, GI, GU, NP were twice as great as in 1978. However, the AWI rates were three times greater in 1978 than 1980. AWI ranked fourth as a medical problem in 1978 and only twelfth in 1980. The AWI data are consistent with the weather conditions of the two exercises although one might have expected orthopedic injuries to be greater in 1978 because of extensive snow and ice conditions that year. Overall the temperature, windchill and snow conditions were much more severe during the 1978 than the 1980 cold weather exercise. The differences for the other classes of illness/injury have no obvious explanation.



PRESENTING COMPLAINT

Figure 4.
Average number of medical complaints per
thousand population per day by gender.



PRESENTING COMPLAINT

*ESTIMATED

Figure 5.
Average number of medical complaints per thousand population per day by gender (Empire Glacier 1978).

Results: Cold Weather Injuries

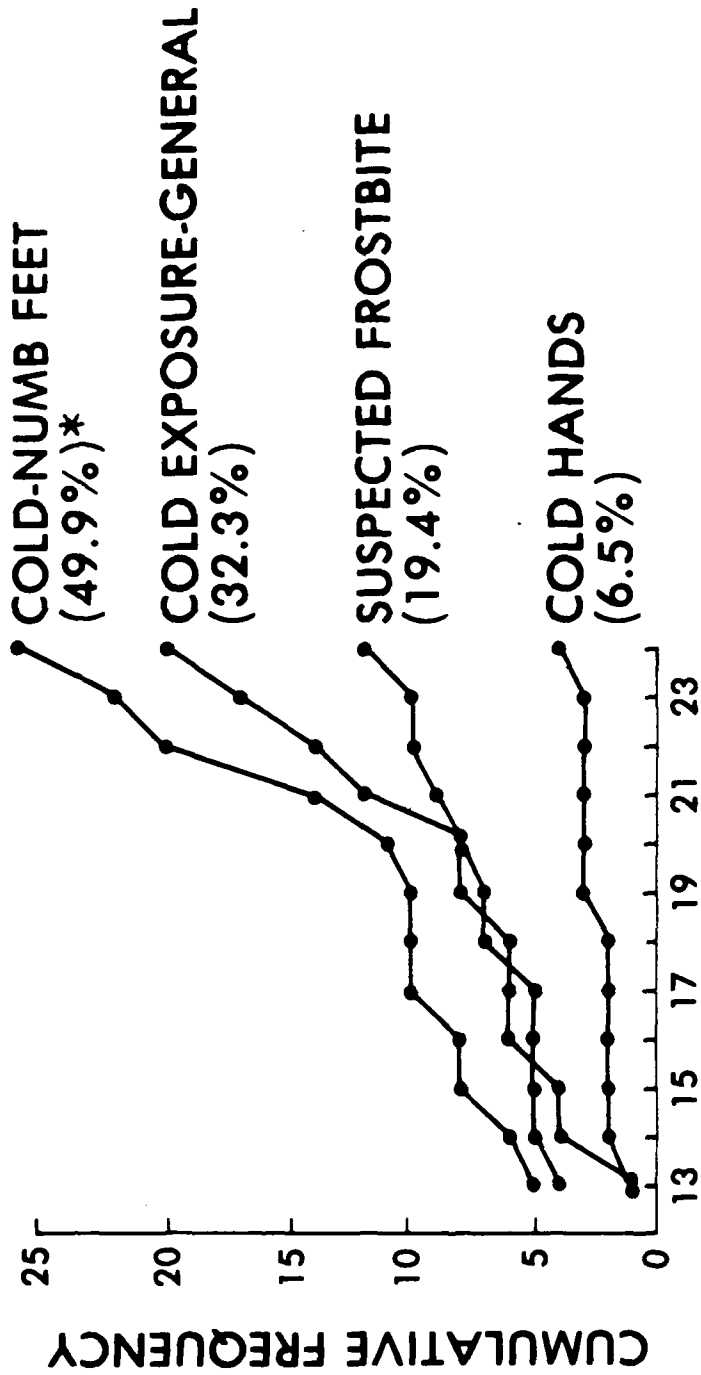
Appendix A (L.) presents a breakdown of adverse weather injuries (AWI) directly attributable to cold weather, as they were entered in the Medical Record Logs. Figure 6 combines the separate categories into four sub-categories, and presents their cumulative frequency from the 13th to the 24th of January (when all MTFs were in operation). Foot injuries were the most frequent type of injury (49.9% of the AWI cases). Because many entries did not specify body area, foot related problems may have been even greater than indicated, since entries for both general cold exposure and suspected frostbite may include some cases of cold injuries to the feet. Cold hands, according to the records, were not a major problem (6.5% of the cases), although some cases may be hidden in the general class of cold injury where body part is unspecified.

Nineteen percent of the cases were suspected frostbite injuries, although only one or possibly two cases were subsequently identified as true frostbite injuries. General cold exposure cases (32%) include chills, dehydration, "cold weather evaluation" and "unspecified."

To determine if cold weather complaint rates related to weather conditions, various analyses were performed. Since injury due to cold takes time to occur, the relationship between reports of injury and actual cold conditions must be separated by time. Therefore, the first comparison was between the number of AWI cases per day and the previous day's average windchill value. This initial relationship proved significant ($r = -.699$, $p < 0.01$). However, we also compared the average windchill values for the two previous days and the relationship was even stronger. Finally, a three-day windchill average was calculated and a maximum correlation with daily AWI case rates was found ($r = -0.813$, $p < 0.01$). A moving average was applied ($n=3$) to both case rates and windchill values, and the data were plotted (Figure 7) to demonstrate the general relationship between these variables. Linear and non-linear models of best fit were tested and the result is shown in Figure 8. The model of best fit was a non-linear inverse regression equation with a correlation of -0.863 , which is statistically significant ($p < 0.01$).

Applying this prediction model to the daily conditions, a predicted cumulative complaint record was computed and compared to the actual record as shown in Figure 9. As seen in this figure, a very close daily match between expected and actual cases was achieved. The true test of this prediction model, however, will occur during its application in future cold weather exercises. What is important about the present model is the emphasis given to exposure time. In addition to windchill, length of exposure is an important variable. It is known that the more severe cases of cold injury (e.g. frostbite) occur after prolonged exposure of 6 to 8 or more hours. Given that military personnel typically have some protection from the elements, the exposure times sufficient to produce such injuries may be even greater. Thus, exposure must, at minimum, be severe enough (below freezing) and long enough (days) before substantial numbers of cold injuries will be sustained. Major exceptions to this would involve cases of acute hypothermia produced by accidental cold water immersion (above freezing) or skin contact with super cooled materials or fluids, where injury can occur within a short period of time.

ADVERSE WEATHER INJURY COMPLAINTS



DATES: JANUARY 1980

* PERCENT OF AWI CASES

Figure 6.
Cumulative frequency of adverse weather injuries.

