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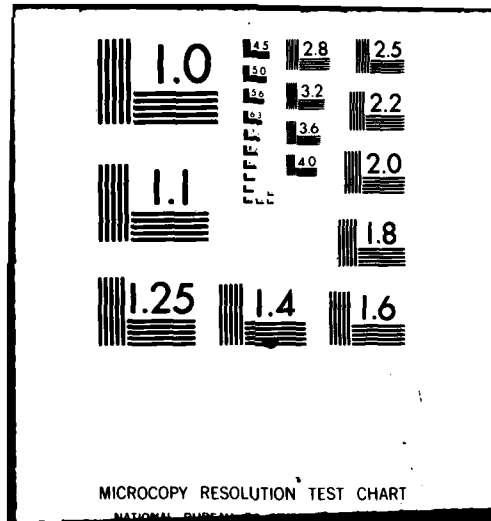
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**CAUSES AND CONSEQUENCES OF ACCIDENTAL INJURIES  
TO NAVY ENLISTED PERSONNEL**

**J. C. FERGUSON  
M. S. MC NALLY  
R. F. BOOTH**

**REPORT NO. 81-34**

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## Causes and Consequences of Accidental Injuries to Naval Enlisted Personnel

John C. Ferguson, Michael S. McNally, and Richard F. Booth

### Summary

#### Problem

A recent epidemiological study of Navy and Marine Corps personnel during the period 1974-1978 revealed that 85% of all deaths were from Accidents, Poisonings, and Violence (APV) and only 15% from disease. Other important consequences of accidents are hospitalization and temporary or permanent disability. APV was shown to be the leading cause of hospitalization among Navy and Marine Corps personnel in 1974. In order to provide a basis for focusing accident prevention programs on causes of accidental injuries resulting in the greatest losses to the naval service, it is necessary to obtain better understanding of the specific causes and consequences of accidental injuries.

#### Objective

The objective of this study was to provide a broad analysis of the consequences of serious accidental injuries in terms of frequencies and durations of hospitalization, physical evaluation board dispositions resulting in loss to the service (through disability), and deaths. These consequences were related to causes of injury, types of injury, and duty status when the injury occurred.

#### Approach

Participants included all male Navy enlisted personnel who had a serious accidental injury during the 5-year period from 1974 through 1978. A serious accidental injury was defined by a hospitalization, a physical evaluation board action, or a death. Data were obtained from the medical history files maintained at the Naval Health Research Center. The following information on individual injuries was analyzed: (1) cause of injury, (2) type of injury (diagnosis), and (3) duty status when the injury occurred--"on duty," "off duty," or "duty status unspecified."

#### Results

Land transport accidents resulted in the greatest numbers of hospitalizations, disability separations, and deaths, accounting for 25% of all hospitalizations and one-half of all disability separations and deaths. The four most frequent causes of accidents--land transport, falls, athletics, and machinery--ranked identically as leading causes of hospitalizations and disabilities and together accounted for 61% of hospitalizations and 94% of disability separations. Land transport, drowning, poisoning, air transport, and guns and explosives accounted for 85% of all deaths. Fractures were the leading types of injuries resulting in hospitalizations and disability separations, accounting for 29% and 52%, respectively. Internal injuries accounted for more than one-half of all deaths.

Off-duty injuries accounted for 58% of the hospitalizations; 21% were on duty and, for the remainder, the duty status was unspecified. Off-duty injuries accounted for 84% of the disability separations, and 116% of these occurred on duty. A large proportion (89%) of accidental deaths occurred off duty; 11% were from on-duty accidents.

The leading causes of on-duty injuries were falls, machinery, and water transport, accounting for 55% of all hospitalizations. The leading causes of disability separations for on-duty injuries were falls, machinery, and athletics, and the leading causes of death from on-duty injuries were air transport, machinery, and water transport.

