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A STUDY OF THE EARLY AEROMEDICAL EVACUATION OF VIETNAM CASUALTIES

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Brooks Air Force Base, Texas

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FOREWORD

This work was done in the Medical Computing Branch, Biometrics Division, under task No. 631903. The study was accomplished during 1968. The paper was submitted for publication on 18 January 1970.

This report has been reviewed and is approved.


JOSEPH M. QUASHNOCK
Colonel, USAF, MC
Commander

ABSTRACT

A study has been made of 3,987 trauma patients who were evacuated by air from Vietnam during the period 8 July to 8 September 1968. This report presents descriptive statistics prepared in the Biometrics Division, USAFSAM, concerning the group as a whole and also subgroups classified by service, by type, location, and severity of injury, by date of leaving Vietnam, and by interval from wounding to evacuation.

The mean time of departure from Vietnam was 7 days after injury and of departure from the Far East for the United States was 21 days after injury. Approximately 7% of the patients were considered to be critically ill, and almost 50% were moved with some appliance which complicated their care. A total of 20 deaths occurred during the period of observation (an overall death rate of 0.5%).

The picture obtained is of a system which moves large numbers of seriously injured patients efficiently, effectively, and safely and produces virtually no adverse effects on the patients whom it serves.

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I. INTRODUCTION

In April 1968, the Command Surgeon, Pacific Air Forces, requested in a letter to the Surgeon, Air Force Systems Command, that a joint study be undertaken of the effects of early aeromedical evacuation of severely wounded casualties. As a result of this request, a meeting was held at Hickam AFB, Hawaii, in late April involving personnel from the office of the PACAF Surgeon, from Headquarters, Aerospace Medical Division, and from the Biometrics Division of the USAF School of Aerospace Medicine.

At this meeting, a plan was evolved under which PACAF and AMD personnel would be primarily responsible for field collection of data while the Biometrics Division, USAFSAM, would undertake two specific portions of the problem: (1) the design of a suitable form which would facilitate recording of data at the casualty staging flights and yet would

present the information in a format optimal for analysis; and (2) the data processing phase including assembling the records, coding them, checking them for errors, and preparing them for computer analysis plus the computer programming necessary to store, analyze, and report the data back to the PACAF Surgeon. This technical report deals essentially with the second of these activities—namely, the data processing.

The data consist of case records of 3,987 trauma victims evacuated by air from Vietnam during the period 8 July to 8 September 1968. They were recorded by medical NCOs who were stationed for the period of the study at the principal sites of exit from Vietnam, at anticipated junction and transfer points within the Far East and Pacific areas, and at selected bases within the United States which were the terminals for most of the aeromedical evacuation flights (fig. 1). They were recorded on a specially designed form utilizing checklists,



FIGURE 1

Map showing junction points in aeromedical evacuation routes.

wherever possible, to give information concerning the agent of injury, the type and location of injury sustained, pertinent observations regarding the patient's condition before and after each leg of the flight, appliances or other specific problems which might have been expected to complicate the patient's travel, and specific events occurring during the flight. In addition, there were sections of the form for recording, in free text, surgical procedures before evacuation and during each stop en route and also problems arising during the evacuation for which a checklist entry was not provided (fig. 2).

The study was designed to provide a survey of the aeromedical evacuation system in general terms: the types of patients flown and the relative frequency of each type, at approximately what time relative to injury and surgery they were flown, and the general classes of problems which arise in the system. It was not designed to support detailed inferences regarding the relative effects of evacuation at various time periods within the patient's course nor to serve as the basis for detailed policy recommendations. However, it was hoped that the general survey of this kind would provide useful information to be used in the design of further, more detailed, studies of problems of special interest.

The report will be divided into four major sections. The first section will discuss the limitations of the data, especially the problems of incomplete and missing data and of some obvious recording errors. This section is not intended to reflect criticism on the recorders who performed admirably under stressful and, at times, trying circumstances, but is nevertheless necessary as a caution to those who may subsequently study these data. The errors and omissions are not of a degree that prevents use for descriptive purposes and for characterization of general trend. They are, however, sufficient to preclude the use of the data for

detailed analysis. An attempt to overinterpret the data could well lead to erroneous conclusions. The second part will be a general summary description of the group as a whole and of several subgroups classified by service, by type of injury, and by various time definitions. The third section will be a more detailed look at certain groups of special interest. This section may also suggest additional special questions which can be answered from the data. The fourth section will contain some general recommendations for possible additional studies.

II. THE DATA—QUALITY AND LIMITATIONS

Success of followup

As may be seen from figure 3, 4,824 case numbers were assigned, of which records were ultimately received at the School of Aerospace Medicine for 3,987. Of these, all but an insignificant number had a complete description of the first leg, including status before and after the flight. Twenty patients or approximately 0.5% died during or after the first leg, and approximately 4% returned to duty. Almost 500 records contained no further description of the patient's subsequent condition, although 205 of them were marked as having been evacuated to the Continental United States (CONUS). Of the remainder, 1,679 were still hospitalized either within the Far East or Pacific area at the end of the study, while 1,622 records contained the description of the patient at the beginning of a flight which should have terminated in CONUS, but of this number 284 records became separated from the patients during flight and were received with no postflight information. This leaves a final group of 1,338 records for which a completely documented flight to CONUS was available.

The fact that, of the 4,824 records initiated, slightly over one-sixth were never received



FIGURE 2

Front and back of recording form.

PATIENT AND EVACUATION LOG

IDENTIFICATION

1. NAME (Last, First, Middle Initial) _____ 2. GRADE _____ 3. SERVICE _____ 4. UNIT _____ 5. POSITION _____

6. DATE OF BIRTH _____ 7. SEX _____ 8. ETHNICITY _____ 9. RELIGION _____

10. SOCIAL SECURITY NUMBER _____ 11. GRADE NUMBER _____ 12. CASE NO. _____

ENTRY DATA

1. DATE _____ 2. TIME _____ 3. LOCATION _____

DESCRIPTION OF INJURY CHECK

1. TYPE _____ 2. TIME _____ 3. LOCATION _____

AGENT OF INJURY

1. RIGHT ARM _____ 2. LEFT ARM _____ 3. HEAD _____ 4. CHEST _____ 5. ABDOMEN _____ 6. OTHER SPECIFY _____

DESCRIPTION OF INJURY

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

SURGICAL HISTORY

1. DATE _____ 2. TIME _____ 3. WHERE FACILITY _____

DESCRIPTION OF INJURY CHECK

1. TYPE _____ 2. TIME _____ 3. LOCATION _____

AGENT OF INJURY

1. RIGHT ARM _____ 2. LEFT ARM _____ 3. HEAD _____ 4. CHEST _____ 5. ABDOMEN _____ 6. OTHER SPECIFY _____

DESCRIPTION OF INJURY

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

PRESENT STATUS

1. CRITICAL/ILL _____ 2. UNCONSCIOUS _____ 3. NON-AMBULATORY _____ 4. UNSTABLE _____ 5. URINARY CATHETER _____ 6. URINARY CATHETER _____ 7. HYDRATION INADEQUATE _____ 8. FEMALE IUD _____ 9. RESPIRATORY DISTRESS _____ 10. RESPIRATORY DISTRESS _____ 11. OTHER IUD _____ 12. OTHER IUD _____

UNUSUAL EVENTS SPECIFIC TO PATIENT

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____

DISPOSITION OF PATIENT - END OF LEG

1. ADMITTED TO CAMP _____ 2. ADMITTED TO HOSPITAL _____ 3. MEDICAL COMPLICATIONS DURING STAY _____ 4. DEATH _____ 5. OTHER _____

PATIENT AND EVACUATION LOG

IDENTIFICATION

1. NAME (Last, First, Middle Initial) _____ 2. GRADE _____ 3. SERVICE _____ 4. UNIT _____ 5. POSITION _____

6. DATE OF BIRTH _____ 7. SEX _____ 8. ETHNICITY _____ 9. RELIGION _____

10. SOCIAL SECURITY NUMBER _____ 11. GRADE NUMBER _____ 12. CASE NO. _____

ENTRY DATA

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1. TYPE _____ 2. TIME _____ 3. LOCATION _____

AGENT OF INJURY

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1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____

PRESENT STATUS

1. CRITICAL/ILL _____ 2. UNCONSCIOUS _____ 3. NON-AMBULATORY _____ 4. UNSTABLE _____ 5. URINARY CATHETER _____ 6. URINARY CATHETER _____ 7. HYDRATION INADEQUATE _____ 8. FEMALE IUD _____ 9. RESPIRATORY DISTRESS _____ 10. RESPIRATORY DISTRESS _____ 11. OTHER IUD _____ 12. OTHER IUD _____

UNUSUAL EVENTS SPECIFIC TO PATIENT

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ 11. _____ 12. _____

DISPOSITION OF PATIENT - END OF LEG

1. ADMITTED TO CAMP _____ 2. ADMITTED TO HOSPITAL _____ 3. MEDICAL COMPLICATIONS DURING STAY _____ 4. DEATH _____ 5. OTHER _____

