A SURVEY OF SELF-REPORTED INJURIES AMONG SPECIAL BOAT OPERATORS

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ABSTRACT

Special Operations place great physical demands on personnel. In most Navy settings, greater physical demands are associated with greater musculoskeletal injury rates. Within the Special Operations community, Special Boat operators have a unique set of risks. Small boats operating in the open ocean are subject to large shock and vibration forces. Exposure to such forces can lead to discomfort, injury and performance degradation. In an effort to begin assessing the prevalence of injuries related to operations in small Special Operations craft, a self-report survey of injuries (SBUIS) was administered to 154 operator personnel drawn from Special Boat Units 12,20 and 22. Sample mean age was 32.0 ± 5.9 yr., mean years of military service was 12.0 ± 5.5, and mean time in Special Boats was 4.7 ± 3.0 yr. The SBUIS obtained demographic information, unit assignment and role information, past general pain levels, details about up to three specific injuries, and exercise history information. Specific injury information included type and location of injury, and type and duration of care for that injury. Of the respondents, 95 reported one injury event, 11 reported 2, and 5 reported 3. The 121 injury events resulted in 153 separate injuries. The most prevalent type of injury was sprains and strains (49.3%) followed by disc problems (7.9%) and trauma (7.9%). The most prevalent injury sites were the lower back (33.6%), knee (21.5) and shoulder (14.1%). Most injuries (94.8%) occurred on the job. The population sample represented 722 person-years of Special Boat Unit exposure. In this sample, injuries resulted in 145 days of hospitalization, 929 days of sick leave, 4,223 days of limited duty, 4,218 days of limited job/mission performance, 2,294 days of lost mission training time, and 4,089 days of lost physical conditioning time. It was possible to compare hospitalization rates for this sample with rates for the Navy as a whole. Hospitalization incidence for the survey respondents was 2,687 per 100,000 person-years exposure. The overall Navy rate for the combination of injuries reported in this sample was 479 per 100,000 person-years. Only constructionmen (CN), seamen (SN), firemen (FN), and airmen (AN) had greater hospitalization rates than SBU respondents. We conclude that SBU personnel are at greater than average

risk of injury associated with SBU training and operations. These findings need to be confirmed. If confirmed, methods to reduce the injury risk must be identified and implemented.

INTRODUCTION

Special Operations place great physical demands on personnel.[1] In most Navy settings, greater physical demands are associated with greater musculoskeletal injury rates.[2,3] Therefore, one would expect that Special Operations personnel would have a relatively large injury rate. While it is known that the injury rate associated with Special Operations training is large,[4] little is known about the injury rate for Special Operations personnel.

Special Boat Operators represent a unique subset of Special Operations forces. They are responsible for the operation of Special Operations boats. Their missions include providing ingress and egress for Sea, Air, and Land (SEAL) team members and patrolling of hostile waterways. While these missions may not seem as physically demanding as those of some other SEAL operators, Special Operations craft pose a unique risk to health.

Small fast boats operating in the open ocean can generate high shock and vibration impulses to their occupants, particularly in high sea states. The shock impulses are due to boats becoming airborne or partially airborne after cresting a wave and slamming down into the water prior to cresting the next wave. Vibration is, for the most part, due to the boat engines. Shock impulses are greater in the vertical axis than in longitudinal or transverse axes. The shock impulses are also greater for lighter boats than heavier boats, and increase with increasing velocity in the ocean water. Vertical acceleration forces between 2 and 10g have been recorded during operations of some older types of Special Operations craft.[5]

Exposure to shock and vibration such as that experienced in Special Operations Craft can lead to discomfort, injury and performance degradation.[5,6] Examples of such effects include annoyance, fatigue, sleepiness, discomfort, anxiety, nausea, loss of visual acuity and hand-eye coordination, abdominal pain or discomfort, testicular pain, headache and other head symptoms, chest pain, back pain, sprains, torn ligaments, broken ankles and legs, damaged vertebrae, and damage to internal organs.

Naval Special Warfare, Special Boat Units have recently expressed concern about the occurrence of such injuries.[7] Anecdotal evidence suggests that Special Boat Unit personnel show injury symptoms consistent with the shock associated with small boat operations (Medical Officer, Special Boat Squadron ONE, personal communication), but further data need to be gathered.

The study presented here describes the beginning of an effort to assess the prevalence of injuries related to operations in small Special Operations craft. In this study, a self-report survey of injuries among Special Boat Unit (SBU) personnel was conducted. Meyer and coworkers[8] have shown that the use of such a survey can be effective to determine injury prevalence among Special Operations personnel, and a survey questionnaire, modeled after the one developed by Meyer et al., was developed for SBU personnel. This report presents the survey used and an analysis of responses to that survey.