#### Conclusions

It was concluded that a small number of causes and types of injuries were involved in the great majority of accidents, a finding which should make it possible to concentrate preventive measures. The leading causes and types of injury resulting in death are quite dissimilar to those resulting in hospitalizations and disability separations. The great majority of accidental injuries occur off duty and are thus outside the range of direct supervisory control.

## Causes and Consequences of Accidental Injuries to Naval Enlisted Personnel

John C. Ferguson, Michael S. McElally, and Richard F. Booth

### Introduction

Accidents are the fourth leading cause of death, following heart disease, cancer, and stroke, among persons of all ages in the United States.<sup>1</sup> For youths aged 15-24 accidents claim more lives than all other causes combined and about five times more than the next leading cause of death. Because almost two-thirds of Navy and Marine Corps personnel are between the ages of 17 and 24, it would be expected that the death rate in this population would be relatively high. A recent epidemiological study of Navy and Marine Corps personnel during the period 1974 through 1978 revealed that 85% of all deaths were from Accidents, Poisonings, and Violence and only 15% from disease.<sup>2</sup> One cause, land transport (predominantly motor vehicle) accidents, accounted for almost 40% of all deaths among naval personnel.

Other important consequences of accidents are hospitalization and temporary or permanent disability. Accidents, Poisonings, and Violence (APV) were shown to be the leading cause of hospitalization among Navy and Marine Corps personnel in 1974.<sup>3</sup> Furthermore, the APV category accounted for almost 25% of the total noneffective days lost through hospitalization (approximately one-half million days). Also, of the leading 20 specific causes of hospital admissions, nine were trauma diagnoses.

This study will provide a comprehensive analysis of the consequences of serious accidental injuries in terms of frequencies and durations of hospitalization, physical evaluation board dispositions resulting in loss to the service (through disability), and deaths. These consequences will be related to causes of injury, types of injury, and duty status when the injury occurred. This analysis should provide a basis for focusing accident prevention programs on causes of accidental injury that result in the greatest losses to the naval service.

### Method

Medical and death data were obtained from computer files maintained at Naval Medical Data Services Center, Bethesda, Maryland. These records were edited and incorporated into the medical history files for all active duty naval personnel maintained at the Naval Health Research Center, San Diego. Participants in the study include all male Navy enlisted personnel who had a serious accidental injury during the 5-year period from 1974 through 1978. A serious accidental injury was defined by a hospitalization, a physical evaluation board action, or a death; these were coded in accordance with the Accidents, Poisonings, and Violence categories of the International Classification of Disease, Adapted for Use in the United States, Eighth Revision. Injuries were not included that were self-inflicted, combat-related, or the result of an assault.

It should be noted that physical evaluation boards usually, but not always, followed hospitalizations and that deaths generally were not associated with either hospitalizations or physical evaluation board actions.

Additional classifications were available to further describe individual injuries: (1) cause of injury where it could be determined, (2) type of injury (diagnosis), and (3) duty status when the injury occurred—"on-duty," "off-duty," or "duty status unspecified." A listing and description of causal factors and types of injuries are presented in Table 1.

Members of the Armed Forces may not be retired or separated for physical disability without a full and fair hearing upon demand. Physical evaluation boards are constituted to provide these hearings and to serve as a fact-finding body for evaluating the physical or mental fitness of members to perform the duties of their grade, rank, or rating. The physical evaluation board can recommend the following dispositions based upon medical, conduct, and active duty status records:

(1) temporary or permanent disability retirement, (2) separation with severance pay, (3) discharge without benefits—disability existed prior to enlistment, (4) discharge without benefits—all other circumstances, (5) fit for limited duty, and (6) fit for full duty. A general category of "disability separation," representing manpower loss to the service, was created by combining categories (1), (2), and (4) above.