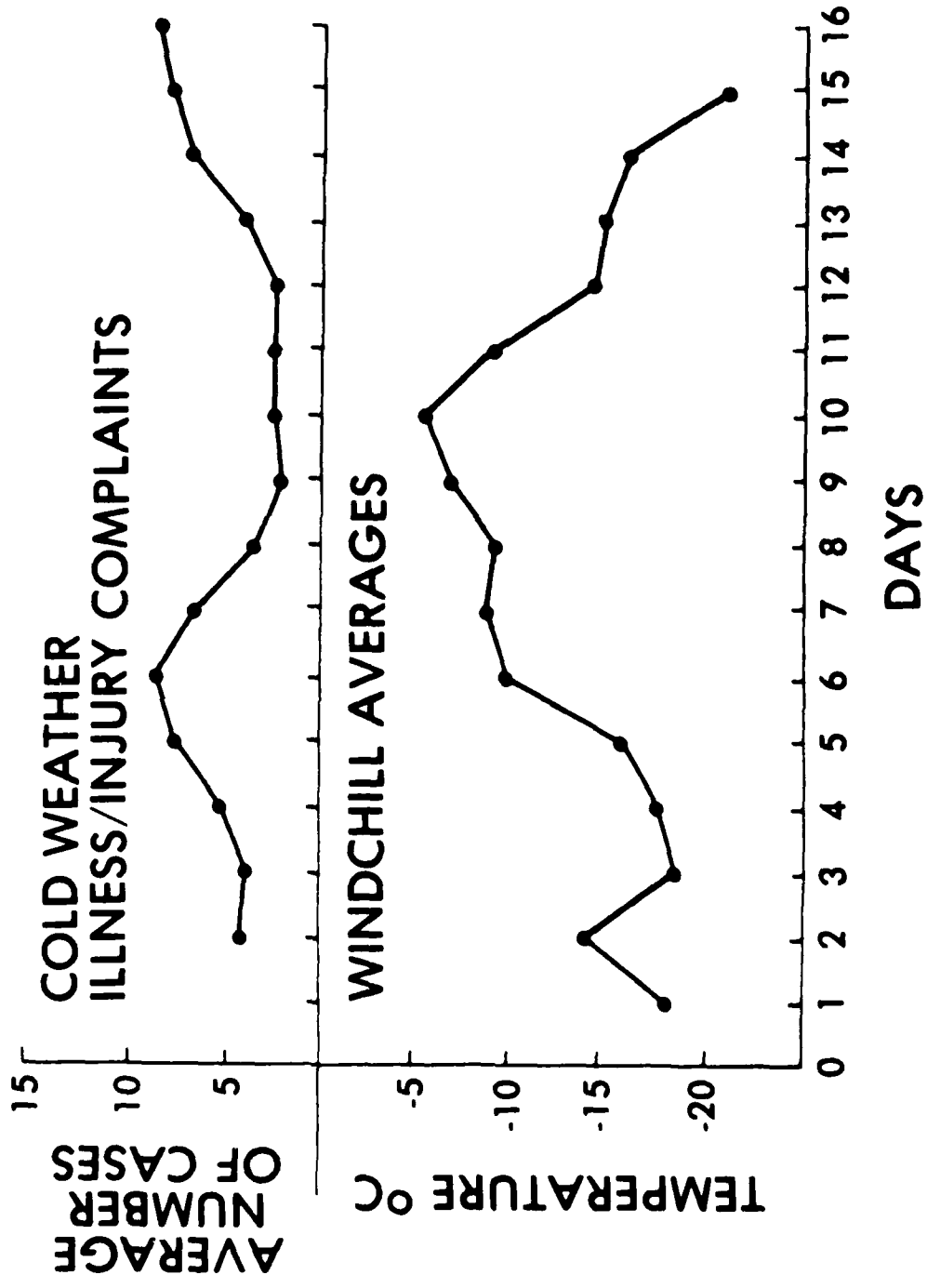


Figure 7.
Comparison of average windchill values
with number of cold weather injury
complaints.

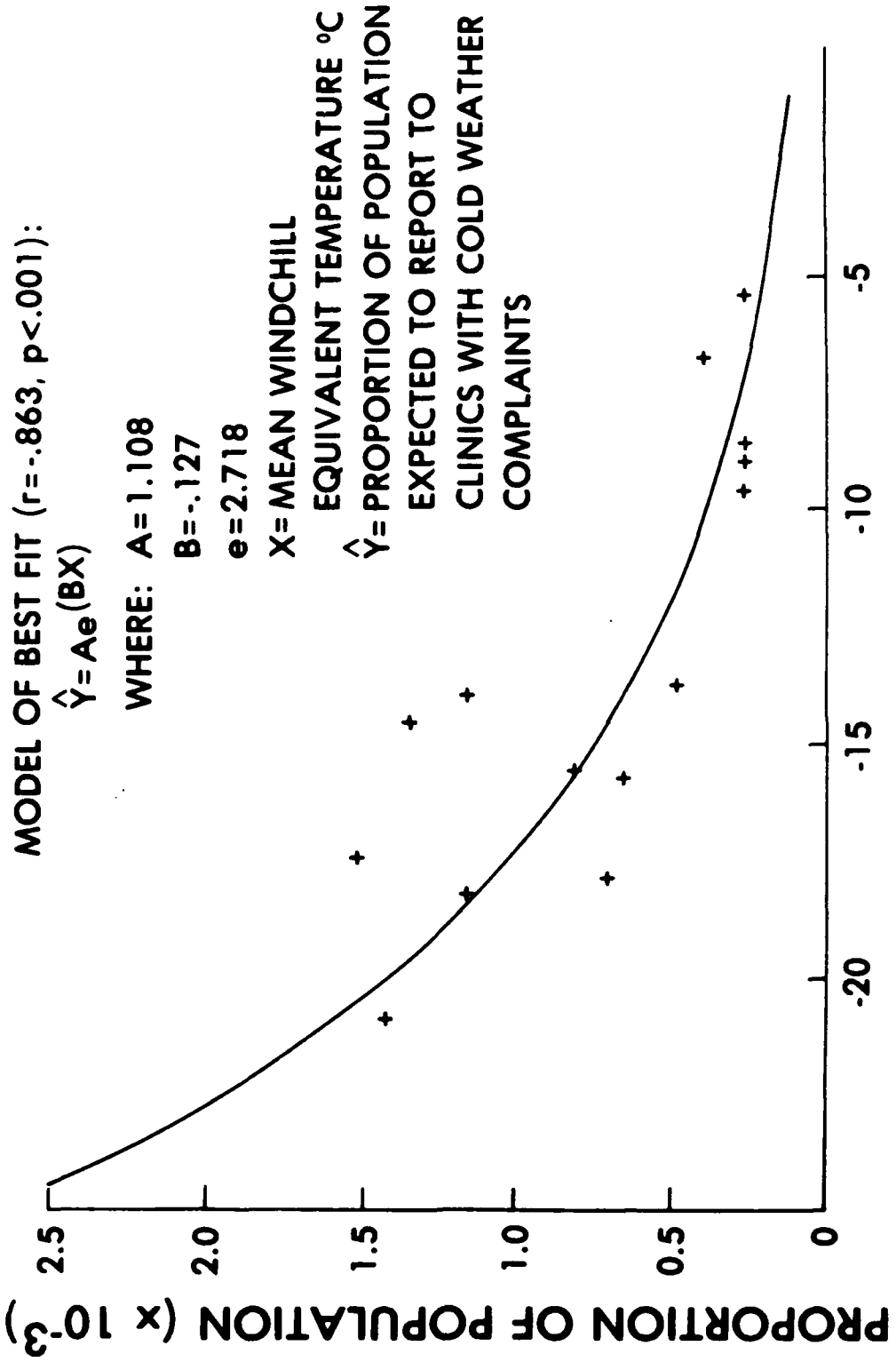
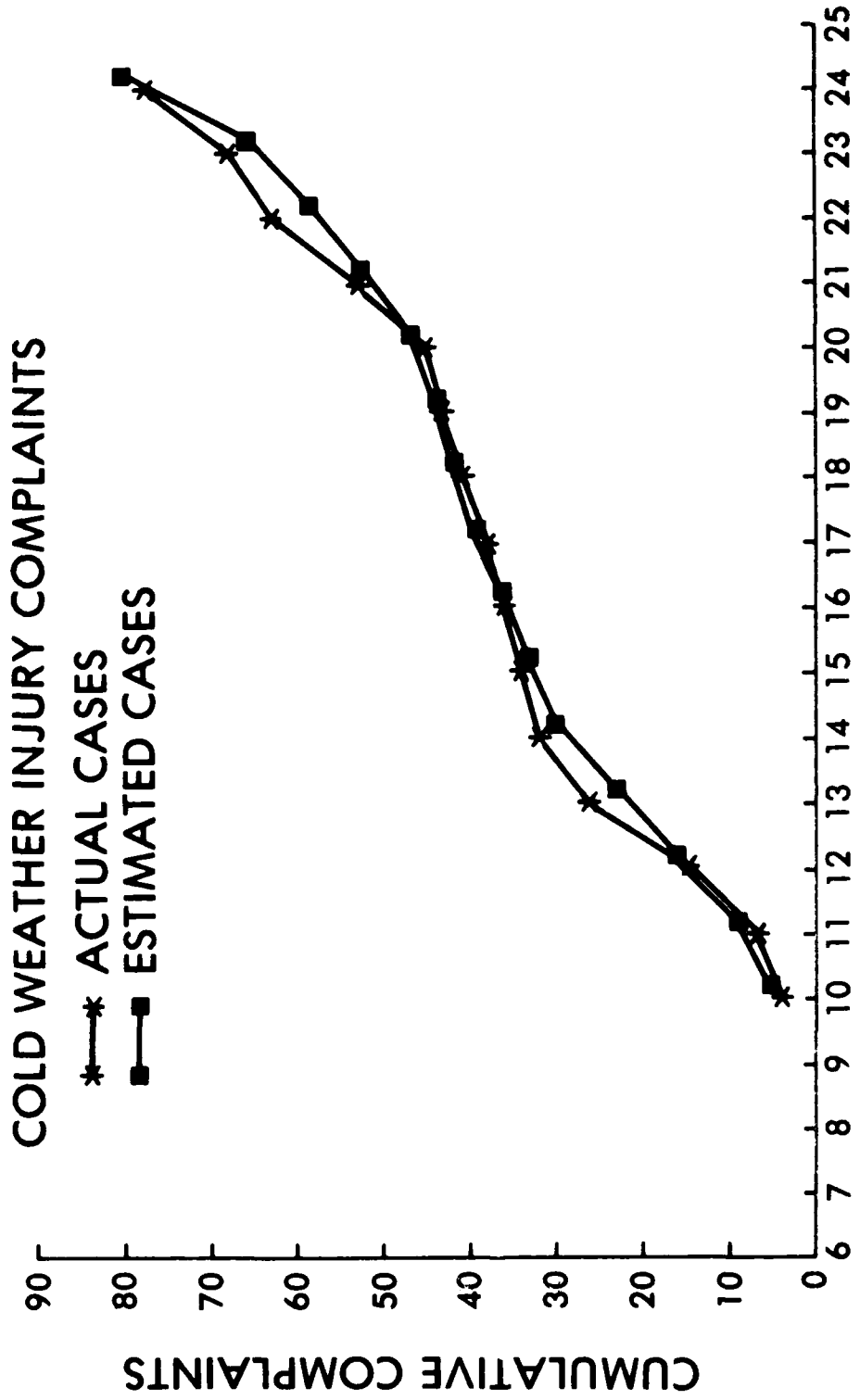