METHODS

The participants in this study were SBU operational personnel, drawn from SBU-12, SBU-20 and SBU-22. Participants were volunteers from groups of SBU personnel attending a General Military Training (GMT) lecture at their Units. One hundred and fifty four SBU personnel participated in this study. They all had the Special Boat Naval Enlistment Codes: (NEC) 5350 (Special Warfare Combatant Crewman [SWCC] basic), 5351 (SWCC Intermediate), or 5352 (SWCC advanced). The participant characteristics are provided in Table 1. Significant differences ($p < 0.05$) were found for age and years of military service across SBUs. Members of SBU-22 were younger, on average, than members of SBU-12 or SBU-20. Members of SBU-22 had fewer years of military service, on average, than members of SBU-20.

The approximate median operator manning levels for these SBUs are: SBU-12, 202.5; SBU-20, 200; and SBU-22, 107.5. Therefore these samples of opportunity represent approximately 41%, 22% and 26% of the populations of SBU-12, SBU-20 and SBU-22, respectively, and about 32% of the estimated SBU operator population across all 3 units.

The participants completed the study by filling out an anonymous questionnaire, the Special Boat Unit Injury Survey (SBUIS). The SBUIS is attached as Appendix A. The first section of the SBUIS consisted of the Information to the Participants, a description of the study goals and procedures and a Privacy Act Statement. The first data section contained questions about general demographic information. A second data section contained questions related to the participant's unit assignment (e.g. position and responsibilities, crew assignment, type of craft operated). A third data section covered general pain levels associated with past injuries. Questions in this section were based on similar patient examination items used by the Quebec Task Force of Spinal Disorders[9] and the Agency for Health Care Policy and Research.[10] The fourth data section solicited details about specific past injuries, and a fifth data section covered current physical activity information. This report will focus on the specific past injuries.

As can be seen, the SBUIS allows reporting of three specific injuries. Review of the responses revealed that several of the respondents indicated multiple sites, and sometimes multiple types of injuries in one specific injury report. To facilitate investigation of injury type by location, the specific injury listed was separated into individual injuries whenever multiple injuries were reported as one specific injury. From this point forward, the information provided in one of the three specific injury reporting sections will be referred to as an "injury event," and the individual components of the injury as "injuries."

Analysis

The data were analyzed by categorizing elements of the data set and reporting frequencies of occurrence of these categories. In addition, relationships between variables in the data set and the occurrence or absence of injury were explored using t-tests for independent means, correlational analyses and logistic regression. All procedures were carried out using SPSS for Windows, release 10.0.5 (27 Nov 1999; SPSS Inc., Chicago, IL).

RESULTS

Prevalence of Injury

Of the 154 operators surveyed 100 (64.9%) reported at least one injury event. Of those 100, 11 reported two injury events, and 5 reported three injury events, for a total of 121 injury events. Table 2 shows the distribution of those reporting an injury across boat units. The prevalence of injury events did not differ significantly among the three SBUs ($\chi^2 = 1.88$, df = 2, $p = 0.39$).

The responses to questions about type of craft operated and position in the boat crew were varied. Some respondents appeared to list their current craft and position, others listed all craft types and positions they had held. Because of these differences in response style, it was not possible to investigate the distribution of injuries by boat type or crew position.

The 121 injury events resulted in a total of 153 injuries. Table 3 provides the distribution of injuries by general type of injury. The most prevalent injury classification shown in Table 3 is sprains and strains (49.3% of the injuries), followed by disc problems and trauma (7.9%). The total number of reported injury types and the total number of reported locations are not equal because it was not always possible to match the reported symptoms with a location or location with reported symptoms. The "mechanical problem" listed in Table 3 was a foot arch problem.

Table 4 shows the distribution of these injuries by anatomical location. Because of incomplete reporting, the total number of events in Table 4 is less than the total number of reported injuries. The most prevalent injury sites in this group are the lower back (33.6% of the injuries), the knee (21.5%), and the shoulder (14.1%).

Respondents were asked to indicate whether their injury event occurred during (1) mission

related operations, (2) unit training, (3) while participating in unit PT, (4) during unusual sea states and/or weather conditions, or (5) was unrelated to SBU activities. Injury circumstances were provided for 115 of the 121 injury events. Only one respondent picked option (2) and this event was recoded as (1), during mission related operations. Table 5 shows the distribution of injury event circumstances. It can be seen from Table 5 that 94.8% of the injury events can be considered on-the-job injuries. Approximately 18% of the reported injury events were listed as occurring during "unusual sea states or weather".

Seeking Medical Treatment

Of the 100 personnel reporting at least one injury, 97 indicated whether or not they sought medical attention. Of these 97, 76 (78.4%) sought medical attention for their injuries. As seen in Tables 3 and 4, these 97 respondents reported 140 injuries for which the injury type was provided, and 149 injuries for which a location was provided. Table 6 provides a cross-tabulation of medical treatment seeking by type of injury. Table 7 is a cross-tabulation of medical treatment seeking by anatomical location of injury.