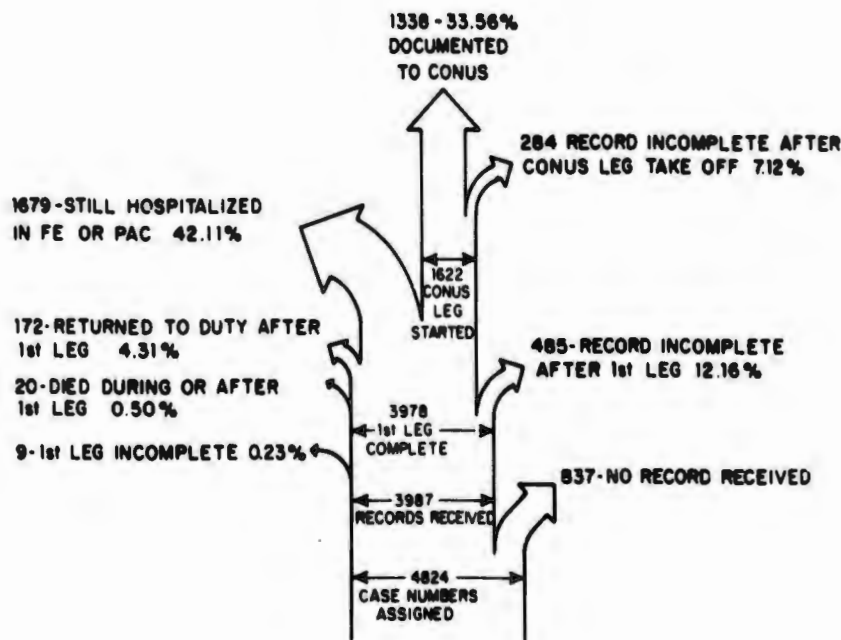


FIGURE 3

Diagram showing ultimate status of records initiated (percentage figures based on 100% = 3,987 records received).

and almost an additional one-sixth were partially incomplete, certainly weakens the study. However, there was no evidence of any systematic loss of records of patients of a given type and we therefore proceeded on the assumption that the patients for whom data are incomplete did not differ significantly from those for whom we have complete information and that, therefore, no bias is being introduced by the loss.

Missing data

As might be expected with data collected under these circumstances, the report forms were frequently incompletely filled out with one or more items missing. The degree to which the data were thus underrecorded is, in some cases, impossible to estimate, but for other segments of the data a reasonable approximation of the degree of incompleteness can be obtained. For example, the service identification was available in 98.5% of the cases. The day of injury was recorded in 93.4% of the cases, but unfortunately in the

small group of deaths, which are of particular interest, this figure was missing in 8 out of 20. Therefore, our information regarding the interval between injury and leaving Vietnam for this group is based on only 60% recording.

Some of the checklists were devised so that there was a place for both a "yes" and a "no" answer, and the recorders were asked to make some entry in one or the other. Despite this request there was no entry, positive or negative, for most of the items on about one-third of the records of patients as they left Vietnam and on more than 20% as they embarked on the transpacific leg. This obviously raises a serious question as to how to interpret the records in which no entry was made. In our summaries, we have counted only the "yes" or positive answers and calculated the percentage of the total for whom such a positive entry was made. This, in essence, assumes that those for whom no entry was made were, in fact, negative. However, we know this is not the case and therefore each of the percentage

estimates for the presence of unfavorable status items and/or appliances should be regarded as the minimum estimate and is almost certainly somewhat of an underestimate.

As an example of the possible degree of underrecording, we may consider the fracture patients. There were 1,471 fracture patients moved on the first leg, but of these only 877 were recorded as having either a cast or a splint or any traction device. Similarly, 682 fracture patients reached CONUS, of which only 343 were recorded as having a cast, traction, or splint. We are forced, then, to conclude either that between 40% and 50% of the fracture patients were moved without any immobilization appliance, or, as seems more likely, that the count of such appliances was severely underestimated.

Incorrect or inconsistent entries

In addition to the missing data, entries on the forms frequently appeared to be inconsistent or erroneous. Examples of this were the recording of a surgical procedure without any previously recorded injury in the general body area and inconsistencies in recording of dates, such as several cases where the date of the first leg of evacuation was earlier than the date of injury. In other cases, it appeared that the recorder had made entries in the "yes" column under "Present Status," when, in fact, he intended to make entries in the "no" column. If it was possible to positively identify an error and to insert correct information obtained from independent sources, we did so before the data were keypunched and entered into the computer. In other cases where we were virtually certain that an error had been made, but had no independent source of determining what the correct information should be, the items were simply deleted. In still other cases, although we were highly suspicious that an error had been made, if it seemed possible that the data as recorded were correct, they were allowed to stand. It is our feeling that errors introduced from this source do not vitiate conclusions based on the larger groupings such as those we have made, but they do indicate a danger if further detailed

analysis were to be done, resulting in subgroups that were much smaller in size than those presently considered.

Observer variation

Another source of a degree of variability and possible inconsistency in the data is the variation between observers which was noted. This is quite understandable since many of the observations were somewhat subjective and it was impossible to provide the observers with criteria which would insure absolute uniformity. In addition, the conditions under which the various observers worked varied widely and this, probably, has also contributed to such variation. Specifically, the observer stationed at the Naval Hospital in Guam appeared to be a very conscientious observer, and the records which he prepared contained a good deal more detail than those prepared at any other site. This may result partly from his personality, but almost certainly was also affected by the fact that he had only 357 patients on whom to make records, whereas the two observers in Japan had almost 10 times this number. Whatever the reason, there is a definite difference in the incidence of certain observations in the patients arriving at Guam as compared with those in Japan and probably a major share of this difference reflects the degree of care with which the complications were sought. For example, 7.1% of the patients arriving in Japan were recorded as having fever, whereas this figure was 41.5% of patients arriving in Guam. Only 0.1% of the patients arriving in Japan were recorded as having inadequate hydration; the corresponding figure for Guam was 8.9%; 2.8% of the patients arriving in Japan had draining wounds recorded compared with 14.8% of those arriving in Guam. The Guam-bound patients were almost exclusively Navy and Marine. This has the effect of causing it to appear that these complications as well as certain others were more frequent in Navy patients than in Army patients whereas the difference probably, to a large extent, is accounted for by observer variation.

Poorly defined or poorly planned items

The last category to which attention should be drawn is certain items which produced very

little information. If the information which they were intended to provide is essential, some thought will have to be given to rephrasing the questions or otherwise changing the manner of recording in subsequent studies. One of these was the item "Unsatisfactory Condition." Here the observers were given no good definition and the use of this category seemed to be that the observers indicated a subjective feeling that possibly this patient should not have been moved. The group was roughly one-half as large as the "Critically III" group, the latter seeming to coincide much more closely with the formal designation by a physician of the patient as "Seriously III" or "Very Seriously III."

A place was provided on the form in which the observer could indicate that a patient deteriorated in flight. Again, no good definition of what constituted deterioration was given the observers, and as a result this item was rarely used. Only 8 cases in about 4,000 were so described. Place was provided for the recording of "Unusual Environmental Events" and "Unusual Specific Events" and here, too, the incidence of positive responses was very low. Possibly this reflects the recording only of events which appreciably influenced the patient's condition. In any case, these entries contributed little to the overall objectives of the study. Another item of interest during our discussions prior to the study was the frequency with which flights were aborted after the patients had been loaded on the aircraft. In the entire course of the study only one such flight was documented, involving only 12 patients; so one must conclude either that this is a rare event or that the recorders did not record it when it occurred.

III. GENERAL DESCRIPTION

Group as a whole (tables I and II)¹

The mean age of the entire group was 21.8 years. Roughly 60% of the group were Army; 35% were Navy and Marines; about 1% were Air Force; and the remainder were civilians or foreign nationals or their service affiliation was not recorded.

CASUALTIES BY TYPE OF INJURY

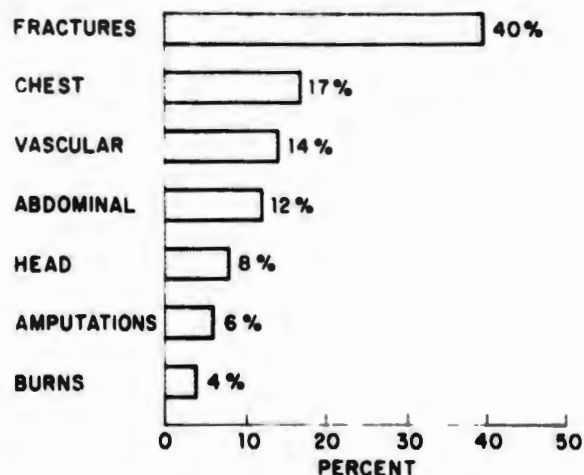


FIGURE 4

Commonest types of injury.