Figure 8.
Prediction of the proportion of the population expected to suffer cold injury given average windchill values.



DATES: JANUARY 1980

Figure 9.
Comparison of expected cumulative frequency of cold weather complaints with actual cumulative frequency.

Appendix B presents brief histories of individual AWI cases who were referred to the hospital for observation and evaluation. With the help of the preventative medicine officer, we were able to obtain brief histories on sixteen men with suspected cold injuries. There was one case of hypothermia, one case of frostbite of the nose, one frostbite of the ears, two cases of trenchfoot, one frostbite of the fingers, and ten cases of cold- numb feet (suspected frostbite). Since the number of patients is small, no reliable pattern could be determined regarding the background characteristics of these patients. Descriptively, all patients were male; eight were Caucasian, five Black, two Hispanic, and one whose racial-cultural identity was not recorded. One (6%) had no instruction in cold injury prevention, two (18.8%) had no cold weather field training, and nine (68.8%) had little (slight) or no prior experience with cold freezing weather (see Appendix C). Among the Caucasian patients six had suspected frostbite of the feet, one suspected trenchfoot and one suspected frostbite of the ears. Among the five Black patients, four had suspected frostbite of the feet, and one had cold- numb fingers. One Hispanic had suspected trenchfoot and the other a diagnosed mild case of frostbite of the nose.

In nearly every case the problems were easily preventable. In the hypothermia case it was reported that the patient had intentionally jumped into a river. In one of the suspected trenchfoot cases, the person reported walking through water and getting his feet wet and failed or was unable to dry them. In the case of suspected frostbite of the ears the individual (a crew leader) compressed his ears by wearing a helmet over his pile cap for a prolonged period, and then the following day exposed his ears to cold freezing winds. This prior trauma may have predisposed the ears to cold injury. Ironically, this is a case of over- protection, which is not uncommon. Among the causes of suspected frostbite of the feet, in three of the cases the individuals wore only combat boots during prolonged (4-5 hours) cold exposure. There were two other cases in which winter vapor barrier boots were too tight. Four cases involved individuals who had developed sweaty feet from physical exertion and were then subjected to prolonged immobility in cold conditions (standing guard, sleeping in APC, tank or unheated tent). Thus, a common sequence is physical activity leading to perspiration, and then prolonged inactivity. The frostbite of the nose was largely due to prolonged exposure to cold winds (as a tank driver during a forced march) with over- protection to the face. In the case of one of the suspected trenchfoot patients, the person had a history of sweaty feet in cold weather. Thus, in nearly every case, proper care and precaution and/or proper use of equipment could have prevented injury.

As one final note, a majority of these cases occurred soon after the beginning of the FTX phase when the men were exposed to the elements after being in garrison for about a week and at a time when the weather was turning colder (viz. 20th of Jan). Thus, although the prerequisite is cold weather, the contributing causes are extended exposure, inadequate equipment and failure to implement preventative measures. However, it should also be noted that the majority of the men and women of this exercise had fairly good preparation, adequate equipment and practiced good preventative medicine having had strong command emphasis on cold injury prevention.

Concluding Comments

Although the Army is well equipped and is able to function in a wide variety of environments, including cold, it is apparent that personnel are not accustomed to functioning in the cold environment. It is estimated that well over 50 percent of the men and women of the Army have little or no practical experience with cold weather. We noted that many soldiers did not, and probably could not make appropriate adjustments in their clothing for the changing conditions. There may have been as many cases of minor injury due to "over-protection" as there were for inadequate protection from the elements. Personnel were seen walking around in arctic attire when conditions were relatively warm. It is possible there were many unreported foot problems as a result of using vapor barrier (VB) boots during these milder days. Furthermore, many personnel were probably predisposed to cold injury when the weather turned colder. Even though it was encouraging to think that there was command emphasis for using protective clothing, inexperience may not have allowed flexibility during rapidly changing conditions.

There was also a lack of awareness regarding problems of dehydration. Although dehydration is frequently not recognized as a cold weather problem, it is probably one of the more significant ones. The effects of mild dehydration are not readily evident in clinical data, but may be manifested in cases of sore throat, upper respiratory infection, constipation and the like. There were few if any indications that anyone was promoting the intake of fluids. Therefore, a need exists for greater emphasis on the problem of dehydration and the requirement of increased fluid intake when operating in cold weather.

A related, but less serious concern exists regarding the understanding of the importance of time in relation to cold injury. In most cases of frostbite (as distinct from superficial "frost-nip"), the exposure time is on the order of 6 to 8 hours or more (4). It is rare to have a real case of frostbite, even in severe weather, when exposure time has been less. Exceptions are water immersion, exposure to certain low freezing fluids (e.g. gasoline) or contact with cold metal.