Among the injury types, the lowest rates of seeking medical attention were those for trauma injuries, and chronic pain. For trauma, this is not surprising in that this category included minor cuts and abrasions. In the case of chronic pain, the respondents often responded that there was nothing to be done, and they chose to live with the pain.

It is difficult to compare medical attention seeking among anatomical locations, because the number of respondents reporting injuries at many of the listed locations is small. If one groups these locations into larger anatomical units, the differences in seeking medical attention by body location seem small. For example, if the body is divided into [1] *head and neck* (head + neck and upper back); [2] *upper limb* (shoulder + elbow + wrist + hand); [3] *trunk* (trunk + low back); and [4] *lower limb* (hip/buttocks + thigh + knee + leg + ankle + foot) the frequencies of seeking medical attention are 9/12 = 75%, 18/24 = 75%, 41/49 = 83.7%, and 46/59 = 78.0%, respectively.

Medical Treatment Sites and Personnel

The SBUIS asks respondents to indicate whether or not their injury was diagnosed, who provided the diagnosis, and where the respondent went for treatment. Responses to the question of whether or not an injury event was diagnosed were provided for 99 of the 100 respondents who were injured. Respondents who reported multiple injury events were consistent across injury events in whether or not they had their injuries diagnosed. Of the 99 injured respondents, 83 (83.8%) had their injuries diagnosed, 16 did not.

Health care providers

Figure 1 provides the distribution of diagnoses by type of health care provider. This distribution is based on a sample of 116 (of 121) injury events for which this information was provided. As can be seen from Figure 1, the most common care provider was the corpsman (42 instances), followed by physician (26 instances).

Medical Treatment Sites

The distribution of health care treatment sites is provided in Figure 2. The most common treatment facility was the Naval Hospital (34 reports), followed by treatment in the field (the combination of the platoon corpsman, and the command Independent Duty Corpsman, 25 reports). In this sample, 16 respondents indicated that they either needed no treatment or that they treated themselves.

Impact of Injury

Survey respondents were asked whether or not their injuries led to limited duty, sick leave, hospitalization, limited their professional or personal training time, or affected their mission performance. Results of the responses to those questions are provided in this section. In order to provide a conservative estimate of the time needed to recover from injury, the value of 121 total injury events was used as the denominator for frequency and mean value calculations. Missing values for any of the impact times listed above were set to a value of zero for those who reported an injury event, but did not indicate the presence or absence of recovery, limited duty, or any of the other impact times.

Figure 3 shows the distribution of hospitalization days due to an injury event.

Hospitalization periods ranged from 0 to 65 days. One can see from Figure 3 that only 16% of the injury events resulted in hospitalizations. In this sample, a total of 145 man-days were lost due to hospitalization. This value represents an average value of 1.2 days of hospitalization per injury event, or 7.25 days for those events (N = 20) requiring hospitalization.

Figure 4 shows the distribution of number of days of sick leave (presumably "sick in quarters") following an injury event. The number of sick days ranged from 0 to 365 days. The total number of man-days lost due to sick in quarters time was 929. Again, only a minority of the injury events resulted in sick leave (N = 17). The average sick leave was 7.7 days per injury event overall, and 54.6 days for those injury events resulting in sick leave.

Figure 5 shows the distribution of the number of days of limited duty reported for injury events. Almost half of the injury events resulted in one or more days on limited duty status. The number of limited duty days ranged from 0 to 455 for a single injury event, with a total of 4,223 limited duty days for this sample. The average number of limited duty days was 34.9 for all injury events, and 79.7 for those injury events for which limited duty was prescribed.

The SBUIS asked respondents to indicate whether or not an injury event limited their job or mission performance, and if it did, for how many days. Figure 6 shows the distribution of responses to this question. The number of days of limited job/mission performance ranged from 0 to 455. Limited performance days were reported for approximately one third of the sample of injury events (N = 40). There were a total of 4,218 days of limited job/mission performance reported for this sample. This represents an average of 34.9 days per injury event, or 105.5 days for each injury event resulting in limited performance days.

SBUIS respondents also indicated the number of job/mission training days lost due to each injury event, as well as the number of personal training days lost. Figure 7 shows the distribution of mission training days lost due to an injury event. The number of days lost ranged from 0 to 365, with a total of 2,294 days lost for the sample. A total of 36 respondents indicated that they had lost mission training time. The average number of training days lost was 19.0 for all injury events, and 63.7 for those injury events resulting in lost training time.