Frequencies and percentages of hospitalizations, disability separations, and death were tabulated by causal factor

and type of injury. In addition, four indicators of the severity of injury were related to causal factor and type of injury: disability separations and deaths combined, the ratio of hospitalizations to disability separations, the ratio of hospitalizations to deaths, and length of hospitalization. The first indicator provided a measure of manpower loss because of injury. The ratios of hospitalizations to disability separations and to death reflected the relative frequencies of various consequences or outcomes and thus provided direct measures of severity by cause or type of injury. Length of hospitalization provided a generally accepted indicator of severity.

Table 1  
Description of Causal Factors and Types of Injury

<u>Causal Factors</u>	<u>Types of Injuries</u>
1. Air transport	1. Fractures
2. Land transport, including automobiles, motorcycles, pedestrians, and bicycles	2. Dislocations
3. Water transport, including all injuries associated with hazards inherent in that means of transporting, such as machinery, falls, watertight doors aboard ship	3. Sprains/strains
4. Athletics, including physical training	4. Head injuries, including cerebral contusion and brain concussion
5. Complications, including reactions to medicines and complications in medical or surgical procedures	5. Internal injuries
6. Guns and explosives	6. Open wounds, including amputations
7. Machinery, tools, and selected agents, including electric current, cutting or piercing instruments, and falling objects	7. Superficial injury
8. Poisoning, including poisoning by industrial toxic substances, either by ingestion, inhalation, or skin contact; insect and snake bites	8. Contusion
9. Fire, hot or corrosive substances	9. Foreign body
10. Environmental factors, including excessive heat	10. Burns
11. Drowning or submersion	11. Nerve injuries, including cranial nerves
13. Falls and miscellaneous, including twisting, turning, slipping, lifting, and hanging/suffocation (not self-inflicted)	12. Adverse effects, including reactions to medicinal substances
	13. Toxic effects, including reactions to environmental substances
	14. Environmental effects, including effects of physical environment, such as heat, cold, and radiation
	15. Complications, including early complications of trauma, surgical procedures, and medical care

#### Results

Frequencies, percentages, and rankings by causal factors for hospitalizations, disability separations, and deaths are shown in Table 2. Cause of injury was unspecified for a relatively large proportion of hospitalizations (23.9%), but this category was used in only a few cases for disability separations (0.9%) or deaths (1.0%) where detailed causal information is generally obtained. The unspecified category was excluded from all rankings.

Land transport accidents resulted in the greatest number of hospitalizations, disability separations, and deaths, accounting for 25% of all hospitalizations and one-half of all disability separations and deaths. The four most frequent causes of accidents—land transport, falls, athletics, and machinery—ranked identically as leading causes of hospitalizations and disabilities and together accounted for 61% of hospitalizations and 94% of disability separations. Land transport, drownings, poisonings, air transport, and guns accounted for 83% of all deaths. Land transport, falls, and athletics were the leading causes of manpower loss.

Frequencies, percentages, and rankings for hospitalizations, disability separations, and deaths by diagnosis or type of injury are shown in Table 3. Fractures were the leading types of injuries resulting in hospitalizations and disability separations, accounting for 29% and 32%, respectively. Fractures, sprains/strains, head injuries, open wounds, and dislocations accounted for 74% of all hospitalizations, and fractures, sprains/strains, dislocations, open wounds, and dislocations

Table 2

## Consequences of Accidental Injuries by Causal Factor

Causal Factor	Hospitalizations			Disability Separations			Deaths			Manpower Loss*		
	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank
Land transport	9,376	25.0	1	1,463	48.4	1	1,117	57.5	1	2,580	52.0	1
Falls	6,149	16.4	2	720	23.8	2	94	4.8	6	814	16.4	2
Athletics	4,436	11.8	3	383	12.7	3	68	3.5	8	451	9.1	3
Machinery	3,066	8.2	4	277	9.2	4	60	3.1	9	337	6.8	4
Poisoning	1,583	4.2	5	4	.1	11	120	6.2	3	124	2.5	8
Complications	1,242	3.3	6	5	.2	10	2	.1	11.5	7	.1	12
Water transport	844	2.2	7	17	.6	6	71	3.7	7	88	1.8	9
Fire	673	1.8	8	8	.3	8.5	20	1.0	10	18	.6	10
Guns	654	1.7	9	93	3.1	5	115	5.9	5	208	4.2	5
Air transport	396	1.1	10	16	.5	7	118	6.1	4	134	2.7	6.5
Environmental	296	.8	11	8	.3	8.5	2	.1	11.5	10	.2	11
Drowning/Submersion	21	.1	12	-	-	-	136	7.0	2	136	2.7	6.5
Unspecified	8,834	23.5	-	27	.9	-	19	1.0	-	46	.9	-
Total	37,570	100.0	-	3,021	100.0	-	1,942	100.0	-	4,963	100.0	-