Of lesser importance is the misunderstanding about windchill equivalent temperatures and the likelihood of frostbite injury. It is not widely understood that frostbite cannot occur unless the actual temperature is below freezing. In other words, although the windchill equivalent values may be below freezing, freezing cannot occur unless the actual temperature is subzero. However, the same windchill factor may have importance when the concern is hypothermia. Hypothermia is, in fact, a greater danger in conditions above freezing. Wind and dampness play an important role in body heat loss, particularly when conditions are milder and personnel may leave protective equipment behind, not anticipating the danger.

In summary, cold weather injury may be prevented by having the proper equipment and knowing how to protect oneself in the face of changing weather conditions. Improper utilization of cold weather clothing and equipment may create as many problems as those items are designed to solve. This re-emphasizes the importance of military exercises in helping provide the essential experiences for coping with the potential hazards of environmental extremes. Fortunately, due to the combination of mild weather and the diligent efforts of many of the personnel, there were no serious cold injuries during this exercise.

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3. Mechanic, D. Sex, Illness, Illness Behavior, and the Use of Health Services. Journal of Human Stress, 1976, 2, 29-40.
4. Hanson, H. E. and R. F. Goldman. Cold Injury in Man; A Review of its Etiology and Discussion of its Prediction. Military Medicine, 1969, 134, 1307-1316.

APPENDIX A

Frequency and Average Rate per day of
Individual Complaints by Category

	<u>Category</u>	<u>(Frequency)</u>	<u>Page</u>
A. URI	- Upper Respiratory Infection	(668) *	A - 2
B. GI	- Gastrointestinal Complaints	(165)	A - 3
C. DERM	- Dermatological Complaints	(229)	A - 4
D. NP	- Neuropsychiatric Complaints	(70)	A - 5
E. GU	- Genito-urinary Complaints	(70)	A - 6
F. MISC	- Miscellaneous Medical Complaints	(270)	A - 7
G. AT	- Acute Trauma (Surgical)	(274)	A - 8
H. ORTHO	- Orthopedic Complaints	(516)	A - 19
I. ENT	- Ear, Nose, Throat Complaints	(278)	A - 10
J. OPT	- Ophthalmological Complaints	(89)	A - 11
K. GYN	- Gynecological Complaints	(11)	A - 12
L. AWI	- Adverse Weather Injury	(62)	A - 13
M. DENT	- Dental Complaints	(92)	A - 14
X. SUPL	- Supply Requests	(35)	A - 15

*Eleven day totals

A. URI - UPPER RESPIRATORY INFECTION

	Eleven-day Totals	Ave./Day	Rates*
1. Common Cold	339	(36.3)	4.15
2. URI, unspecified	176	(16.0)	1.83
3. Cough (and sore throat)	26	(2.4)	.27
4. Bronchitis	13	(1.2)	.14
5. Pneumonia	13	(1.2)	.14
6. URI, congestion	11	(1.0)	.11
7. Tonsillitis	10	(0.9)	.10
8. Pharyngitis	7	(0.6)	.07
9. Chest Pain	7	(0.6)	.07
10. Allergy	3	(0.3)	.03
11. Asthma/Trouble Breathing	3	(0.3)	.03
<hr/>			
	TOTAL : 668	(60.7)	6.95

* Rates = Complaints per 1000 population per day.

B. G.I. - GASTROINTESTINAL COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Nausea (Upset Stomach)	33	(3.0)	.34
2. Stomach Pain	26	(2.4)	.27
3. Hemorrhoids	18	(1.6)	.18
4. Flu (includes non-intestinal flu)	16	(1.5)	.17
5. Viral Gastroenteritis	16	(1.5)	.17
6. Vomiting	15	(1.4)	.16
7. Constipation	8	(0.7)	.08
8. Diarrhea	7	(0.6)	.07
9. Cramps	7	(0.6)	.07
10. Abdominal Pain	7	(0.6)	.07
11. Viral Syndrome	7	(0.6)	.07
12. G.I. unspecified	2	(0.2)	.02
13. Gas Pressure (Stomach)	1	(0.1)	.01
14. Appendicitis	1	(0.1)	.01
15. Watery Stool	1	(0.1)	.01
<hr/>			
TOTAL:	165	(15.0)	1.72

* Rates = Complaints per 1000 population per day.

C. DERM - DERMATOLOGICAL COMPLAINTS

	Eleven-day Totals	Ave./Day	Rate*
1. Skin Rash/Irritation	51	(4.6)	.53
2. Face Rash/Shaving Profile	33	(3.0)	.34
3. Skin Problem, unspecified	19	(1.7)	.19
4. Jock Itch	16	(1.5)	.17
5. Blister	12	(1.1)	.13
6. Cyst	12	(1.1)	.13
7. Warts	11	(1.0)	.11
8. Calluses	10	(.9)	.10
9. Athlete's Foot, Itchy Foot	8	(.7)	.08
10. Ingrown Toenail	8	(.7)	.08
11. Scabies, Itchiness	6	(.5)	.06
12. Crabs, Lice	5	(.5)	.06
13. Cellulitis	5	(.5)	.06
14. Boil (back, neck, ear)	4	(.4)	.05
15. Acne	4	(.4)	.05
16. Dermatitis-Exzema-Seborrhea	3	(.3)	.03
17. Bunion	3	(.3)	.03
18. Skin Infection	3	(.3)	.03
19. Skin Allergy	3	(.3)	.03
20. Leg Rash	2	(.2)	.02
21. Folliculitus	2	(.2)	.02
22. Pityriasis Rosea	2	(.2)	.02
23. Cold Sore	2	(.2)	.02
24. Hand, skin problem unspecified	1	(.1)	.01
25. Dandruff	1	(.1)	.01
26. Ringworms	1	(.1)	.01
27. Dry Skin	1	(.1)	.01
28. Hidrosis	1	(.1)	.01
TOTAL:			
	229	(20.8)	2.38

* Rates = Complaints per 1000 population per day.

D. N.P. - NEUROPSYCHIATRIC COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Headache	40	(3.6)	.41
2. Faint/Dizzy	12	(1.1)	.13
3. Head Trauma/Concussion	7	(.6)	.07
4. Anxiety	5	(.5)	.06
5. N.P. unspecified	2	(.2)	.02
6. Fatigue	1	(.1)	.01
7. Psychosomatic Chest Pain	1	(.1)	.01
8. Request Mental Hygiene	1	(.1)	.01
9. Malaise	1	(.1)	.01
<hr/>			
	TOTAL: 70	(6.4)	.73

* Rates = Complaints per 1000 population per day.

E. G.U. - GENITO-URINARY COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Venereal Disease Unspecified	13	(1.2)	.14
2. Kidney Infection	12	(1.1)	.13
3. Testicle, swollen, pain	10	(.9)	.10
4. Urinary Tract Infection (U.T.I.)	8	(.7)	.08
5. Urethral Discharge	5	(.5)	.06
6. Unspecified G.U.	4	(.4)	.05
7. Epididymitis	3	(.3)	.03
8. Penis Soreness	3	(.3)	.03
9. Gonorrhoea (G.C.)	3	(.3)	.03
10. Blood in Urine	2	(.2)	.02
11. Urethritis	2	(.2)	.02
12. Groin Pain	2	(.2)	.02
13. Pancreatitis	1	(.1)	.01
14. Chancroid	1	(.1)	.01
15. Dysuria	1	(.1)	.01
<hr/>			
TOTAL:	70	(6.4)	.73

* Rates = Complaints per 1000 population per day.