Figure 8 shows the distribution of personal training time lost due to the occurrence of an injury event. The total number of days lost was 4,089 (approximately twice that for mission training), and ranged from 0 to 365 for an injury event. A total of 51 injury events resulted in lost personal training time. The average time lost was 33.8 days for all injury events, and 80.2 days for those events resulting in lost personal training time.

In general, the majority of respondents sustaining an injury event reported that no time was lost for each of various types of impact days. However, of the 121 injury events, only 33 (27.3%) resulted in no time lost of any type. Sixty-three (52.1%) resulted in no lost time due to medical consequences of the injury (hospitalization, sick leave, or limited duty time).

Predictors of Injury

The demographic variables were investigated as predictors of injury during duty with the SBUs. Questionnaire respondents were classified as either injured or not, based on their responses to the specific injury section of the questionnaire. Table 8 shows the mean values of some demographic variables for the injured and non-injured groups, as well as the correlation between the variable and injury status.

As can be seen from Table 8, significant difference in mean values and a significant correlation coefficient was found only for number of years in the SBUs. The association between time in the SBUs and injury status is illustrated in Figure 9. The bars in Figure 9 represent respondents in this survey grouped by the number of years they have been assigned to SBUs. The bars are divided to indicate the proportions of each group that reported or did not report an injury event. The greatest proportion of those not reporting an injury event are in the groups "less than 1 year" or between 1 and 2 years in the SBUs.

An effort was made to model the risk associated with time assigned to a SBU, and to

determine whether or not other demographic variables might be associated with the risk of injury once the variance attributable to years of SBU service had been taken into account. A forward, likelihood ratio, logistic regression analysis with injury status as the independent variable was carried out using the demographic variables. The resulting model is provided as equation.[1] As would be expected from the results shown in Table 8, number of years of SBU service was one of the predictors. Stature also entered as a significant ($p < 0.05$) predictor.

$$\text{Prob. of injury} = \frac{e^{0.452 \times Yrs.SBU + 0.075 \times Stature(cm) - 14.681}}{1 + e^{0.452 \times Yrs.SBU + 0.075 \times Stature(cm) - 14.681}}$$

The probability of injury was calculated using this model for each individual in this sample. Study participants were then grouped based on their probability of injury rounded to the nearest 10%. Table 9 provides the distribution of mean years of SBU service and stature, as well as injury status for each of these probability groups. The Pearson's correlation coefficient between the injury status groups and the injury probability groups was 0.460 ($p < 0.001$). While the predicted probabilities of injury are significant predictors of the measured probabilities, inspection of the values provided in Table 9 suggests that prediction is better at the extremes of the probability range than it is in the middle of the range.

DISCUSSION

This survey was not designed to investigate specific associations between the shock and vibration environment of Special Operations craft. Rather, the survey was intended to collect reports about the prevalence and variety of injury events associated with serving in the SBUs. The pattern of injury: primarily sprains and strains, and primarily involving the lower back, knee, and shoulder is consistent with the performance of heavy physical activity. The influence of shock and vibration on the development of these injuries cannot be judged from the responses to this survey.

It is clear from the survey that the majority of SBU personnel (64.9%) are injured on the job. As would be expected, the risk of injury increases with continued exposure to the job. Most personnel who were injured sought medical attention (78.4%). The most common treatment provider was either a corpsman (36.2%) or a physician (22.4%). Treatment was most commonly provided at the unit level (26.7%) or at the hospital (29.3%).

The real impact of these injuries is difficult to assess from this survey. It is difficult to know how to evaluate the effects of lost personal and mission training time on readiness. If one is conservative and assumes that the times reported for medical treatment (hospitalization, sick leave, and limited duty time) overlap, the estimate of days lost associated with medical treatment is 4,223 days (the time reported for limited duty days). As pointed out earlier, this represents an average of a little more than a month of "non-effective time" following an injury event. The total reported years of service in the SBUs for this sample is 722. The 4,223 days of medical treatments represent an average treatment rate of 5.85 days per person-year for the SBU population. Similarly, the 121 injury events represent an incidence rate of 0.16 injury events per person-year.

Nineteen of the 121 injury events resulted in hospitalization. The hospitalization incidence rate is, therefore, 19 ÷ 722 = 0.02632 hospitalizations per year or 2,632 per 100,000 exposure years (95% confidence interval = 1,568 to 4,050) (12, p186). To provide a reference frame for this number, an analysis was carried out using the Epidemiological Interactive System (EPISYS) software and database developed at the Naval Health Research Center.[11] EPISYS consists of a database of inpatient hospitalization, demographic and career history records for all Navy enlisted personnel on active duty between 01 January

1980 and 30 September 1997, and software to access, analyze, and summarize these data.

Since EPISYS only contains enlisted records, the comparison was adjusted to include only those hospitalizations reported by enlisted SBUIS respondents. The number of hospitalizations was unchanged, but the denominator value of 722 person-years had to be adjusted to 707 person-years served in SBU by the enlisted respondents.