The most common agents of injury were fragmentation devices of various types, and the commonest type of injury was soft tissue injury to multiple extremities. Almost 40% of the patients had fractures; 14% had vascular injury; and 6% had amputations. Somewhat over 17% had chest injuries; approximately 12% had abdominal injuries; 8% had head injuries of various types; and 4% had burns (fig. 4). Nearly one-half of the group were moved with some appliance—cast, IV, tube, etc.—which complicated their care. Three-fourths were nonambulatory at the time they were moved, and about 1% were described as unconscious. Almost 7% of the patients were designated as critically ill either at the beginning or at the end of the first leg of their flight. The mean time of departure from Vietnam was just under 7 days after their injury and the mean time of departure for CONUS was 21 days after injury. These time distributions will be discussed in more detail later. Of the entire group, approximately 4% had returned to duty by the end of the study, 42% were still hospitalized in either the Far East or Pacific area, 46% had been evacuated to CONUS, and the status of 7% could not be

¹All tables mentioned in this report appear in appendix I.

determined. During the period of the study 20 patients died (an overall death rate of 0.5%).

Subgroups by service (tables III-VI)

An interesting comparison can be made between the patients of the various military services. As was stated earlier, the Army provided roughly 60% of the total cases, Marines and the Navy together about 35%, and the Air Force about 1%. The spectrum of injury types was somewhat different, with the Air Force having the highest percentage of burned casualties and the Marine and Navy group also showing relatively more than the Army group. Conversely, the rate of vascular injuries was higher in the Army group than in either of the other two groups. The Air Force had the highest fracture rate, followed by the Army, with the Marines and Navy definitely lower. Whether this represents a difference in the type of injury sustained by the three groups or whether this reflects a policy difference in the type of cases selected for evacuation cannot be determined from the data. A quite definite and striking difference is seen in the time after the injury when the various groups left Vietnam. The mean time of departure for the Navy-Marine group was about 5½ days, whereas for the Army it was almost 8 days. The figure for the Air Force, although based on a much smaller group of patients, more nearly approximated that of the Army. On the other hand, the Army and the Navy-Marine groups differed very little in the time after injury at which they departed for CONUS; thus the Navy-Marine group left Vietnam earlier by almost 3 days, but spent a correspondingly longer period of time hospitalized elsewhere in the theater before being transported to CONUS. The time of departure for CONUS for the Air Force group is very much shorter, but there were only 4 patients in the group, so that this mean time figure is rather meaningless. Of the group evacuated from Vietnam, roughly 50% of the Navy-Marine patients eventually were evacuated to CONUS as compared with 44% of the Army and only 32% of the Air Force patients. Conversely, the highest percentage of casualties

returned to duty was shown by the Air Force, with the Army second and the Navy-Marine group last. This suggests that possibly the Navy-Marine physicians are retaining within Vietnam, for definitive treatment, a higher percentage of the more mildly injured patients, but there may well be other factors which are not reflected in these data.

Subgroups by type of injury (tables III, VII-X)

Burns. There were 174 patients with burns, representing 4.4% of the total group. Of the burned group, 45% were Navy and Marine, which is a higher percentage than that of Navy-Marine in the group as a whole. The most striking feature of the burned group is the rapidity with which they were evacuated from Vietnam. As might be expected, this was a very seriously injured group and slightly over 20% were critically ill at the time of the first flight. Another index is that many of them were receiving an IV during this first flight. Of the burned group, 6 patients died giving a death rate of 3.4%, considerably higher than for the group as a whole. On the other hand, the percentage who returned to duty within the period of the study was almost twice that for the group as a whole. Approximately 40% of them were moved to CONUS, but this CONUS leg took place, on the average, on the 14th day, which is almost 7 days earlier than for the group as a whole.

Fractures. There were 1,471 patients documented as having fractures of one or more sites. As was mentioned earlier, the Navy-Marine group tended to be somewhat underrepresented in the fracture patients. The mean time of leaving Vietnam for the fracture group was approximately 6½ days after wounding or very nearly that of the group as a whole, but on the average they left for CONUS about 1 day earlier than the overall group. Understandably, they had a high incidence of appliances but, as already mentioned, it is felt that even this is considerably underreported. It should probably be noted that of this group, 63 patients flew with a wired jaw,

despite our previous understanding that this was felt to be a relative, if not an absolute, contraindication to aeromedical evacuation flight. Some further comments about this group will be made later in the report. Of the entire fracture group, over 50% were evacuated to CONUS within the period of observation, which probably reflects the relatively long period of convalescence anticipated for most of the group.

Soft tissue injuries. The patients with soft tissue injuries were separated into two categories: those with a soft tissue injury confined to a single extremity and those with soft tissue injuries involving either more than one extremity or an area of the body other than an extremity. However, other associated injuries were not eliminated from either of the groups. The group with a single soft tissue injury, therefore, represented a somewhat more mildly wounded group, but not as much so as would have been the case had associated fractures, burns, etc. been eliminated. The single soft tissue injury group left Vietnam almost one day earlier than the study group as a whole, whereas the group with multiple soft tissue injuries lagged behind the overall group by nearly a day. A similar disparity was seen in the departure time for CONUS. The single soft tissue injury group moved, on the average, about the 19th day, and the multiple soft tissue injury group moved on the 23d day as compared to the overall average of 21 days. The single soft tissue injury group had a lower incidence of most unfavorable status items and appliances other than casts. There were no deaths in the single soft tissue injury group, but, other than this, the ultimate disposition of the two groups was very similar to that for the overall population.

Vascular injuries. Vascular injuries comprised about 14% of the total (562 patients), with the percentage of Navy-Marine patients being considerably lower than expected. Of the vascular injury group, 25% also underwent an amputation. The patients in this group were moved somewhat more slowly than the whole population both from Vietnam and to CONUS, but not as much so as we had been led

to believe was the accepted policy. A significantly higher percentage of them were considered critically ill at the time of the first leg, and the death rate was also higher than that for the total population.

Amputations. A total of 253 patients had amputations performed prior to the first leg of their flight. As already mentioned, there is a high coincidence of vascular injuries with amputations, but the incidence of fractures within the amputation group is no higher than that for the entire population. These patients tended to move earlier from Vietnam but to remain longer within the theater, reaching CONUS almost 1 day later on the average than the whole study group. A high proportion of them were considered critically ill at the time of their first flight and an especially high percentage were described by the observer as being in unsatisfactory condition. Six of these patients died, which is the second highest death rate of any of the injury groups defined.

Chest injuries. There were 694 patients that had either vascular or soft tissue injuries to the chest. The group tended to move somewhat more slowly than the group as a whole, leaving Vietnam about 8½ days after injury and making the transpacific flight almost 24 days after wounding. With this exception, their descriptive statistics tended to coincide rather closely with those for the group as a whole.

Abdominal injuries. A total of 489 patients had either soft tissue or vascular injuries of the abdomen. They also tended to move somewhat slowly, leaving Vietnam approximately 9 days after injury and not arriving in CONUS until over 25 days had elapsed. They had a higher incidence of supporting appliances, especially IVs and gastric tubes.

Head injuries. There were 333 patients who were moved with head injuries other than burns of the head. The serious problem represented by this group is evidenced by the fact that 27% were considered critically ill; 5 patients or 1.5% subsequently died; 8% of them were unconscious at the time of the first flight;

and 15% were considered by the observers to be in unsatisfactory condition. They also moved considerably later in their course than the average, the interval between their wounding and movement being exceeded only by that for the abdominal injury group.

Subgroups by date of leaving Vietnam (tables XI-XVI)

Since the study covered a 2-month period, we thought it possible that, due to changes in the tactical situation or in the availability of hospital beds or in stated policy for selection for evacuation, there might be a change in the composition of the group over time. We, therefore, divided the total 8-week period into four periods of 2 weeks each and compiled separate reports for each time period. The total number of subjects evacuated within each time period is remarkably constant, varying only from a low of 979 to a high of 1,021. The composition by service shows a steady increase with time in the proportion of patients which are Army and a corresponding decrease in the number of patients that are Navy and Marine. The spectrum of injury types does not seem to change appreciably over the four time periods. The second and third time periods have slightly more critically ill patients than the first and the fourth, but this may well not represent a significant difference. The number of patients moved while unconscious and the number considered to be in unsatisfactory condition are both appreciably lower in the last two time periods, but the number removed for medical reasons was highest in the last 2 weeks. The routes of evacuation remained relatively constant with minor exceptions. The sites of origin show one significant change, that being a rather appreciable drop in the number of patients leaving via Da Nang in the last 2 weeks, with a comparable rise in the number leaving Cam Ranh Bay. The proportion of patients routed to Guam remains very constant at 8% to 9%; the number terminating at Clark AB, Philippines, varies from 1% to 4%, and the balance were routed to Japan. The time of leaving Vietnam shows a steady decline over the 8-week period, the average interval from wounding being a full day shorter in the last

2 weeks than in the first. A similar decrease with time is seen in the interval between wounding and departure for CONUS, but the figures for the last 2 weeks are difficult to interpret both because of the small size of the group and the fact that those patients who would have moved more slowly have not yet had time to do so before the end of the study. The death rate throughout the first three periods is quite constant. No deaths had been recorded in the last group up to the time of the end of the study, but, of course, the period of observation for this group was much shorter.