F. MISC. - MISCELLANEOUS MEDICAL COMPLAINTS

	Eleven-day Total	Ave./Day	Rates*
1. Followup Action	167	(15.2)	1.74
2. Miscellaneous, unspecified	31	(2.8)	.32
3. Chest Pains	14	(1.3)	.15
4. Side Pains	10	(0.9)	.10
5. Physical Exam	6	(0.5)	.06
6. B/P Check	6	(0.5)	.06
7. Insulin Shot	5	(0.5)	.06
8. Profile Update	4	(0.4)	.05
9. Fever	3	(0.3)	.03
10. Consult for EKG	3	(0.3)	.03
11. Cardiovascular	3	(0.3)	.03
12. X-Ray	3	(0.3)	.03
13. Mouth, unspecified	1	(0.1)	.01
14. Personal	1	(0.1)	.01
15. Gynecomastia	1	(0.1)	.01
16. Fuel Inhalation	1	(0.1)	.01
17. Intoxication	1	(0.1)	.01
18. Fuel Ingestion	1	(0.1)	.01
19. Blood Poisoning	1	(0.1)	.01
20. Human Bite	1	(0.1)	.01
21. Swelling, unspecified	1	(0.1)	.01
22. Lump on Breast	1	(0.1)	.01
23. Spitting Blood	1	(0.1)	.01
24. Feet, unspecified	1	(0.1)	.01
<hr/>			
TOTAL:	270	(24.5)	2.80

* Rates = Complaints per 1000 population per day.

G. A.T. - ACUTE TRAUMA (SURGICAL) COMPLAINTS

	Eleven-day Total	Ave./Day	Rates**
1. Hand-Wrist	56	(5.1)	.58
2. Thumb-Finger	51	(4.6)	.53
3. Burns*	19	(1.7)	.19
4. Knee	17	(1.5)	.17
5. Foot-Ankle	16	(1.5)	.17
6. Face-Lip-Mouth	15	(1.4)	.16
7. Leg-Hip	13	(1.2)	.14
8. Head	11	(1.0)	.11
9. Back	9	(.8)	.09
10. Chest	8	(.7)	.08
11. Elbow	8	(.7)	.08
12. Arm	8	(.7)	.08
13. Splinter	7	(.6)	.07
14. Laceration	6	(.5)	.06
15. AT, unspecified	6	(.5)	.06
16. Groin-Genitals	4	(.4)	.05
17. Toes	4	(.4)	.05
18. Shoulder	4	(.4)	.05
19. Puncture Wound	3	(.3)	.03
20. Chin	2	(.2)	.02
21. Side Abrasion	1	(.1)	.01
22. Eye cut	1	(.1)	.01
23. Stab Wound	1	(.1)	.01
24. Stitches	1	(.1)	.01
25. Contusion	1	(.1)	.01
26. Appendicitis	1	(.1)	.01
<hr/>			
TOTAL:	274	(24.9)	2.85

*This may be under-reported since many burns
are probably listed under body parts.

** Rates = Complaints per 1000 population per day.

H. ORTHO - ORTHOPEDIC COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Back Complaints	134	(12.2)	1.4
2. Ankle (Pain/Strain)	69	(6.3)	.72
3. Knee	57	(5.2)	.60
4. Foot	34	(3.1)	.35
5. Shoulder	25	(2.3)	.26
6. Thumb/Finger	23	(2.1)	.24
7. Strain/Sprain	22	(2.0)	.23
8. Hand	19	(1.7)	.19
9. Wrist	19	(1.7)	.19
10. Pulled Muscle	12	(1.1)	.13
11. Leg	12	(1.1)	.11
12. Arm (Strain/Pull)	11	(1.0)	.11
13. Elbow	11	(1.0)	.11
14. Tendonitis	10	(.9)	.10
15. Neck	9	(.8)	.09
16. Rib Injury	8	(.7)	.08
17. Hip Injury	8	(.7)	.08
18. Orthopedic, unspecified	7	(.6)	.07
19. Joint Problems	5	(.5)	.06
20. Head/Face	4	(.4)	.05
21. Foot (Swollen)	3	(.3)	.03
22. Chest Pain	3	(.3)	.03
23. Hernia	2	(.2)	.02
24. Arthritis	2	(.2)	.02
25. Fracture	2	(.2)	.02
26. Groin Injury	1	(.1)	.01
27. Collarbone	1	(.1)	.01
28. Coccyx Fracture	1	(.1)	.01
29. Flat Feet	1	(.1)	.01

TOTAL: 516 (46.7) 5.35

* Rates = Complaints per 1000 population per day.

I. ENT- EAR, NOSE AND THROAT COMPLAINTS

	Eleven-day Total	Ave./Day	Rates*
1. Sore Throat	163	(14.8)	1.69
2. Earache	36	(3.3)	.38
3. Sinusitis	34	(3.1)	.35
4. Nosebleed (Epistaxis)	11	(1.0)	.11
5. Nasal/Sinus Congestion	9	(.8)	.09
6. Ear	9	(.8)	.09
7. Strep Throat	8	(.7)	.08
8. Nasal Injury	2	(.2)	.02
9. Nose	2	(.2)	.02
10. ENT, unspecified	2	(.2)	.02
11. Hearing Loss	1	(.1)	.01
12. Laryngitis	1	(.1)	.01
<hr/>			
	TOTALS: 278	(25.3)	2.90

* Rates = Complaints per 1000 population per day.

J. OPT. - OPHTHALMOLOGICAL COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Eye, unspecified	29	(2.6)	.30
2. Eye Irritation	12	(1.1)	.13
3. Conjunctivitis	9	(.8)	.09
4. Eye Drops	7	(.6)	.07
5. Object in Eye	6	(.5)	.06
6. Eye Abrasion	6	(.5)	.06
7. Fuel in Eye	6	(.5)	.06
8. Eye Laceration	4	(.4)	.05
9. Eye Pain	3	(.3)	.03
10. Chemical Burns	2	(.2)	.02
11. Eye Examination	2	(.2)	.02
12. Broken Glasses	2	(.2)	.02
13. Swelling under Eye	1	(.1)	.01
<hr/>			
TOTALS:	89	(8.1)	.93

* Rates = Complaints per 1000 population per day.

K. GYN - GYNECOLOGICAL COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. GYN, unspecified	3	(0.3)	.80
2. Menstrual Cramps	3	(0.3)	.80
3. Pregnancy	1	(0.1)	.80
4. Yeast Infection	1	(0.1)	.27
5. Vaginitis	1	(0.1)	.27
6. Spotting Blood	1	(0.1)	.27
7. Contraception/Pills, Foam	1	(0.1)	.27
<hr/>			
TOTAL:	11	(1.0)	2.66

* Rates = Complaints per 1000 population per day.

L. AWI - ADVERSE WEATHER INJURY COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Cold Feet	17	(1.5)	.17
2. Frostbite (suspected)	14	(1.3)	.15
3. AWI, unspecified	10	(0.9)	.10
4. Cold Exposure	6	(0.5)	.06
5. Cold Weather Evaluation	3	(0.3)	.03
6. Dehydration	3	(0.3)	.03
7. Cold Hands	2	(0.2)	.02
8. Numb Feet	2	(0.2)	.02
9. Chills	2	(0.2)	.02
10. Pain in Feet	2	(0.2)	.02
11. Swollen Feet	2	(0.2)	.02
12. Trench (Immersion) Foot	2	(0.2)	.02
<hr/>			
TOTALS:	62	(5.6)	.64

* Rates = Complaints per 1000 population per day.

M. DENT - DENTAL COMPLAINTS

	Eleven-day Totals	Ave./Day	Rates*
1. Toothache	38	(3.5)	.40
2. Dental, unspecified	31	(2.8)	.32
3. Lost Filling	5	(0.5)	.06
4. Abcess	5	(0.5)	.06
5. Tooth Injury	4	(0.4)	.05
6. Tooth Extraction	3	(0.3)	.03
7. Wisdom Tooth/growing or impacted	2	(0.2)	.02
8. Decay/Cavity	1	(0.1)	.01
9. Displaced Teeth	1	(0.1)	.01
10. Teeth Cleaning	1	(0.2)	.01
11. Swollen Gums	1	(0.1)	.01
<hr/>			
TOTAL:	92	(8.4)	.96

* Rates = Complaints per 1000 population per day.