\*Includes Disability Separations and Deaths.

Table 3

## Consequences of Accidental Injuries by Type of Injury

Causal Factor	Hospitalizations			Disability Separations			Deaths			Manpower Loss*		
	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank
Fractures	10,860	28.9	1	1,584	52.4	1	119	6.1	4	1,703	34.3	1
Sprains/strains	5,514	14.7	2	318	10.5	2	1	.1	11.5	319	6.4	5
Head injuries	4,261	11.3	3	196	6.5	6	228	11.7	3	424	8.5	3
Open wounds	3,957	10.5	4	276	9.1	4	51	2.6	6	327	6.6	4
Dislocations	3,042	8.1	5	310	10.3	3	2	.1	10	312	6.3	6
Complications	2,404	6.4	6	45	1.5	7	15	.8	9.5	60	1.2	9
Contusions	2,331	6.2	7	18	.6	9	0	-	-	18	.4	13
Adverse effects	1,393	3.7	8	214	7.1	5	75	3.9	5	289	5.8	8
Burns	996	2.7	9	26	.9	8	22	1.1	8	48	1.0	11
Superficial injuries	788	2.1	10	3	.1	13	1	.1	11.5	4	.1	15
Internal injuries	641	1.7	11	16	.5	10	1,062	54.7	1	1,078	21.7	2
Toxic effects	566	1.5	12	2	.1	14.5	49	2.5	7	51	1.0	10
Environmental effects	381	1.0	13	2	.1	14.5	301	15.5	2	303	6.1	7
Nerve injury	288	.8	14	6	.2	11	0	-	-	6	.1	14
Foreign bodies	148	.4	15	5	.2	12	16	.8	9.5	21	.4	12
Total	35,570	100.0	-	3,021	100.0	-	1,942	100.0	-	4,963	100.0	-

\*Includes Disability Separations and Deaths.

medicinal effects accounted for 89% of the disability separations. Internal injuries accounted for more than one-half of all deaths (54.7%) while environmental effects and head injuries accounted for another 27%. Fractures, internal injuries, and head injuries were the leading injury types resulting in manpower loss.

The most frequent types of injury resulting in hospitalization for each causal factor are shown in Table 4. Most causal factors tended to have unique patterns of associated injuries. For example, land transport accidents resulted



most frequently in fractures or head injuries while gun accidents resulted in a high frequency of open wounds. As would be expected, fires resulted in burns in almost all cases, and poisonings generally resulted in toxic or adverse effects. Machinery accidents most often resulted in open wounds or fractures. Athletic accidents and falls resulted in similar patterns of injury with fractures and sprains/strains predominating.

Table 4  
Percentage Distribution of Accidental Injuries by Causal Factor and Type of Injury

Type of Injury	Causal Factor												
	1 <sup>a</sup>	2	3	4	5	6	7	8	9	10	11	12	13
Fractures	31.3	43.4	28.2	34.8		11.9	18.3			6.5		35.7	22.8
Sprain/strains	17.2		12.5	23.7								22.8	25.5
Head injuries		20.0	7.8	6.6			7.7					13.7	10.2
Open wounds	14.6	8.5	14.4			67.0	42.5			10.5			8.3
Dislocations			7.5	22.2								10.8	9.9
Complications					76.4								6.5
Contusions	12.9	6.2	9.3	5.7		12.8	7.6					6.3	7.3
Adverse effects								69.9		6.8			
Burns									87.0				
Toxic effects								26.2					
Environmental effects										60.1	81.0		
Other	24.2	21.9	20.3	7.0	23.6	8.3	23.9	3.9	13.0	16.1	19.0	10.7	9.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