Subgroups by severity—PACAF criteria (tables XVII-XIX)

A very interesting comparison is that based on a classification of the patients into serious, moderately serious, and nonserious injuries according to criteria which were formulated in the office of the PACAF Surgeon (appendix II). The group considered serious by these criteria numbered 633; moderately serious, 2,035; and nonserious, 1,319. Percentagewise, these were 15.9%, 51.0%, and 33.1% of the total group, respectively. The distribution of service affiliations among these groups is quite uniform. The group considered nonseriously injured were moved somewhat earlier in their course than the other two categories, especially on the second leg of evacuation. Understandably, the fraction returned to duty was higher for the moderately serious and the nonseriously injured group, whereas all but one of the deaths occurred in those considered seriously injured. Comparisons based on type of injury and presence of unfavorable status items and/or complicating appliances are difficult to make because, in many cases, the parameter of interest was used as a part of a definition of one group or another. As a result, certain diagnoses and descriptive categories were either excluded from or forced into one or the other of the severity groups.

Subgroups by interval between injury and departure from Vietnam (figs. 5-7, tables XX-XXIV)

Since one question of special interest was the effect of time of evacuation on the ultimate

outcome, we tried to examine a little more closely the effect of the interval between injury and time of departure. To do this we divided each group into six time intervals: less than 2 days, 2 to 4 days, 4 to 5 days, 5 to 6 days, 6 to 7 days, 7 to 8 days, 8 to 9 days, 9 to 10 days, and greater than 10 days. The results of this time division are seen in figures 5 through 7. Virtually all of the distributions have a skew in the direction of long time values. This has the effect of causing

9 to 10 days, and greater than 10 days. The results of this time division are seen in figures 5 through 7. Virtually all of the distributions have a skew in the direction of long time values. This has the effect of causing

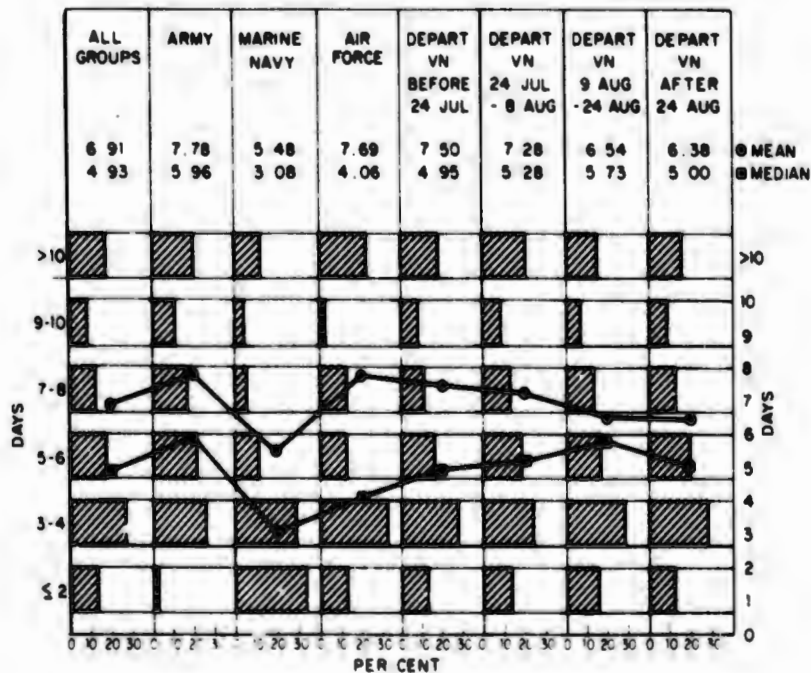


FIGURE 5

Figures 5 through 7 show distribution of time of departure from Vietnam for various groups.

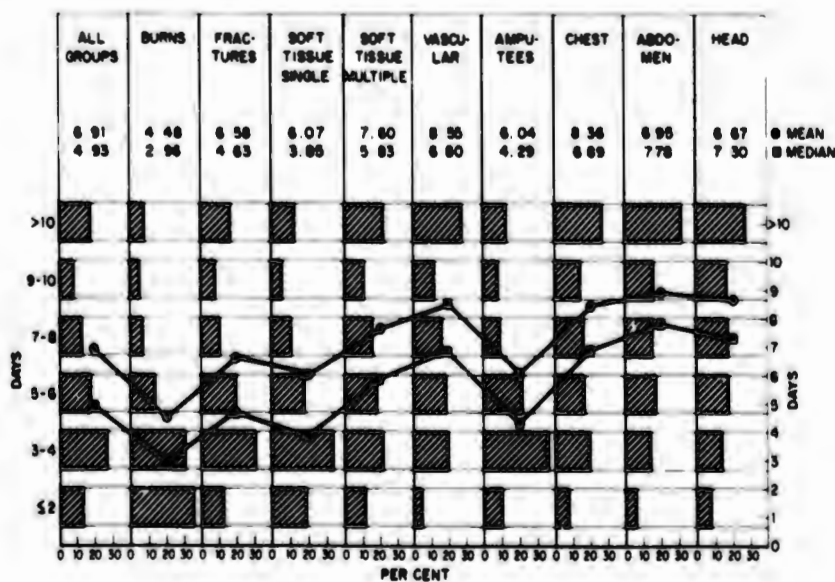


FIGURE 6

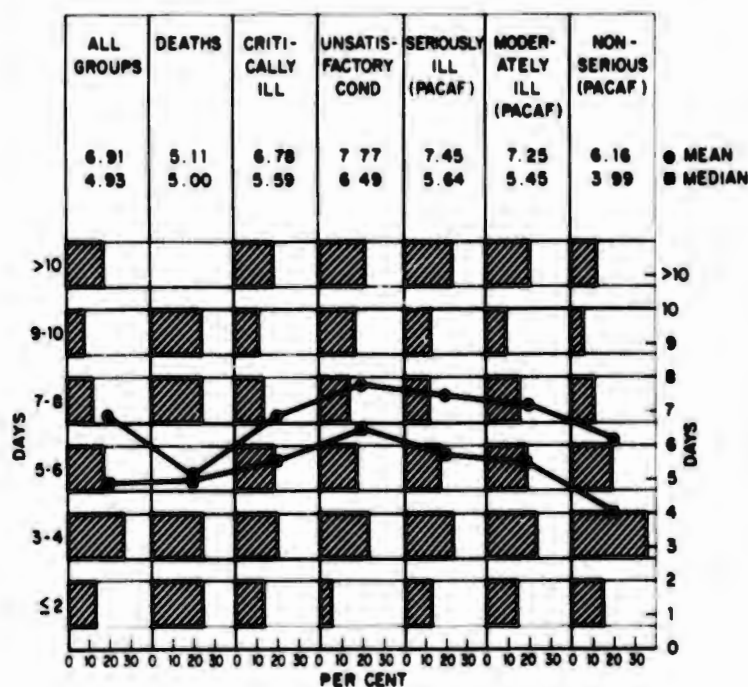


FIGURE 7

the mean to exceed the median as indicated on the graphs. As will be noted, there is considerable variation between the time distributions of the various injury groups, and the majority of them are significantly different from the overall pattern when tested by χ^2 . The only exception is the critically ill group which, curiously enough, parallels very closely the overall population.

In addition, individual reports were run for the patients evacuated in each of the six time intervals. A comparison of these re-emphasizes that which the graphs have already shown—namely, that the Navy and Marine patients are more heavily represented in the early evacuation groups, as are the burn victims. In addition, the early evacuated patients had a higher incidence of appliances and were more apt to be febrile and nonambulatory. In contrast, the late moving patients include more than the expected number of vascular casualties, of those considered by the observers to be in unsatisfactory condition, and of patients moved with wired jaw.

The death rate did not appear to be correlated with the time of movement nor did the proportion who deteriorated in flight. The

proportion of patients remaining hospitalized in the Far East at the end of the study and the proportion evacuated to CONUS also appeared essentially unrelated to the time of evacuation. Furthermore, the difference between the mean interval from injury to exit from Vietnam and the mean interval from injury to departure for CONUS remains remarkably constant for the six groups. Stated in other words, this means that the length of time that each group spent hospitalized in the Far East or the Pacific area was essentially the same for those evacuated soon after injury as for those held for a longer time within Vietnam (from 13.5 to 14.7 days).

IV. GROUPS OF SPECIAL INTEREST (TABLES XXV-XXIX)

This section deals with certain groups which were considered to be especially interesting for a variety of reasons. In some cases, the groups were large enough so that they were analyzed by the standard computer program. In others, since the groups were small, it was more efficient merely to identify the subjects and pull from the file the original report for more detailed manual study.

Patients considered critically ill either at the beginning or at the end of the first leg

This group consists of 265 cases, roughly 6% of the entire study population. As might be expected, burns, vascular injuries, amputations, and head injuries are especially well represented in this group. Virtually all of the unfavorable status items are found with greater frequency in this group than in the population as a whole, and the same is true of the appliances which attest to the problems attendant with the transportation of this group. It is of interest to note that the average intervals from injury to exit from Vietnam and from injury to departure for CONUS for this group are almost identical with those for the population as a whole. The death rate, as might be expected, is much higher; indeed 18 of the 20 patients who died are found in this group. With minor exceptions, the "Critically Ill" group behaved much like a subgroup of those meeting the "Seriously Ill" (PACAF) criterion which, in fact, it was. Both contained a high percentage of burns, vascular injuries, and amputations. The percentage of the patients who were unconscious at the time of moving and who were felt by the observers to be in unsatisfactory condition was also high.