X. SUPL - SUPPLY REQUESTS

	Eleven-day Totals	Ave./Day	Rates*	
1. RX Refill	17	(1.5)	.17	
2. Bandages/Dressing	6	(0.5)	.06	
3. Cold Pack	5	(0.5)	.06	
4. Supl/unspecified	3	(0.3)	.03	
5. Glasses	2	(0.2)	.02	
6. Bacitracin Ointment	1	(0.1)	.01	
7. Face Mask	1	(0.1)	.01	
TOTAL:		35	(3.2)	.37

* Rates = Complaints per 1000 population per day.

Appendix B

Cold Weather Injury

Case Histories

		Page
Case 1	Suspected hypothermia	B2
Case 2	Suspected frostbite - nose	B2
Case 3	Suspected frostbite - ears	B3
Case 4	Suspected frostbite - fingers	B3
Cases 5-6	Suspected trenchfoot	B4
Cases 7-16	Suspected frostbite - feet	B5-B9

CASE HISTORIES

Case 1. Suspected hypothermia (probably mild).

Individual: 20 year old, male, racial identity unrecorded, E-1.

Signs/Symptoms: Measured rectal temperature 97^oF after cold water immersion. There was some delay in obtaining body temperature.

Reported: 0530, 11 January 1980.

Exposure: True story not known. Individual was reportedly found in Black River, where the water temperature was 40^oF, and air temp. 29^oF. He was immersed for only a few minutes before being found by "joggers". He was wrapped in blanket, taken to nearby medical clinic. Weather conditions involved freezing rain and subject was clad only in underwear.

History: Florida resident, no other history obtained.

Case 2. Suspected frostbite of the nose (first degree, mild).

Individual: 20 year old, male, Puerto Rican, E-3, tank driver.

Signs/Symptoms: Tingling of nose, some blistering and discomfort.

Reported: 12 January 1980.

Exposure: On the 10th of Jan he was on a 4-5 h road march (tank) with temperatures 5-15^oF, and experienced tingling of nose. On the 11th he drove vehicle with his head out of the hatch while wearing two face guards, temperatures 29-43^oF. On the 12th, he reported to clinic after someone observed a bleb on his nose.

History: Puerto Rican resident, stationed at Fort Knox, KY with no prior experience with cold freezing weather. History of difficulty breathing in cold air, particularly during P.T. exercise. Reported being more sensitive to cold than others. Dislikes cold very much. Had classes and films on cold injury prevention. Light smoker and does not consume alcohol, or coffee. Was not on medication.

Case 3. Suspected frostbite of ears (official diagnosis: ischemic injury due to compression and possible contact dermatitis).

Individual: 24 year old, male, white, E-5, TOW section chief, (armored personnel carrier commander).

Signs/Symptoms: Sore painful ears, stinging from cold air exposure, with redness and swelling.

Reported: 17 January 1980.

Exposure: Exposed to cold wet weather before injury on 16 Jan, wore face guard and CVC helmet with earphones over pile cap which compressed top of ears throughout 12-14 hour FTX spent mostly standing up in vehicle hatch. Ears felt "relief" when finally released. Next day, after 5 min in cold air, face and ears were stinging and tops of ears were red and then swollen and itching.

History: Raised in Puerto Rico, stationed at Fort Knox, KY. No prior experience with cold weather, but received a great deal of instruction and some field training in cold injury prevention. Reported being more sensitive to cold than others. Dislikes cold very much. Doesn't smoke or consume alcohol. Drinks caffeinated beverages daily in small amounts. Not on any medication at the time.

Case 4. Suspected frostbite of fingers (not confirmed).

Individual: 21 year old, male, black, E-2, Redeye missile technician, serving as infantry scout.

Signs/Symptoms: Pain and blanching of feet, fingers; tips cool, tender, but without blistering or anesthesia.

Reported: Saw medic at 1600 on 23 January 1980.

Exposure: Exposed to cold dry weather before injury while standing guard on 20 Jan. Engaged in very active physical work prior to sedentary duty. Returned from field 23 Jan still suffering some discomfort, especially while taking a shower.

History: Raised in Cleveland, stationed at Fort Knox, KY. Slight amount of experience with cold freezing weather. Frostnip on hands two years ago. Dislikes cold very much. Slight amount of instruction and field training in cold injury prevention. Doesn't smoke and occasionally consumes alcohol and caffeinated beverages. Was taking aspirin daily.

Case 5. Suspected trenchfoot (not confirmed).

Individual: 19 year old, male, Hispanic, E-3, telecommunications specialist (Air Force).

Signs/Symptoms: Complained of athlete's feet. Medic observed cellulitis of right foot and suspected trenchfoot.

Reported: Exposed 13 January, reported 23 January 1980.

Exposure: Went through puddle wearing A.F. mukluks 10 days prior, when air temperature was 21^oF. Engaged in somewhat active physical work prior to exposure.

History: From Bakersfield, CA, stationed at Patrick AFB, FL, with no prior experience with freezing weather. More sensitive to cold than others. Dislikes cold very much. Has had a moderate amount of classroom instruction in cold injury prevention but no field training. Doesn't smoke, consumes a little bit of caffeinated beverages and occasionally drinks alcoholic beverages. Has been taking aspirin for the past three days.

Case 6. Suspected trenchfoot (not confirmed).

Individual: 21 year old, male, white, E-1, combat engineer.

Signs/Symptoms: Medic observed pale, cold, flaky feet during routine check. Subject had no discomfort and was not concerned, but was ordered evacuated by ambulance.

Reported: 21 January 1980.

Exposure: Went to field 18 Jan, was exposed to cold weather and involved in slightly active physical work. Stayed over night in APC on 20 Jan, waiting for mission which never came. Did get out to walk occasionally but got little sleep. Reported he was unable to change socks.

History: Raised in New Hampshire and had a great amount of experience with freezing weather. Enjoys cold weather very much. However, feet often sweat when exposed to cold conditions. Stationed at Fort Knox, KY. Had a slight amount of classroom instruction and field training in cold injury prevention. Was on no medication, occasionally consumes alcohol and caffeinated beverages, and is a daily moderate smoker.

Case 7. Suspected frostbite of the feet (not confirmed).

Individual: 22 year old, male, black, E-2, infantry.

Signs/Symptoms: Feet hurt while in sleeping bag.

Reported: Occurred 18 Jan, reported 19 Jan 1980, 1000 hours.

Exposure: In the field 3 days, wearing VB boots, changed socks three time, exposed to cold weather prior to injury. Slept in sleeping bag on ground and experienced cold aching feet.

History: Born in Minnesota but raised in deep South, stationed at Fort Stewart, GA. Doesn't care for cold weather. Has had a slight amount of expericnce and a great deal of instruction in cold injury prevention. Drinks caffeinated beverages quite a bit and is an occasional smoker and drinker. Was not on medication.

Case 8. Suspected frostbite of the feet (not confirmed).

Individual: 20 year old, male, black, E-3, infantry.

Signs/Symptoms: Complained of cold feet, noticed whiteness, boots felt tight.

Reported: 20 January 1980.

Exposure: Went to field 18 Jan. Weather was cold wet with some slight snow (30°F). In APC on 19 Jan, feet were "white", but rewarmd; on 20 Jan did not rewarm, so went to medic. Complained that there were no heaters or warm up tents. VB boots seemed too tight, but he removed them occasionally.