<sup>a</sup>1 = Air transport (N = 396); 2 = Land transport (N = 9,376); 3 = Water transport (N = 844); 4 = Athletics (N = 4,436); 5 = Complications (N = 1,242); 6 = Guns/Explosives (N = 654); 7 = Machinery (N = 3,066); 8 = Poisoning (N = 1,583); 9 = Fire (N = 673); 10 = Environmental (N = 296); 11 = Drowning/Submersion (N = 21); 12 = Falls (N = 6,149); 13 = Unspecified (N = 8,834).

Consequences of accidental injuries as a function of duty status are shown in Table 5. Frequencies and percentages of hospitalization, disability separations, and deaths by duty status at the time of the accident are indicated. Of 37,570 hospital admissions, 58% were for injuries that occurred off-duty; of 20% of these admissions, duty status was not known or not recorded. Of 3,021 disability separations, 84% were for off-duty injuries and 16 for on-duty injuries; only 0.1% were unspecified as to duty status. A large proportion (89%) of deaths was related to off-duty accidents; 11% were from on-duty accidents and only 0.4% unspecified as to duty status.

Table 5  
Consequences of Accidental Injuries by Duty Status

Duty Status	Hospitalizations		Disability Separations		Deaths	
	Number	Percent	Number	Percent	Number	Percent
On-duty	8,051	21.4	488	16.2	204	10.5
Off-duty	21,860	58.2	2,530	83.7	1,733	89.2
Unspecified	7,659	20.4	3	.1	5	.3
Total	37,570	100.0	3,021	100.0	1,942	100.0

Although only 21% of all hospitalizations were for injuries specified as occurring on duty, these accidents are especially worthy of attention because of the degree of command supervision and control that exists and, therefore, the greater opportunity for intervention and prevention. The consequences of on-duty injuries by causal factor are shown separately in Table 6. It is noteworthy that the leading causes of injury are quite different for on-duty accidents as compared to off-duty accidents. The leading causes of on-duty injuries were falls, machinery, and water transport which accounted for 55% of all hospital admissions for injury. The leading causes of disability separations for on-duty injuries were falls, machinery, and athletics, and the leading causes of death from on-duty injuries were air transport, machinery, and water transport.

Table 6  
Consequences of On-Duty Accidental Injuries by Causal Factor

Causal Factor	Hospitalizations			Disability Separations			Deaths			Manpower Loss*		
	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank	Number	Percent	Rank
Falls	2,185	27.1	1	242	49.6	1	11	5.4	6	253	35.6	1
Machinery	1,537	19.1	2	108	22.1	2	25	12.3	2	133	19.2	2
Water transport	709	8.8	3	16	3.3	5	24	11.8	3	40	5.8	5
Athletics	502	6.2	4	65	13.3	3	3	1.5	9	68	9.8	4
Complications	439	5.5	5	2	.4	10	0	0	-	2	.3	12
Land transport	392	4.9	6	17	3.5	4	16	7.8	4.5	33	4.8	6
Air transport	356	4.4	7	15	3.1	6	96	47.1	1	111	16.0	3
Fire	318	4.0	8	2	.4	10	6	2.9	7	8	1.2	9
Poisoning	300	3.7	9	2	.4	10	1	.5	10	3	.4	11
Guns	188	2.3	10	9	1.8	7	4	2.0	8	13	1.9	8
Environmental	123	1.5	11	7	1.4	8	0	0	-	7	1.0	10
Drowning/Submersion	5	.1	12	0	0	-	16	7.8	4.5	16	2.3	7
Unspecified	997	12.4	-	3	.6	-	2	1.0	-	5	.7	-
Total	8,051	100.0		488			204	100.0		692	100.0	

\*Includes Disability Separations and Deaths.