Patients considered to be in unsatisfactory condition at the end of the first leg

This is another group of considerable interest, but quite hard to interpret. As was mentioned earlier, the observers were not given a very specific definition as to what patients should be thus categorized, and the composition of the group is therefore interesting. It contains only 127 patients or about 3.2% of the entire group. It is about half the size of the critically ill group, and virtually all of its subjects are also in the critically ill group. Like the critically ill group, this group includes many vascular injuries, amputations, and head injuries; but, by contrast, there is not a disproportionate number of burned patients. It does not differ from the critically ill group in the frequency of appliances or unfavorable status items. This group moved from Vietnam about 1 day later in their course than

the critically ill patients and delayed over 2 days in their departure for CONUS. Despite its lack of definition there is evidence that this group did, in fact, contain a high proportion of the most serious problem cases in the study, since 18 patients in the group died—a death rate of 10.2%, which is the highest of any group defined. In addition, a greater percentage of its members, than of any other group, also had been evacuated to CONUS by the end of the study.

Patients dying during the study

Twenty patients died during their time within this study—that is, prior to 8 September and prior to their arriving in CONUS. From other sources of information, we have learned of additional deaths which took place after arrival in CONUS or in Japan after 8 September. However, since no systematic effort was made to record all such deaths, in order to keep the data base consistent we have chosen not to include them in this analysis. As might be expected, this group, virtually without exception, had injuries which were serious in nature and frequently multiple and extensive. Burns, vascular injuries, amputations, head injuries, and multiple soft tissue injuries were all common. Information regarding the interval between wounding and date of evacuation from Vietnam was available on only 12 out of 20 patients, but these 12 all moved very early in their course, the mean time from wounding to evacuation being a little over 5 days. Of the 20 patients, 18 were considered to be critically ill at the time of evacuation and other indices of the serious nature of their condition were also present with increased frequency. One of the patients died in flight, and 3 others were recorded as having problems en route; one of these three and one other patient were removed at Clark AB for medical reasons.

Five of the patients died within 3 days after their evacuation, but one of these was listed as dying from septicemia and toxemia and one other experienced cardiac arrest after an additional surgical procedure had been performed at an in-transit hospital. It is, therefore, unlikely that their deaths were attributable to

evacuation. One other patient whose condition was described as having worsened during flight died of brain damage 2 days subsequent to arrival. One patient, who had a tracheotomy performed in flight, died 3 days after arrival. For the last of the 5 who died soon after arrival, no information is given on which one may judge the relationship to the previous flight. The remainder of the deaths took place from 4 to 39 days after evacuation, and the records contained no information that supports any assumption that the evacuation process had contributed to the deaths. Thus, at most, 4 patients died—1 in flight and 3 others shortly after arrival at the first destination—under circumstances which even suggest the possibility that their conditions were adversely affected by evacuation.

Patients removed from flight for medical reasons

Nineteen patients were reported removed for medical reasons, of which 16 were Marine or Navy. All of these 16 plus one of the 3 Army patients were evacuated through Da Nang and presumably were bound for Guam, although this is not in all cases clearly indicated. During the same period 357 patients reached Guam, so that, if we can conclude that these 17 patients were, in fact, destined for Guam, we may calculate that 17 out of 374 or about 4.5% of the patients manifested for Guam had to be removed early for medical reasons. All of the removals, of course, were made at Clark AB, since this is the only site where an initial flight from Vietnam stopped before reaching its destination.

The majority of the patients in this group had multiple injuries and were obviously moved under less than optimal conditions. The majority had several appliances, such as IVs and tubes of various sorts. However, only one of the group was listed as critically ill at the beginning of the flight. They were moved earlier than the rest of the group, in fact, quite significantly so. The average time from wounding to leaving Vietnam was 5 days, and half of the group moved in 3 days or less. There were no burned patients in the group and

relatively few fractures. The commonest injuries seemed to be multiple soft tissue injuries, including trauma either to the chest or the abdomen or both. The majority of them had had some surgical procedure before leaving Vietnam, and in most cases this was a fairly major procedure. The cause of removal was not always clearly stated, but in virtually every case there is recorded some unfavorable change during flight.

The commonest causes of removal seem to be abdominal pain or distention and fever. Three patients were also removed for which the only recorded cause was the presence of a gastric tube. Two patients were removed because of discomfort, two because of an unsatisfactory wound condition, and two because of the presence of a chest tube, one of which was recorded as not functioning properly. One patient was removed because of bleeding, but the site of the bleeding was not recorded. A look at the ultimate outcome of these 19 cases removed reveals that 7 of them subsequently moved on to Guam and eventually to CONUS after stays at Clark AB which varied from 2 to 22 days. Two of the patients died at Clark AB. The other 10 were still hospitalized there as of the last day of the study; however, 7 of these 10 reached Clark AB within 2 weeks of the end of the study. In fact, of the entire group of 19 patients, 8 were moved in the last 2 weeks of the study. This may suggest either that the criteria used at Da Nang to assess readiness for evacuation changed in the latter part of the study or that the criteria applied at Clark AB for removal were different, or it may be that this preponderance of problems of this type in the last portion of the study is merely a coincidence. The breakdown of the entire patient group by time of leaving Vietnam does not reveal any significant change in the composition of the groups with time (tables XII and XIV).

Patients moved with wired jaw

The presence of jaw wires has been considered to be at least a relative, if not absolute, contraindication to aeromedical evacuation in the past. Since this is the case, it is interesting

to look at the experience of such patients in the study group. There were 66 patients who had the jaw immobilized during the first flight, of which only 2 had records marked "banded" or "rubber bands." The other 64 presumably had hard wire fixation, although this is not positively recorded. Of the 66 patients, only one is described as experiencing any difficulty. This patient became nauseated, vomited in flight, and had to have the wires cut. One further patient is described as becoming nauseated after admission to the Guam hospital, but there is no record of his experiencing trouble in flight. One other patient had a gastrostomy tube and another had a tracheotomy and was receiving tube feeding during flight, both of whom traveled without incident. Of the 66 patients, 20 subsequently flew an additional leg during the course of the study, 11 of these still with jaw wiring and no record of any difficulty during this additional leg. We have, then, description of 77 flights of varying lengths with only one instance of difficulty.

V. RECOMMENDATIONS FOR FURTHER STUDIES

Specific groups

The population of this study was deliberately selected to represent the entire spectrum of injured patients being evacuated from Vietnam. This is in keeping with the basic purpose of the study which was essentially to yield a better description of the overall patient population than was previously available. We hope that this survey will now serve as a basis for identifying certain specific groups of special interest which can be made the subject of further studies, smaller in scope in terms of total number of patients but permitting more specific inquiry into the pertinent problems of that specific group. Typical of such groups might be a more detailed study of burned patients, those with chest injuries, those with head injuries, those with vascular repair, etc.

Once the subject population of such a study has been defined and the questions of special interest with regard to the care of that particular patient group have been identified, the

details of the study can be worked out. Optimally, a new questionnaire should probably be designed for each such study permitting the recording of information which may be of interest to the particular group under concern, but not of any other. Therefore, the information base can be more detailed and more specifically designed to match the needed output. This will permit far more penetrating analyses than are possible with the present data base. It is entirely likely that the pertinent observations will be of a kind that could best be made by physicians and this may require the use of physicians as primary data recorders.

Better criteria for effect

One of the weaknesses of the present study has been the lack of objective criteria for comparing groups treated differently and, thus, for evaluating the effect of various treatments. The criteria needed are of two types, those for judging the immediate effects of evacuation and those for evaluating its effect on the ultimate outcome.

Criteria for immediate effect. The only objective criterion available for judging immediate effect of flight in this study has been the death rate and, as pointed out, this is so low that it does not serve as an effective basis for comparing various subgroups. All one can say is that only 1 patient of almost 4,000 died en route and that, at most, 2 or 3 others died shortly after a flight under circumstances which permit speculation that the flight may have played a role in the deaths. The entries "Unsatisfactory Condition" and "Deteriorated in Flight" were placed on the form in the hopes that these would give additional bases for judging the immediate effects of the flight, but the relative rarity with which entries were made in these areas and the lack of objective criteria for their application has made them of very little use. Some similar designation based, hopefully, on observations which are specific for the group under study will be necessary to help summarize and compare the immediate effect.

Criteria for long-term effect. Because of the limited data recording period in this study, important information which might be obtained from long-term followup of the patients could not be included. However, in the later, more specific studies, an attempt should be made to utilize this kind of information wherever possible. More detailed recording of the hospital course after each leg of the flight would be very helpful. The need for further treatment, further surgical procedures, and the presence or absence of complications, as well as the duration of hospitalization, might all be pertinent information items. In addition, whenever possible, patients should be followed to final discharge from hospitalization even though, in some cases, this might require several months of observation.