EPISYS allows queries of the database to be constructed using specific International Classification of Diseases (ICD9) codes.[13] The lists of injury types and locations were reviewed and a list of ICD9 codes representing the injuries reported by the SBUIS respondents was developed. These codes were used in EPISYS to determine the incidence of hospitalization due to these injuries and conditions in the Navy population at large. Hospitalization incidence values were broken out by NEC to allow comparisons with specific Navy occupations. EPISYS was created before the particular NECs used to select participants in this study were created. Therefore, we cannot use EPISYS to validate the hospitalization rates developed from the data collected in the SBUIS. The specific ICD9 codes used to construct the hospitalization incidence rates are provided in Table 10.

The overall hospitalization incidence attributable to the ICD9 diagnoses listed in Table 10 was 479 per 100,000 person-years exposure (95% confidence interval = 475 - 486). The adjusted incidence rate for the SBUIS enlisted respondents was 2,687 (1,619 - 4,164), over 5.5 times the overall Navy rate. EPISYS provides 83 NEC categories. When the hospitalization incidence denominator is calculated as the total number of person-years served in the Navy, rather than just in the SBUs, the value is 1,718 person-years, and the incidence rate becomes 1,106 per 100,000 person-years exposure (685 – 1,177). Table 11 lists the 10 greatest hospitalization incidence rates and their associated Navy ratings.

One can see in Table 10 that there are 4 ratings with clearly greater hospitalization incidence rates than the remaining ratings: CN, SN, FN, and AN. The hospitalization incidence for SBU personnel based on time in the SBU is greater than that of all of the ratings shown in the table except the CNs. The value for CNs differs significantly ($p < 0.05$) from that of the SBU personnel. From the 95% confidence interval for the incidence rate of SBU personnel, it can be seen that, while greater, the SBU incidence rate does not differ significantly from those of the SNs or FNs. Nonetheless, the hospitalization rate for SBU personnel is significantly greater than that of 80 of the 83 Navy ratings contained in EPISYS.

The incidence rate for SBU-personnel based on total time in the Navy would rank 5th, less than that for ANs and greater than that for HMs. This incidence rate is still significantly greater than the average rate for Navy personnel, and significantly greater than the hospitalization incidence rates of 61of the 83 ratings in EPISYS.

A limitation to this analysis is that the list of diagnoses used in the analysis is too specific. The injuries reported in the SBUIS may be indicators of more general categories, and the list of ICD9 codes may not adequately reflect that level of generalization. Despite this drawback, the comparison of hospitalization rates certainly suggests that SBU operators are being injured at a greater rate than most of the Navy population, and that this is a situation that warrants further investigation.

CONCLUSION AND RECOMMENDATIONS

The analysis of the responses to the SBUIS leads us to conclude that SBU personnel are at greater than average risk for injury associated with SBU training and operations. Our recommendation is that these findings be confirmed by further study including review of medical records. If the findings of this report are borne out, methods to reduce the injury risk must be identified and implemented.

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SPECIAL BOAT UNIT INJURY SURVEY

Introduction

The nature of special operations requires Naval Special Warfare Personnel (NSW) to perform at high levels of their physical capacity for extended periods of time. In many cases, NSW missions are conducted under extreme environmental conditions that can compromise human performance. Because of the high physical, mental, and environmental demands required to conduct these missions, intense physical conditioning is a necessary component of SOF operational training. The operational tempo, coupled with the training requirements necessary to perform missions, place SOF personnel at risk for musculoskeletal injury.

Injuries related to the activities of special boat unit operations has become a concern of the command at the Special Boat Squadrons. For this reason, a study is currently underway to determine factors related to injuries among Special Boat Unit (SBU) personnel. The initial goal of the study is to determine the extent of injuries among SBU operators so that effective countermeasures can be integrated into SBU training and craft design to reduce the risk of injury and sustain optimal performance. The integration of injury prevention countermeasures will also serve to enhance the health and safety of SBU personnel during their naval careers.

Questionnaire Instructions

The Special Boat Unit Injury Survey is designed to obtain information on the prevalence of musculoskeletal injuries among existing SBU personnel. Your participation in the survey is voluntary and anonymous. Please do not place any identifying marks on the survey forms. The survey questionnaire consists of five parts: The first section asks for certain demographic data, the second part asks for job-related information, the third section attempts to obtain general injury information, and the fourth section seeks more specific injury information for each injury sustained during your affiliation with the special boat units. The last section focuses on your physical fitness training practices. Please answer all questions **HONESTLY** and **DIRECTLY**. If asked to provide an explanation for your response, please do so to the best of your ability. If any of the questions are unclear, please ask the survey administrator for clarification. The information you provide will impact on the health and well-being of current and future SBU personnel. Thank you for your cooperation by participating in this survey.