History: Moderate amount of experience with freezing weather; believes he had frostbite at age 4. Usually has problems with cold feet. Doesn't care for cold weather. Raised in New Jersey, stationed at Fort Stewart, GA. Daily moderate smoker, occasionally drinks caffeinated beverages but no alcohol. Was not on medication.

Case 9. Suspected frostbite of feet (not confirmed).

Individual: 18 year old, male, white, E-1, bridge specialist, serving as infantry.

Signs/Symptoms: Painful swollen feet.

Reported: Exposed 20 Jan 1980 then saw medic.

Exposure: Went to field 16 Jan, with the Special Forces. Exposed to cold wet weather before injury, spent most of previous night walking until feet cold and numb. Seen by medic who warmed feet by fire and evacuated him to rear. Patient felt it was not serious and wanted to return to field.

History: Raised in Iowa, stationed at Fort Knox, KY. Moderate amount of experience with freezing weather and feet get cold easily. Finds cold weather tolerable. Moderate amount of classroom instruction and field training in cold injury prevention. Heavy smoker, and consumes alcohol and caffeinated beverages occasionally. Was not on any medication at the time.

Case 10. Suspected frostbite of the feet (not confirmed).

Individual: 20 year old, male, white, E-1, combat engineer.

Signs/Symptoms: Complained of cold numb feet; toes ached and tingled when rewarmed.

Reported: Exposed to adverse conditions 20 January 1980.

Exposure: Exposed to cold wet weather prior to being seen by medic. Went to field 18 Jan, stayed in APC over night the 20th, (same section as Case #6) with only slight amount of physical activity. Complained he had only C-rations for breakfast and lunch, and cold dinner with one cup of coffee.

History: Raised in Ohio, stationed at Fort Knox, KY. Reported that cold usually bothers him, that hemorrhoids are aggravated by the cold. Doesn't care for cold weather in general. No classroom instruction and no field training in cold injury prevention. No medication, a moderate smoker, consumes alcohol occasionally and drinks caffeinated beverages daily in small amounts. Was not on medication.

Case 11. Suspected frostbite of the feet (not confirmed).

Individual: 19 year old, male, white, military police.

Signs/Symptoms: Red flaky skin, numb, cold feet.

Reported: Exposed on 20 Jan 1980, reported to medic at 2030 on 21 Jan.

Exposure: On guard duty for approximately 6 hours, wearing VB boots. Was not active and socks were wet.

History: Raised in Indiana, duty station Fort Knox, KY. Slight amount of experience with cold, and says cold weather usually bothers him. Moderate amount of instruction and no field training in cold injury prevention. Was on medication (unspecified), smokes, and occasionally consumes alcohol and caffeinated beverages.

Case 12. Suspected frostbite of the feet (not confirmed).

Individual: 25 year old, male, black, E-5, fire support specialist.

Reported: 1830 hours on 21 January 1980.

Exposure: Went to the field 18 Jan; vehicle heater failed that night. Little sleep, but occasionally rewarmed in cold sleeping bag. Started with combat boots, plus overshoes, and changed socks faithfully, but was exposed to cold wet weather, so changed to VB boots. On 20 Jan, noticed VB boots were too tight and noticed swelling on 21 Jan, reported to medic, then to aid station. Involved in slight active work before injury.

History: Duty station Fort Knox, KY; from Cincinnati, had 2 year tour in Germany. Reported having history of poor circulation in hands and feet. Slight amount of experience with cold freezing weather. Doesn't care for cold weather. Moderate amount of classroom instruction and a slight amount of field training in cold injury prevention. Occasionally consumes alcoholic and caffeinated beverages. Moderate smoker and on no medication at the time.

Case 13. Suspected frostbite of the feet (not confirmed).

Individual: 19 year old, male, black, E-1 tank driver, serving as loader.

Signs/Symptoms: Cold, numb feet; pain on bottom of left foot and toes after rewarming.

Reported: 1030 hours on 22 January 1980.

Exposure: Exposed to cold dry weather before injury and on 21 Jan at 2100 the heater of tank went out. Bothered by pain in feet and toes, so changed socks. Slept in tank and feet felt colder so changed from combat boots to VB boots at 0600 on 22 Jan. Involved in slightly active work before these conditions.

History: From Florida, stationed at Fort Knox, KY. This was first exposure to freezing weather but reports feet get cold easily under mildly cold conditions. Dislikes cold very much. Moderate amount of instruction and slight amount of field training in cold injury prevention. Smokes occasionally, consumes alcohol and caffeinated beverages daily and on no medication.

Case 14. Suspected frostbite of the feet (not confirmed).

Individual: 20 year old, male, white, E-3 combat engineer.

Signs/Symptoms: Cold feet, 1 cm blister on right great toe.

Reported: 1500 hours on 22 January 1980.

Exposure: Went to the field on the 18th; on 22 Jan was immobile in unheated 2-1/2 ton truck for 4-5 hours in combat boots and overshoes (no VB boots). Involved in somewhat active work before injury.

History: From Chicago, IL and had a great amount of experience with freezing weather. Stationed at Fort Knox, KY. Enjoys cold weather very much. Generally feels warmer than others in cold. Moderate amount of instruction and field training in cold injury prevention. Heavy smoker, consumes alcohol on occasions and drinks caffeinated beverages daily. Was on no medication.

Case 15. Suspected frostbite of the feet (not confirmed).

Individual: 20 year old, male, white, E-4 cavalry scout.

Signs/Symptoms: Toes were numb, feet wet and cold.

Reported: Exposure occurred 22 Jan 1980, reported the same day.

Exposure: Exposed to cold wet weather before injury. Fell on ice and injured knee. Feet were wet from perspiration. Seen by medic who removed boot and kept foot elevated and exposed to wind for 45 min in an unheated APC. Foot numb when tried to walk. Somewhat active prior to injury.

History: Stationed at Fort Knox, KY. Slight amount of experience with freezing weather, moderate amount of instruction and field training in cold injury prevention. Generally colder than others in cold weather. Dislikes cold very much. Doesn't smoke, occasionally drinks alcohol and drinks coffee daily. Not on any medication at the time.

Case 16. Suspected frostbite of feet (not confirmed).

Individual: 26 year old, male, white, E-5 combat engineer squad leader.

Signs/Symptoms: Cold sore feet.

Reported: 22 January 1980.

Exposure: Went to field on 16 Jan. No heat in APC for 5 days. Cramped in APC, so had little chance to stretch out; dismounted only for chow. Got 2 "warm" meals/day but were often late and cold. Got little to drink and was often thirsty. Seen by medic after 24 h of foot discomfort, evacuated to rear 22 Jan.

History: Raised in Florida, stationed at Fort Stewart, GA but had previous tour in Korea, where he had frostnip on nose and frequent foot problems ("fungus") from wearing VB boots. Moderate experience with cold weather, moderate instruction and training. Dislikes cold very much. Doesn't smoke, occasional coffee and alcohol drinker. Was not taking medication.

APPENDIX C

Interview Form and Summary of Interview Data*

Explanation: The table in this Appendix gives the percent of individuals within each medical category who responded to the Item listed. Specifically, it gives the percent of those with type of complaint who responded to one choice (such as NOT AT ALL) of each listed question of the interview. For example, the first entry for URI, is 3.8 which means that 3.8 percent of 137 (the number of URI cases interviewed) or approximately 5 people responded "NOT AT ALL" to the question "Do you drink caffeinated beverages (coffee, tea, or colas)?" (See copy of interview question 6).

- | | |
|---------------------------------------|-------------------|
| 1. Copy of Interview Form | Pages C-2 and C-3 |
| 2. Table C. Summary of Interview Data | Page C-4 |

* Caution should be taken in interpreting these data since interviews were not scheduled on a random basis. The NP and OPT percentages for females, for example, are much higher than that found in the more complete medical log records (see Figure 4). Table C data, therefore, are to be considered descriptive of this study only.