Randomization procedure to determine the time for evacuation

The present study was deliberately designed as a survey with no attempt being made to affect the time at which the patients were evacuated, but rather to observe the evacuation process as it now exists. However, this has resulted in data in which the effects of time of evacuation are partially obscured by other variables, such as the fact that the early evacuated patients differ from the later ones in the type of injury represented, the extent and severity of the injury, and possibly in other ways which these data do not reveal. Consideration should, therefore, be given to the possibility of some degree of experimental control over the times of evacuation, if at all possible, in order to strengthen the study in its ability to separate clearly the effect of time of evacuation from the effect of other variables. It is recognized that, in a clinical situation and especially in one where the tactical situation, the availability of beds, interservice differences in policy, and the preference of individual physicians all affect the decision regarding a given patient, strict experimental handling will be difficult. Nevertheless, the

advantages to be gained from such a procedure are considerable and careful thought should be given during the design phase of follow-on studies to see if such a feature could be incorporated.

VI. CONCLUSIONS

A study has been made of the trauma patients who were evacuated by air from Vietnam during the period 8 July to 8 September 1968. Despite the recording difficulties which are inherent in a study of this kind, a sizable body of data has been acquired which, it is felt, gives a reasonably accurate picture of the system as it functioned during that time period.

Records were received for a total of 3,987 patients of which approximately 45% were followed to CONUS, 42% remained hospitalized within the Far East at the end of the study, and 4% had returned to duty. The mean time of departure from Vietnam was 7 days after injury and of departure from the Far East for CONUS was 21 days after injury. Approximately 7% of the patients were considered to be critically ill at the time of flight from Vietnam and almost 50% moved with some appliance which complicated their care: IV, gastric tube, chest tube, cast, etc. Only 0.2% were considered to have undergone a deterioration in their condition during flight. There was 1 death in flight and a total of 20 deaths occurring during the period of observation, for an overall death rate of 0.5%.

The picture obtained is one of a system which moves large numbers of seriously injured patients efficiently, effectively, and safely. Many of them are moved very early after wounding; many of them are moved with appliances and/or conditions which present problems for the flight crews. Despite this, there is very little evidence in the study of any adverse effect of the evacuation process on the patients served by it.

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APPENDIX I

TABLES I-XXIX

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TABLE I

Service affiliation and age characteristics of subjects

Service group	No. of patients	Percent of total	Mean age
Army	2,462	61.7	22.03
Navy-Marine	1,418	35.6	20.90
Air Force	34	0.9	26.52
Other or unknown	73	1.8	28.78
Total	3,987	100.0	21.79

TABLE II

Relationship of type of injury to location

Location	Burn	Fracture	Soft tissue injury (single)	Soft tissue injury (multiple)	Vascular injury	Amputation
Right arm	129	258	257	771	124	55
Left arm	125	301	253	788	108	44
Right leg	64	371	341	965	123	100
Left leg	59	374	361	980	108	90
Head	16	53	—	314	10	
Face	82	114	—	509	5	
Neck	32	19	—	198	19	
Chest	79	109	—	679	76	
Abdomen	35	37	—	486	44	
Pelvis	13	46	—	430	10	
Total patients	174	1,471	1,212	2,267	562	253

TABLE III

Distribution of injury type and location by service

Type or location of injury	All patients		Army		Navy-Marine		Air Force	
	No.	%	No.	%	No.	%	No.	%
Burn	174	4.4	89	3.6	79	5.6	4	11.8
Fracture	1,471	36.9	1,010	41.0	418	29.1	16	47.1
Soft tissue injury (single)	1,212	30.4	745	30.3	442	31.2	9	26.5
Soft tissue injury (multiple)	2,267	56.9	1,380	56.1	837	59.0	11	32.4
Vascular injury	562	14.1	443	18.0	101	7.1	3	8.8
Amputation	253	6.3	156	6.3	89	6.3	2	5.9
Chest injury	694	17.4	451	18.3	224	15.8	6	17.6
Abdominal injury	489	12.3	296	12.0	181	12.8	2	5.9
Head injury	333	8.4	214	8.7	113	8.0	1	2.9
Total patients	3,987	100.0	2,462	100.0	1,418	100.0	34	100.0

TABLE IV

Distribution of status at start of first flight by service

Status item	All patients		Army		Navy-Marine		Air Force	
	No.	%	No.	%	No.	%	No.	%
Moved with appliance	1,854	46.5	1,025	41.6	776	54.7	21	61.8
Critically ill	265	6.6	172	7.0	81	5.7	4	11.8
Nonambulatory	3,125	78.4	1,848	75.1	1,195	84.3	24	70.6
Unconscious	38	1.0	15	0.6	22	1.6	1	2.9
Total patients	3,987	100.0	2,462	100.0	1,418	100.0	34	100.0

TABLE V

Relationship of evacuation schedule to service affiliation

Mean time (days)	All patients	Army	Navy-Marine	Air Force
Injury to exit from Vietnam	6.9	7.8	5.5	7.7
Last surgery to exit from Vietnam	5.4	5.8	4.7	5.5
Injury to departure for CONUS	21.3	21.5	21.1	15.5

TABLE VI

Distribution of disposition at end of study by service

Disposition at end of study	All patients		Army		Navy-Marine		Air Force	
	No.	%	No.	%	No.	%	No.	%
Returned to duty	172	4.3	133	5.4	30	2.1	6	17.6
Died	20	0.5	11	0.4	9	0.6	0	—
Still hospitalized in Far East or Pacific	1,679	42.1	1,049	42.6	578	40.8	15	44.1
Evacuated to CONUS	1,827	45.8	1,080	43.9	711	50.1	11	32.4
Unknown	289	7.2	189	7.7	90	6.3	2	5.9
Total patients	3,987	100.0	2,462	100.0	1,418	100.0	34	100.0

TABLE VII

Relationship of evacuation schedule to injury type and location

Mean time (days)	Burn	Fracture	Soft tissue injury (single)		Soft tissue injury (multiple)	Vascular	Amputation	Chest injury	Abdominal injury	Head injury
			No.	%						
Injury to exit from Vietnam	4.5	6.6	6.1	7.6	8.5	6.0	8.4	9.0	8.7	
Last surgery to exit from Vietnam	3.3	5.0	4.3	6.0	6.1	4.7	6.6	7.1	7.3	
Injury to departure for CONUS	14.0	20.2	19.3	23.2	23.5	22.3	23.8	25.2	25.1	

TABLE VIII

Distribution of disposition at end of study by injury type and location

Disposition at end of study	Burn		Fracture		Soft tissue injury (single)		Soft tissue injury (multiple)		Vascular		Amputation		Chest injury		Abdominal injury		Head injury	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Returned to duty	13	7.5	31	2.1	49	4.0	96	4.2	16	2.8	3	1.2	32	4.6	10	2.0	18	5.4
Died	6	3.4	8	0.5	0	—	14	0.6	7	1.2	6	2.4	4	0.6	3	0.6	5	1.5
Still hospitalized in Far East or Pacific	79	45.4	545	37.0	499	41.2	992	43.3	246	43.3	97	33.3	317	45.7	207	42.3	150	45.0
Evacuated to CONUS	71	40.8	760	51.7	576	47.5	1,008	44.2	245	43.6	123	48.6	291	41.9	221	45.2	142	42.6
Unknown	5	2.9	127	8.6	88	7.3	162	7.1	48	8.5	24	9.5	50	7.2	48	9.3	18	5.4
Total patients	174	100.0	1,471	100.0	1,212	100.0	2,267	100.0	562	100.0	253	100.0	694	100.0	489	100.0	353	100.0

TABLE IX

Distribution of special problems and appliances by injury type and location

Special problem or appliance	Burn		Fracture		Soft tissue injury (single)		Soft tissue injury (multiple)		Vascular injury		Amputation		Chest injury		Abdominal injury		Head injury	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Any appliance	79	45.4	1,023	69.5	548	45.2	1,019	44.9	260	46.3	144	56.9	261	37.6	263	53.8	114	34.2
Critically ill	35	20.1	91	6.2	8	0.7	198	8.7	70	12.5	61	24.1	50	7.2	50	10.2	90	27.0
Unconscious	1	0.6	17	1.2	3	0.2	33	1.5	4	0.7	3	1.2	8	1.2	7	1.4	26	7.8
Unsatisfactory condition	7	4.0	44	3.0	6	0.5	104	4.6	30	5.3	26	10.3	25	3.6	27	5.5	49	14.7
IV running	63	36.2	177	12.0	85	7.0	358	15.8	60	10.7	66	26.1	85	12.2	100	20.4	30	9.0
Gastric tube	2	1.1	12	0.8	2	0.2	64	2.8	7	1.2	2	0.8	24	3.5	40	8.2	11	3.3
Tracheotomy	4	2.3	42	2.9	0	—	55	2.4	8	1.4	8	3.2	15	2.2	10	2.0	14	4.2
Wired jaw	0	—	63	4.3	2	0.2	43	1.9	1	0.2	2	0.8	7	1.0	5	1.0	8	2.4
Colostomy	2	1.1	33	2.2	0	—	117	5.2	26	4.6	10	4.0	31	4.5	87	17.8	10	3.0
Chest tube	0	—	10	0.7	4	0.3	49	2.2	3	0.5	1	0.4	41	5.9	20	4.1	3	0.9
Total patients	174	100.0	1,471	100.0	1,212	100.0	2,267	100.0	562	100.0	253	100.0	694	100.0	489	100.0	333	100.0