1. Demographics

Age _____
Height _____
Weight _____
Job (NEC) designator _____
Rank/pay grade _____
Years of military service _____
Years in special boat unit _____

2. Job-related Information

Current Unit Assignment
_____

Craft Type
1. 24' RIB
2. I-RIB
3. PB MKIII/IV
4. MK V SOC
5. HSB
6. Other (specify)
_____

Crew Position
1. Pilot
2. Coxswain
3. Engineer
4. Throttleman
5. Navigator
6. Other (specify)
_____

3. General Injury Information

Have you ever been injured during an SBU operation, including training?

NO ⇒ Go to section 5.
YES ⇒ How many times have you been injured during your affiliation with a special boat unit? _____
⇒ If injured more than once, which of the following statements most correctly characterizes those injuries.
1. reinjury of previous existing injury
2. my injuries are unrelated (i.e. distinct)
3. reinjury of a previous injury and sustained an additional injury

Approximately how long (in months) were you in a special boat unit before you received your first injury? _____

Do you experience chronic pain associated with your injury?
NO YES ⇒ Location _____
Frequency _____
Type of pain_____

Do you experience chronic pain in general?
NO YES ⇒ Location _____
Frequency _____
Type of pain_____

4. Specific Injury Information

Injury number 1 (Please provide information for **<u>each</u>** injury)

Please indicate the type of injury sustained (stress fracture, shoulder separation, etc.)?

_____

Was your injury diagnosed by a clinician?

NO YES ⇒ please specify (Corpsman, Physical Therapist, Orthopedist, etc.)

_____

Where (bodily location) did you sustain the injury?

_____

What were the circumstances that resulted in your injury?

1. mission related operations
2. during unit training
3. while participating in unit PT
4. unusual sea states and/or weather conditions
5. my injury was unrelated to SBU-activities

Did you seek medical attention for your injury?

NO ⇒ Please indicate why

_____

YES ⇒ Please indicate where

____ Platoon (corpsman)
____ Command IDC
____ Specwar Medical Facility, specify _____
____ BUD/S medical
____ Naval Medical Hospital
____ Other Naval facility, specify _____
____ Civilian Practitioner, specify _____
____ Other, specify _____

Did the injury result in any of the following?

____ Hospitalization, number of days _____
____ Sick Leave, number of days _____
____ Limited duty, number of days _____
____ Lost training time, number of days _____
____ Limitations in your personal training, number of days _____
____ Limited job/mission performance, number of days _____

4. Specific Injury Information (continued)
Injury number 2

Please indicate the type of injury sustained (stress fracture, shoulder separation, etc.)?

_____

Was your injury diagnosed by a clinician?
NO YES ⇒ please specify (Corpsman, Physical Therapist, Orthopedist, etc.)

_____

Where (bodily location) did you sustain the injury?

_____

What were the circumstances that resulted in your injury?

1. mission related operations
2. during unit training
3. while participating in unit PT
4. unusual sea states and/or weather conditions
5. my injury was unrelated to SBU activities

Did you seek medical attention for your injury?
NO ⇒ Please indicate why.

_____

YES ⇒ Please indicate where
____ Platoon (corpsman)
____ Command IDC
____ Specwar Medical Facility, specify _____
____ BUD/S medical
____ Naval Medical Hospital
____ Other Naval facility, specify _____
____ Civilian Practitioner, specify _____
____ Other, specify _____

Did the injury result in any of the following?

____ Hospitalization,	number of days _____
____ Sick Leave,	number of days _____
____ Limited duty,	number of days _____
____ Lost training time,	number of days _____
____ Limitations in your personal training,	number of days _____
____ Limited job/mission performance,	number of days _____

4. Specific Injury Information (continued)
Injury number 3

Please indicate the type of injury sustained (stress fracture, shoulder separation, etc.)?

_____

Was your injury diagnosed by a clinician?
NO YES ⇒ please specify (Corpsman, Physical Therapist, Orthopedist, etc.)

_____

Where (bodily location) did you sustain the injury?

_____

What were the circumstances that resulted in your injury?

1. mission related operations
2. during unit training
3. while participating in unit PT
4. unusual sea states and/or weather conditions
5. my injury was unrelated to SBU activities

Did you seek medical attention for your injury?
NO ⇒ Please indicate why

_____

YES ⇒ Please indicate where
____ Platoon (corpsman)
____ Command IDC
____ Specwar Medical Facility, specify _____
____ BUD/S medical
____ Naval Medical Hospital
____ Other Naval facility, specify _____
____ Civilian Practitioner, specify _____
____ Other, specify _____

Did the injury result in any of the following?