The leading causes of off-duty injuries (not shown separately) were as follows: Land transport, athletics, and falls accounted for 71% of hospital admissions; land transport, falls, and athletics were leading causes of disability separations, and land transport, drownings, and poisonings were leading causes of death.

The severity of accidental injuries in terms of rankings on three indices or criteria was examined in relation to causal factors and type of injury. Results are shown in Table 7.

Land transport (motor vehicle) accidents and guns caused severe injuries in terms of all criteria--disability separation, deaths, and average length of hospitalization. Falls and athletics caused relatively severe injuries in terms of disability separations and length of hospitalization but not deaths. Internal injuries were most severe in terms of the death criterion; internal injuries also resulted in relatively long hospitalizations but relatively few disability separations. Environmental effects (heat, cold, and radiation) and toxic effects were relatively severe with respect to the death criterion but not the disability separation or length of hospitalization criteria. Superficial injuries, contusions, and treatment complications were the least severe types of injuries with respect to all criteria combined.

#### Discussion

Since relatively few causes and types of injury accounted for the majority of hospitalizations and disability separations, it should be possible to concentrate preventive or emergency service efforts on specific causes and types of injuries. Accidents due to land transport (motor vehicles), falls, athletics, and machinery accounted for 61% of all

Table 7

## Severity of Accidental Injuries by Causal Factor and Type of Injury

Causal Factor	Hospitalizations/ Disability Separations		Hospitalizations/ Deaths		No. of Hospital Days <sup>a</sup>	Rank
	Ratio	Rank <sup>a</sup>	Ratio	Rank <sup>a</sup>		
Land transport	6.4	1	8.4	4	25.2	1
Falls	8.5	3	65.4	10	15.2	5
Athletics	11.6	5	65.3	9	16.2	3
Machinery	11.1	4	51.1	7	15.0	6
Poisoning	395.8	11	13.2	6	5.2	12
Complications	248.4	10	621.0	12	11.1	10
Water transport	49.6	8	11.9	5	14.0	9
Fire	84.1	9	33.7	8	15.8	4
Guns	7.0	2	5.7	3	22.1	2
Air transport	24.8	6	3.3	2	14.1	8
Environmental	37.1	7	148.5	11	9.8	11
Drowning/Submersion	-	-	.2	1	14.9	7
<u>Type of Injury</u>						
Fractures	6.9	2	91.2	9	27.4	1
Sprains/strains	17.3	5	5514.0	13	12.1	7
Head injury	21.7	6	18.7	6	8.2	12
Open wounds	14.3	4	77.6	8	17.1	6
Dislocations	9.8	3	1521.0	12	19.9	2.5
Complications	53.4	11	160.3	10	11.5	8
Contusions	129.5	12	-	-	8.1	13
Adverse effects	6.5	1	18.6	5	5.4	14
Burns	38.3	8	45.3	7	17.9	5
Superficial injuries	262.7	14	788.0	11	8.6	10
Internal injuries	40.1	9	.6	1	19.4	4
Toxic effects	283.0	15	11.4	4	5.0	15
Environmental effects	190.5	13	1.3	2	8.3	11
Nerve injury	48.0	10	-	-	19.9	2.5
Foreign bodies	29.6	7	9.3	3	8.7	9

<sup>a</sup>Rankings are all from most (1) to least severe.

hospitalizations and 94% of all disability separations. Musculoskeletal system injuries (fractures, dislocations, and sprains/strains) accounted for 73% of all disability separations. The leading causes and types of injury resulting in death were quite dissimilar from those resulting in hospitalizations and disability separations, but again a relatively small number of causes and types of injury produced the majority of deaths. The five leading causes of death--land transport, drowning, poisoning, air transport, and guns--and the five leading injury types--internal injuries, environmental effects, head injuries, fractures, and adverse effects--comprise 83% and 92%, respectively, of all deaths.