TABLE X

Cross relationship between injury types

	All patients		Burn		Fracture		Soft tissue injury (single)		Soft tissue injury (multiple)		Vascular injury		Amputation	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Burn	174	4.4	174	100.0	12	0.8	10	0.8	22	1.0	2	0.4	7	2.8
Fracture	1,471	36.9	12	6.9	1,471	100.0	493	40.7	649	28.6	209	37.2	87	34.4
Soft tissue injury (single)	1,212	30.4	10	5.7	493	33.5	1,212	100.0	0	—	171	30.4	70	27.7
Soft tissue injury (multiple)	2,267	56.9	22	12.6	649	44.1	0	—	2,267	100.0	357	63.5	155	61.3
Vascular injury	562	14.1	2	1.1	209	14.2	171	14.1	357	15.7	562	100.0	142	56.1
Amputation	253	6.3	7	4.0	87	5.9	70	5.8	155	6.8	142	25.3	253	100.0

TABLE XI

Distribution of service affiliation by date of leaving Vietnam

Service affiliation	All patients		8 July-23 July		24 July-8 Aug.		9 Aug.-24 Aug.		25 Aug.-8 Sept.	
	No.	%	No.	%	No.	%	No.	%	No.	%
Army	2,462	61.7	530	54.1	621	60.8	620	63.1	683	69.8
Navy-Marine	1,418	35.6	426	43.5	373	36.5	335	34.1	276	28.2
Air Force	34	0.9	10	1.0	9	0.9	7	0.7	7	0.7
Other or unknown	73	1.8	14	1.4	18	1.8	21	2.1	13	1.3
Total patients	3,987	100.0	980	100.0	1,021	100.0	983	100.0	979	100.0

TABLE XII

Distribution of injury type by date of leaving Vietnam

Type of injury	All patients		8 July-23 July		24 July-8 Aug.		9 Aug.-24 Aug.		25 Aug.-8 Sept.	
	No.	%	No.	%	No.	%	No.	%	No.	%
Burn	174	4.4	30	3.1	48	4.7	48	4.9	47	4.8
Fracture	1,471	36.9	378	38.6	411	40.3	353	35.9	318	32.5
Soft tissue injury	3,479	87.3	849	86.6	882	86.4	847	86.2	878	89.7
Vascular injury	562	14.1	120	12.2	134	13.1	156	15.9	149	15.2
Amputation	253	6.3	65	6.6	66	6.5	56	5.7	64	6.5
Total patients	3,987	100.0	980	100.0	1,021	100.0	983	100.0	979	100.0

TABLE XIII

Distribution of flight route by date of leaving Vietnam

Route of flight	All patients		8 July-23 July		24 July-8 Aug.		9 Aug.-24 Aug.		25 Aug.-8 Sept.	
	No.	%	No.	%	No.	%	No.	%	No.	%
Origin:										
Da Nang	1,665	41.8	434	44.3	477	46.7	414	42.1	335	34.2
Cam Ranh Bay	1,001	25.1	256	26.1	223	21.8	215	21.9	305	31.2
Tan Son Nhut	1,321	33.1	290	29.6	321	31.4	354	36.0	339	34.6
Destination:										
Clark	148	3.7	27	2.8	40	3.9	11	1.1	48	4.9
Japan	3,479	87.3	869	88.7	883	86.5	879	89.4	846	86.4
Guam	357	9.0	84	8.6	98	9.6	92	9.4	83	8.5
Total patients	3,987	100.0	980	100.0	1,021	100.0	983	100.0	979	100.0

TABLE XIV

Distribution of certain status items by date of leaving Vietnam

Status item	All patients		8 July-23 July		24 July-8 Aug.		9 Aug.-24 Aug.		25 Aug.-8 Sept.	
	No.	%	No.	%	No.	%	No.	%	No.	%
Moved with appliance	1,554	46.5	457	46.6	541	53.0	459	46.7	387	39.5
Critically ill	265	6.6	52	5.3	90	8.8	70	7.1	51	5.2
Nonambulatory	3,125	78.4	748	76.3	822	80.5	768	77.6	771	78.8
Unconscious	38	1.0	20	2.0	11	1.1	4	0.4	3	0.3
Unsatisfactory condition	127	3.2	33	3.4	58	5.7	25	2.5	9	0.9
Removal for medical reasons	19	0.5	4	0.4	3	0.3	2	0.2	7	0.7
Total patients	3,987	100.0	980	100.0	1,021	100.0	983	100.0	979	100.0

TABLE XV

Relationship of evacuation schedule to date of leaving Vietnam

Mean time (days)	All patients	8 July-23 July	24 July-8 Aug.	9 Aug.-24 Aug.	25 Aug.-8 Sept.
Injury to exit from Vietnam	6.9	7.5	7.3	6.5	6.4
Last surgery to exit from Vietnam	5.4	5.4	5.9	5.2	5.0
Injury to departure for CONUS	21.3	22.8	22.3	18.0	12.3

TABLE XVI

Distribution of disposition at end of study by date of leaving Vietnam

Disposition at end of study	All patients		8 July-23 July		24 July-8 Aug.		9 Aug.-24 Aug.		25 Aug.-8 Sept.	
	No.	%	No.	%	No.	%	No.	%	No.	%
Returned to duty	172	4.3	59	6.0	75	7.3	31	3.2	7	0.7
Died	20	0.5	7	0.7	7	0.7	6	0.6	0	—
Still hospitalized in Far East or Pacific	1,679	42.1	137	14.0	209	20.5	490	49.8	822	84.0
Evacuated to CONUS	1,827	45.8	655	66.8	642	62.9	396	40.3	131	13.4
Unknown	289	7.2	122	12.4	88	8.6	60	6.1	19	1.9
Total patients	3,987	100.0	980	100.0	1,021	100.0	983	100.0	979	100.0

TABLE XVII

Distribution of service affiliation by severity of injury

Service affiliation	All patients		Serious		Moderately serious		Nonserious	
	No.	%	No.	%	No.	%	No.	%
Army	2,462	61.7	372	58.8	1,253	61.6	837	63.5
Navy-Marine	1,418	35.6	245	38.7	731	35.9	442	33.5
Air Force	34	0.9	6	0.9	14	0.7	14	1.1
Other or unknown	73	1.8	10	1.6	37	1.8	26	2.0
Total patients	3,987	100.0	633	100.0	2,085	100.0	1,319	100.0

TABLE XVIII

Relationship of evacuation schedule to severity of injury

Mean time (days)	All patients	Serious	Moderately serious	Nonserious
Injury to exit from Vietnam	6.9	7.4	7.2	6.2
Last surgery to exit from Vietnam	5.4	6.3	5.7	4.4
Injury to departure for CONUS	21.3	23.1	22.1	19.2

TABLE XIX

Distribution of disposition at end of study by severity of injury

Disposition at end of study	All patients		Serious		Moderately serious		Nonserious	
	No.	%	No.	%	No.	%	No.	%
Returned to duty	172	4.3	3	0.5	97	4.8	72	5.5
Died	20	0.5	19	3.0	1	0.05	0	—
Still hospitalized in Far East or Pacific	1,679	42.1	245	38.7	912	44.8	522	39.6
Evacuated to CONUS	1,827	45.8	323	51.0	873	42.9	631	47.8
Unknown	289	7.2	43	6.8	152	7.5	94	7.1
Total patients	3,987	100.0	633	100.0	2,085	100.0	1,319	100.0

TABLE XX

Distribution of service affiliation by interval from wounding to evacuation

Service affiliation	All patients		1-2 days		3-4 days		5-6 days		7-8 days		9-10 days		Over 10 days	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Army	2,462	61.7	58	11.0	593	58.3	505	74.5	403	81.4	256	77.3	477	70.9
Navy-Marine	1,418	35.6	460	37.1	395	38.8	160	23.6	83	16.8	66	19.9	182	27.0
Air Force	34	0.9	4	0.8	10	1.0	4	0.6	4	0.8	1	0.3	7	1.0
Other or unknown	73	1.8	6	1.1	20	2.0	9	1.3	5	1.0	8	2.4	7	1.0
Total patients	3,987	100.0	528	100.0	1,018	100.0	678	100.0	495	100.0	331	100.0	673	100.0