____ Hospitalization,	number of days _____
____ Sick Leave,	number of days _____
____ Limited duty,	number of days _____
____ Lost training time,	number of days _____
____ Limitations in your personal training,	number of days _____
____ Limited job/mission performance,	number of days _____

5. Physical Activity Information

What is you current physical fitness (PRT) score? _____

How often do you perform physical fitness related activities (**other than unit PT**)?

1. unit PT is the only physical fitness related activity
2. once per week
3. twice per week
4. three times per week
5. four times per week
6. five times or more per week

Which type of exercise (**excluding unit PT**) do you perform for physical fitness purposes?

Walking
NO YES ⇒ How many times per week. _____
How many mile per session _____
Duration of each session _____

Running/Jogging
NO YES ⇒ How many times per week. _____
How many miles per session _____
Duration of each session _____

Bicycling
NO YES ⇒ How many times per week _____
How many miles per session _____
Duration of each session _____

Swimming laps (35 laps in a 25 yard pool ≈ 0.5 miles)
NO YES ⇒ How many times per week. _____
How many miles per session _____
Duration of each session _____

Calisthenics
NO YES ⇒ How many times per week. _____
Duration of each session _____

Weight (Resistance) Training
NO YES ⇒ How many times per week. _____
Duration of each session _____

Other fitness related activities (specify) _____
NO YES ⇒ How many times per week. _____
Duration of each session _____

Table 1. Participant Characteristics[1]

	SBU-12	SBU-20	SBU-22	Total
N	83	43	28	154
Age	32.2 ± 6.1	33.3 ± 4.7	29.5 ± 6.0[2]	32.0 ± 5.9
Stature (in)	70.6 ± 2.8	70.5 ± 2.8	71.4 ± 2.4	70.7 ± 2.7
Weight (lb)	186.1 ± 21.8	186.3 ± 23.7	195.1 ± 22.8	187.8 ± 22.7
BMI ($kg \cdot m^{-2}$)	26.3 ± 2.5	26.4 ± 2.5	27.0 ± 2.8	26.4 ± 2.5
Years in Military	11.7 ± 5.7	13.8 ± 4.7	10.0 ± 5.1[3]	12.0 ± 5.5
Years in SBU	4.5 ± 3.2	5.1 ± 2.7	4.7 ± 2.9	4.7 ± 3.0

[1]Values shown are means ± std. dev.
[2]Differs significantly ($p < 0.05$) from SBU-12 and SBU-20 values.
[3]Differs significantly ($p < 0.05$) from SBU-20 value.

Table 2.
Number of Injury Events by Boat Unit.*

	Reporting injury	No injury reported
SBU-12	56 (67.5%)	27 (32.5%)
SBU-20	29 (67.4%)	14 (32.6%)
SBU-22	15 (53.6%)	13 (46.4%)
Total	100 (64.9%)	54 (35.1%)

*Values shown are number of respondents and percent within each SBU.

Table 3.
Distribution of Injuries by Type

Injury Type	No. of Injuries
Chronic pain	8
Sprain/Strain	69
Trauma	11
Inflammation	7
Ligament/Tendon Tear	5
Dislocation/Separation	9
Stress fracture	8
Fracture	5
Disc problems	11
Arthritis/Bone Spurs	2
Mechanical problem	1
Hemorrhoids	2
Heat Injury	2
Total	140

Table 4.
Distribution of Injuries by Anatomical Site

Anatomical Location	No. Reported Injuries
Head	3
Neck and Upper Back	9
Shoulder	21
Elbow	2
Wrist	1
Hand	1
Trunk	2
Low Back	50
Hip/Buttocks	6
Thigh	2
Knee	32
Leg	7
Ankle	10
Foot	3
Total	149

Table 5. Injury Event Circumstances*

Mission related	76 (66.1%)
During Unit PT	12 (10.4%)
During Unusual Sea States or Weather	21 (18.3%)
Unrelated to SBU Activities	6 (5.2%)

*Values shown are counts and percentage of injury events

Table 6.
Medical Attention Frequency* by Injury Type

Injury Type	Sought Medical Attention?	
	Yes	No
Chronic pain	3 (50%)	3 (50%)
Sprain/Strain	51 (75%)	17 (25%)
Trauma	5 (45%)	6 (55%)
Inflammation	6 (86%)	1 (14%)
Ligament/Tendon Tear	5 (100%)	0
Dislocation/Separation	8 (89%)	1 (11%)
Stress fracture	7 (88%)	1 (12%)
Fracture	4 (100%)	0
Disc problems	11 (100%)	0
Arthritis/Bone Spurs	1 (100%)	0
Mechanical problem	1 (100%)	0
Hemorrhoids	3 (100%)	0
Heat Injury	2 (100%)	0

* Number of respondents (row percentage)