The finding that causes of injury have unique patterns of injury types has implications for the providing of emergency services and possibly even for hospital staffing. Locations where there is the potential for machinery accidents should be prepared to treat open wounds and fractures. Almost two-thirds of water transport accidents were fractures, open wounds, sprains/strains, and contusions.

A large proportion of accidental injuries resulting in hospitalizations, disability separations, and deaths occurred off duty and are thus outside the range of direct supervisory control. Different methods of insuring compliance with safety regulations and preventive measures may be required for the off-duty environment.

The finding that the leading causes of death in an on-duty status was dissimilar from those in an off-duty status

emphasizes the importance of the environment in which the accident occurred. In this study the risks inherent in the leading causes of death--air transport, machinery, and water transport--are all environments with considerably greater exposure in an on-duty status. Although on-duty accidents accounted for a small proportion of the total, there were a small number of on-duty causes that comprised over 50% of the total. Air and water transport and machinery are the most important of these because they are associated with the highest incidence. Safety management and command supervision should continue to stress aviation safety and put more emphasis on programs to reduce the hazards inherent in water transport and machinery.

The indicators of manpower loss and severity appear to be meaningful and useful as measures of hazards inside and outside the work place, reflecting the relative severity and cost of consequences in terms of length of hospital stay, replacement costs, and permanent manpower loss to the service. The predominance of accidental injuries due to land transport, guns, falls, machinery, and athletics associated with the manpower loss and the hospitalization/disability ratio severity indicator should alert military supervisors and safety personnel to these causes for increased accident prevention efforts. These severity measures have promise as useful tools for more detailed future analyses and comparative studies.

The purpose of this study was to provide a broad analysis of the consequences of serious accidents. In pursuing this goal, it became apparent that more detailed analyses of some additional factors contributing to accidents would be needed to provide guidelines for reduction and prevention. Specifically, analyses of the interaction of cause and type of injury would provide information on how to focus prevention measures. An analysis of the on-duty work setting would lead to the identification of high risk occupations and work assignments. The results of research on the relationship of occupation to demographic variables, personality characteristics, job experience, and supervisory level would allow further focused prevention measures for certain types of individuals, occupations, and environments.

#### Summary

1. Land transport and fractures were the leading cause and type of injury. A small number of causes and types of injury are involved in the great majority of accidents. The same four causes--land transport, falls, athletics, and machinery--accounted for 61% of all hospitalizations and 94% of all disability separations. This finding should make it possible to concentrate prevention measures and emergency services.

2. The leading causes and types of injury resulting in death are quite dissimilar to those resulting in hospitalizations and disability separations; also, the leading causes of death in on-duty status are dissimilar from causes in off-duty status.

3. Fractures result in the longest average hospital stay of 27.4 days, followed by dislocations and nerve injuries at 19.9 days.

4. Causes of injury are associated with unique patterns of types of injury. This finding has implications for the providing of emergency services.

5. The great majority of accidental injuries resulting in hospitalizations, disability separations, and deaths occur off duty and are thus outside the range of direct supervisory and management control.

6. Air and water transport and machinery are on-duty causes resulting in more than 70% of the total deaths. On-duty accidents are more under management supervision and control than off-duty accidents. Safety management should continue to stress aviation safety and put more emphasis on programs to reduce the hazards inherent in serving aboard ship and in working with machinery.

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ability separations and deaths occurred from off duty accidents. Land transport and fractures were the leading causes and types of injury, respectively. The same four causes, land transport, falls, athletics, and machinery accounted for 61% of all hospitalizations and 94% of all disability separations, but the leading causes of death were dissimilar from those resulting in hospitalizations and disability separations. On duty air and water transport and machinery accounted for more than 50% of total hospitalizations for those causes. The results were discussed in terms of guidelines for accident prevention programs and management supervision and control.

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