TABLE XXI

Distribution of injury type and location by interval from wounding to evacuation

Injury type or location	All patients		1-2 days		3-4 days		5-6 days		7-8 days		9-10 days		Over 10 days	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Burn	174	4.4	58	11.0	50	4.9	23	3.4	11	2.2	9	2.7	13	1.9
Fracture	1,471	36.9	174	33.0	425	41.7	274	40.4	144	29.1	117	35.3	235	34.9
Soft tissue injury (single)	1,212	30.4	217	41.1	382	37.5	207	30.5	122	24.6	69	20.8	144	21.4
Soft tissue injury (multiple)	2,267	56.9	243	46.0	470	46.2	376	55.5	329	66.5	233	70.4	465	69.1
Vascular injury	562	14.1	26	4.9	104	10.2	100	14.7	83	16.8	63	19.0	150	22.3
Amputation	253	6.3	25	4.7	86	8.4	52	7.7	23	4.6	20	6.0	31	4.6
Chest injury	694	17.4	43	8.1	129	12.7	109	16.1	106	21.2	95	28.7	174	25.9
Abdominal injury	489	12.3	24	4.5	63	6.2	77	11.3	69	13.9	74	22.4	144	21.4
Head injury	333	8.4	22	4.2	42	4.1	51	7.5	51	10.3	49	14.8	81	12.0
Total patients	3,987	100.0	528	100.0	1,018	100.0	678	100.0	495	100.0	331	100.0	673	100.0

TABLE XXII

Distribution of certain status items by interval from wounding to evacuation

Status item	All patients		1-2 days		3-4 days		5-6 days		7-8 days		9-10 days		Over 10 days	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Moved with appliance	1,854	46.5	342	64.8	544	53.4	304	44.8	160	32.3	129	39.0	265	39.4
Critically ill	265	6.6	31	5.9	44	4.3	42	6.2	32	6.5	27	8.2	41	6.1
Nonambulatory	3,125	78.4	486	92.0	825	81.0	541	79.8	359	72.5	256	77.3	462	68.6
Febrile	435	10.9	173	32.8	103	10.1	52	7.7	34	6.9	23	6.9	35	5.2
Unsatisfactory condition	127	3.2	5	0.9	22	2.2	17	2.5	14	2.8	16	4.8	21	3.1
Wired jaw	66	1.7	1	0.2	7	0.7	8	1.2	12	2.4	6	1.8	28	4.2
Total patients	3,987	100.0	528	100.0	1,018	100.0	678	100.0	495	100.0	331	100.0	673	100.0

TABLE XXIII

Relationship of evacuation schedule to interval from wounding to evacuation

Mean time (days)	All patients	1-2 days	3-4 days	5-6 days	7-8 days	9-10 days	Over 10 days
Injury to exit from Vietnam	6.9	1.5	3.1	5.1	7.1	9.0	17.6
Injury to departure for CONUS	21.3	16.2	17.2	19.8	21.2	22.5	31.8
Difference	14.4	14.6	14.1	14.7	14.1	13.5	14.2

TABLE XXIV

Distribution of disposition at end of study by interval from wounding to evacuation

Disposition at end of study	All patients		1-2 days		3-4 days		5-6 days		7-8 days		9-10 days		Over 10 days	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Returned to duty	172	4.3	5	0.9	27	2.7	26	3.8	51	10.3	16	4.8	27	4.0
Died	20	0.5	3	0.6	3	0.3	0	—	3	0.6	3	0.9	0	—
Still hospitalized in Far East or Pacific	1,679	42.1	231	43.8	433	42.5	298	44.0	208	42.0	189	42.0	268	39.8
Evacuated to CONUS	1,827	45.8	258	48.9	483	47.4	300	44.2	191	38.6	151	45.6	328	48.7
Unknown	289	7.2	31	5.9	72	7.1	54	8.0	42	8.5	22	6.6	50	7.4
Total patients	3,987	100.0	528	100.0	1,018	100.0	678	100.0	495	100.0	331	100.0	673	100.0

TABLE XXV

Distribution of service affiliation by special groups

Service affiliation	All patients		Deaths		Critically ill		Unsatisfactory condition	
	No.	%	No.	%	No.	%	No.	%
Army	2,462	61.7	11	55.0	172	64.9	79	62.2
Navy-Marine	1,418	35.6	9	45.0	81	30.6	41	32.3
Air Force	34	0.9	0	—	4	1.5	3	2.4
Other or unknown	73	1.8	0	—	8	3.0	4	3.1
Total patients	3,987	100.0	20	100.0	265	100.0	127	100.0

TABLE XXVI

Distribution of injury type and location by special groups

Injury type or location	All patients		Deaths		Critically ill		Unsatisfactory condition	
	No.	%	No.	%	No.	%	No.	%
Burn	174	4.4	6	30.0	35	13.2	7	5.5
Fracture	1,471	36.9	8	40.0	91	34.3	44	34.6
Soft tissue injury (single)	1,212	30.4	0	—	8	3.0	6	4.7
Soft tissue injury (multiple)	2,267	56.9	14	70.0	198	74.7	104	81.9
Vascular injury	562	14.1	7	35.0	70	26.4	30	23.6
Amputation	253	6.3	6	30.0	61	23.0	26	20.5
Chest injury	694	17.4	5	25.0	50	18.9	25	19.7
Abdominal injury	489	12.3	2	10.0	50	18.9	27	21.3
Head injury	333	8.4	5	25.0	90	34.0	49	38.6
Total patients	3,987	100.0	20	100.0	265	100.0	127	100.0

TABLE XXVII

Distribution of certain status items by special groups

Status item	All patients		Deaths		Critically ill		Unsatisfactory condition	
	No.	%	No.	%	No.	%	No.	%
Moved with appliance	1,854	46.5	15	75.0	182	68.7	83	65.4
Critically ill	265	6.6	18	90.0	265	100.0	120	94.5
Unconscious	38	1.0	3	15.0	22	8.3	14	11.0
Unsatisfactory condition	127	3.2	13	65.0	120	45.3	127	100.0
Tracheotomy	61	1.5	7	35.0	34	12.8	20	15.7
Wired jaw	66	1.7	0	—	8	3.0	2	1.6
Total patients	3,987	100.0	20	100.0	265	100.0	127	100.0

TABLE XXVIII

Relationship of evacuation schedule to special groups

Mean time (days)	All patients	Deaths	Critically ill	Unsatisfactory condition
Injury to exit from Vietnam	6.9	5.1	6.8	7.8
Last surgery to exit from Vietnam	5.4	4.8	5.6	5.9
Injury to departure for CONUS	21.3	—	21.1	23.4

TABLE XXIX

Distribution of disposition at end of study by special groups

Disposition at end of study	All patients		Deaths		Critically ill		Unsatisfactory condition	
	No.	%	No.	%	No.	%	No.	%
Returned to duty	172	4.3	0	—	1	0.4	1	0.8
Died	20	0.5	20	100.0	18	6.8	13	10.3
Still hospitalized in Far East or Pacific	1,679	42.1	0	—	90	34.0	29	22.8
Evacuated to CONUS	1,827	45.8	0	—	145	54.7	80	63.0
Unknown	289	7.2	0	—	11	4.2	4	3.1
Total patients	3,987	100.0	20	100.0	265	100.0	127	100.0

APPENDIX II

Criteria for Classification of Severity of Injury

Nonserious injury

In order to be classified nonseriously injured, a patient must meet *all* the following four criteria:

1. Have either:
 - (a) Burns of no more than two areas with no associated soft tissue injury or fracture,
 - (b) Soft tissue injuries limited to extremities,
 - (c) Fracture limited to one extremity, or
 - (d) A combination of (b) and (c).
2. Not have amputation or vascular injury.
3. Not have any unfavorable present status items listed under III B on recording form, other than: (3) nonambulatory, (4) on narcotics, or (12) on antibiotics.
4. Not have any specific problems or appliances listed under III C on recording form, other than: (1) cast, (2) traction, or (3) splint.

Serious injury

The presence of *any one* of the following would result in a patient being classified as seriously injured:

1. Fractures of more than two areas.
2. Burns of more than four areas.
3. Amputation of more than two extremities.
4. Fracture of pelvis or head.
5. Presence of any of the following unfavorable status items: (1) critically ill, (2) unconscious, (5) blood pressure unstable, (6) urine output inadequate, (8) hydration inadequate, (10) abdominal distention, or (11) respiratory distress.
6. Presence of any of the following problems or appliances: (4) chest tube, (5) blood transfusion, (7) colostomy, (8) gastric tube, (10) orthopedic frame, (11) tracheotomy, or (12) respirator.

Moderately serious injury

Any patient not meeting the above criteria for nonserious or serious injury was classified as having a moderately serious injury.

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13. ABSTRACT A study has been made of 3,987 trauma patients who were evacuated by air from Vietnam during the period 8 July to 8 September 1968. This report presents descriptive statistics prepared in the Biometrics Division, USAFSAM, concerning the group as a whole and also subgroups classified by service, by type, location, and severity of injury, by date of leaving Vietnam, and by interval from wounding to evacuation. The mean time of departure from Vietnam was 7 days after injury and of departure from the Far East for the United States was 21 days after injury. Approximately 7% of the patients were considered to be critically ill and almost 50% were moved with some appliance which complicated their care. A total of 20 deaths occurred during the period of observation for an overall death rate of 0.5%. The picture obtained is of a system which moves large numbers of seriously injured patients efficiently, effectively, and safely and produces virtually no adverse effects on the patients whom it serves.		

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