APPENDIX C

BACKGROUND MEDICAL HISTORY (fill in or circle)

1. Age: _____ (yrs)
2. Sex: 01 MALE 02 FEMALE
3. Height: _____ (ft + in)
4. Weight: _____ (lbs)
5. Race: 01 Black 02 White 03 Other: _____
6. Do you drink caffeinated beverages (coffee, tea, colas)?
01 Not at all 03 Daily, a little bit
02 Occasionally 04 Daily, quite a bit
7. Do you drink alcoholic beverages (beer, mixed drinks, wine, etc.)?
01 Not at all 03 Daily, a little bit
02 Occasionally 04 Daily, quite a bit
8. Do you smoke (cigarettes, pipes, etc.)?
01 Not at all 03 Daily, light to moderate smoker
02 Occasionally 04 Daily - heavy smoker
9. In the last week have you been on medication - drugs?
01 Not at all 03 Daily, mild doses
02 Occasionally 04 Daily, moderate to heavy doses

MILITARY HISTORY:

10. Years in Active Military Service _____ yrs.
11. Military Rank E _____ or W.O. _____ or O _____
12. Primary job position (MOS or SSI number): _____ Title: _____
13. Duty job position (MOS or SSI number): _____ Title: _____
14. Do you consider the military your career? 01 Yes 02 No 03 Maybe
15. Your official duty station: _____
16. Present Branch of Service: 01 Army 02 Air Force 03 Navy 04 Marines
05 Other: _____
17. How much experience have you had with freezing weather or cold climates?
01 No Experience 03 A Moderate Amount
02 A Slight Amount 04 A Great Amount
18. In general, how do (would) you feel about living in a geographical area having cold winters?
01 I (would) really enjoy it. 03 I don't (wouldn't) care for it.
02 I (would) tolerate it. 04 I (would) dislike it very much.

Continue To Next Page

19. Check the activities you have done in cold weather:

- | | | |
|---|---|---|
| <input type="checkbox"/> Snow Skiing | <input type="checkbox"/> Ice Fishing/Skating | <input type="checkbox"/> Shoveling Snow |
| <input type="checkbox"/> Snow Shoeing | <input type="checkbox"/> Ice Sailing | <input type="checkbox"/> Other |
| <input type="checkbox"/> Making a Snowman | <input type="checkbox"/> Snow Sledding/
Snowmobiling | <input type="checkbox"/> None of these |

20. Compared to others around you, in a cool or cold environment, how do you generally feel?

- | | |
|-----------------------------|---|
| 01 Colder than others | 03 Warmer than others |
| 02 About the same as others | 04 Have no idea how I differ from
others in this respect |

21. How much military classroom instruction have you had for taking care of yourself in cold weather?

- | | |
|--------------------|----------------------|
| 01 No Instruction | 03 A Moderate Amount |
| 02 A Slight Amount | 04 A Great Amount |

22. How much field training have you had on taking care of yourself in cold weather?

- | | |
|----------------------|----------------------|
| 01 No Field Training | 03 A Moderate Amount |
| 02 A Slight Amount | 04 A Great Amount |

23. How many times have you been treated by medical personnel for any of the following cold related injuries? Please give exact number.

- | | | |
|------------------------------------|--------------------------------------|---|
| Frostnip <input type="checkbox"/> | Chilblains <input type="checkbox"/> | Check if none of these <input type="checkbox"/> |
| Frostbite <input type="checkbox"/> | Hypothermia <input type="checkbox"/> | |

24. How many times untreated? Please give exact number.

- | | | |
|------------------------------------|--------------------------------------|---|
| Frostnip <input type="checkbox"/> | Chilblains <input type="checkbox"/> | Check if none of these <input type="checkbox"/> |
| Frostbite <input type="checkbox"/> | Hypothermia <input type="checkbox"/> | |

25. Do you have any special problem when you are exposed to cool or cold conditions?

- | | |
|-------|---------------------------------|
| 01 No | 02 Yes, Specify: _____
_____ |
|-------|---------------------------------|

Thank you for your help

APPENDIX C

Summary Of Interview Background Data By Diagnostic Category

(Table gives percent of individuals within category who responded to listed item)

Category:	URI	G.I.	DERM	N.P.	G.U.	MISC	A.T.	ORTHO	ENT	OPT	GYN	AWI	DENT
(No. Interviewed)	(137)	(21)	(39)	(8)	(11)	(33)	(23)	(80)	(55)	(6)	(2)	(16)	(17)
Caffeine: (Not at all)	3.8	10.0	8.9	0.0	9.1	9.4	0.0	9.1	7.8	50.0	0.0	6.3	0.0
Alcohol: (Not at all)	17.4	15.0	19.4	0.0	0.0	12.5	9.5	12.8	15.7	16.7	50.0	25.0	12.5
Smoking: (Not at all)	37.9	45.0	38.9	0.0	45.5	31.3	19.0	28.2	54.9	33.3	50.0	43.8	40.0
On Medication: (not at all)	74.8	70.0	82.9	71.4	72.7	68.8	85.7	76.0	76.5	66.7	50.0	87.5	81.3
Cold Experience: (Slight-None)	29.1	21.0	32.4	28.6	54.6	25.8	19.1	30.8	37.3	33.3	50.0	68.8	18.8
Cold Attitude: (Dislikes)	43.5	47.3	59.4	42.9	63.7	40.7	30.0	55.9	47.1	50.0	100	68.8	43.8
Cold Activities: (None)	15.6	10.5	16.7	0.0	30.0	13.8	10.5	18.9	21.7	0.0	50.0	25.0	21.4
Cold Sensitivity: (Colder/Others)	18.0	21.1	20.0	28.6	40.0	13.8	10.5	14.9	13.0	20.0	0.0	37.5	28.6
Cold Instruction: (None)	7.0	0.0	5.7	14.4	20.0	10.3	15.8	4.1	6.7	0.0	50.0	6.3	0.0
Field Training: (None)	32.8	15.8	27.3	28.6	50.0	31.0	21.1	19.4	19.6	20.0	100	18.8	21.4
Prior Cold Inj. (Treated)	3.2	5.3	6.1	0.0	0.0	3.4	0.0	10.0	6.5	0.0	0.0	20.0	0.0
Prior Cold Inj. (Untreated)	5.8	5.3	6.2	14.3	0.0	3.6	0.0	9.0	4.6	20.0	0.0	12.6	0.0
%Cases Female:	10.9	19.0	2.6	37.5	18.2	12.1	13.0	5.0	5.5	33.3	100	0.0	5.9
Cases by Unit:													
AFFOR	17.5	14.3	12.8	25.0	18.2	27.3	13.0	5.0	43.6	0.0	50.0	43.8	0.0
COSCOM	40.1	23.8	23.1	0.0	36.4	15.2	13.0	37.5	23.6	33.3	0.0	0.0	47.1
OPFOR	16.8	9.5	10.3	0.0	27.3	33.3	47.8	22.5	5.5	16.7	0.0	56.3	0.0
ARPOR	25.5	47.6	48.7	75.0	18.2	24.2	26.1	33.7	27.3	50.0	50.0	0.0	52.9
Cases by Race:													
Black:	32.8	23.8	38.5	37.5	45.5	27.3	26.1	42.5	27.3	16.7	50.0	31.3	41.2
White:	59.9	66.7	51.3	62.5	54.5	60.6	56.5	50.0	61.8	83.3	50.0	56.3	52.9
Other:	3.6	4.8	5.1	---	---	3.0	4.3	5.0	3.6	---	---	12.5	5.9
Mean Age(Yrs):	24.4	23.7	23.3	21.0	22.1	26.8	23.6	24.5	26.1	22.2	22.0	21.4	22.2

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