Table 7. Medical Attention Frequency* by Injury Location

Anatomical Location	Sought Medical Attention?	
	Yes	No
Head	3 (100%)	0
Neck and Upper Back	6 (67%)	3 (33%)
Shoulder	15 (75%)	5 (25%)
Elbow	1 (50%)	1 (50%)
Wrist	1 (100%)	0
Hand	1 (100%)	0
Trunk	1 (100%)	0
Low Back	40 (83%)	8 (17%)
Hip/Buttocks	6 (100%)	0
Thigh	1 (50%)	1 (50%)
Knee	24 (75%)	8 (25%)
Leg	5 (71%)	2 (29%)
Ankle	9 (99%)	1 (11%)
Foot	1 (50%)	1 (50%)

* Number of respondents (row percentage)

Table 8. Demographic Variables and Injury Status

Variable	Injured Group (N = 100)		Non-Injured Group (N = 54)		Correlation Coefficient
Age (yr.)	32.5	(5.2)	31.2	(6.9)	0.11
Height (cm)	180.2	(6.5)	178.4	(7.5)	0.13
Weight (kg)	86.2	(10.5)	83.4	(9.7)	0.13
BMI ($kg \cdot m^{-2}$)	26.5	(2.6)	26.2	(2.3)	0.06
Years Military Svc.	12.5	(4.7)	10.9	(6.6)	0.14
Years in SBUs	5.5	(2.9)	3.1	(2.5)*	0.39**

Values shown are means (1 std. dev.)
* Means differ significantly ($P < 0.05$)
** Correlation coefficient significant ($P < 0.05$)

Table 9. Distribution of Injuries by Probability Group

Probability Group	Mean Years of SBU Service[1]		Mean Stature[1]		Number Not Injured	Number Injured[2]	
20%	0.2	(0.1)	171.0	(3.8)	3	0	(0%)
30%	0.8	(0.6)	177.2	(4.2)	6	3	(33%)
40%	2.0	(1.0)	176.4	(6.5)	19	7	(27%)
50%	2.6	(0.8)	177.6	(5.9)	6	7	(54%)
60%	3.4	(1.1)	181.4	(8.0)	4	15	(79%)
70%	4.8	(1.1)	179.9	(6.4)	7	24	(77%)
80%	6.2	(1.1)	181.7	(6.8)	5	16	(76%)
90%	8.2	(1.4)	181.6	(6.9)	4	20	(83%)
100%	11.5	(1.4)	181.3	(8.0)	0	8	(100%)

[1]Value shown is mean and (1 std. dev.)
[2]Value shown is count and (percent of probability group)

Table 10. ICD9 codes used to represent reported SBU-injuries

Injury type	Injury location	ICD9 code(s)[1]
Sprain/strain[2]	Neck/upper back/trunk	847*
	Shoulder	840*
	Wrist	84200 – 84209
	Lower back	846*
	Hips/buttocks	843*
	Knee	844*
	Leg	"
	Ankle	84510 - 84519
Dislocation/separation	Shoulder	831*, 83961
	Knee	836*
Fracture[3]	Neck/upper back	80700 – 80719
	Lower back	805*
	Leg	820* - 823*, 827* - 829*
	Foot	825*, 826*
	Shoulder	810* - 812*
	Hand	815* - 817*
	Ankle	824*
Disc problems	Neck & back	722*
Arthritis/bone spurs	Lower back & knee	712*, 715*
Mechanical	Foot	734*, 75450 - 75479
Hemorrhoids		45560
Inflammation	Elbow	716*
	Hips[4]	-
	Knee	68260 – 68269, 7300 – 73029
	Leg	95880 - 95889
Trauma	Bruised shoulder	92300-92309
	Bruised lower limb	924*
	Bruised ribs	73390, 92210
	Lacerated lower back	920*
	Lacerated chin	876*
Chronic pain	Neck/upper back	87344, 87354
	Lower back	72310 - 72319
	Knee	71946
	Leg & foot	72950 - 72959

[1] * in code indicates all codes within that 3-digit series are included.
[2]Includes ligament and tendon tears
[3]Includes stress fracture
[4]Included in arthritis

Table 11. Hospitalization Incidence Rates[1]

Ranking	Navy Rate	Hospitalization Incidence[2]	95% confidence interval
1	CN – constructionman	5,698	4,201 – 7,530
2	SN – seaman	1,701	1,657 – 1,764
3	FN – fireman	1,698	1,630 – 1,795
4	AN – airman	1,457	1,397 – 1,546
5	HM – corpsman	781	754 – 828
6	BT – boiler technician	762	724 – 826
7	SM - signalman	747	683 - 857
8	BM – boatswain's mate	723	689 – 781
9	OS – operations specialist	690	659 – 747
10	HT – hull technician	676	644 – 735

[1]Incidence is hospitalization for diagnoses indicated in Table 10. Only 10 greatest incidence rates are listed.
[2]Incidence is per 100,000 person-years exposure

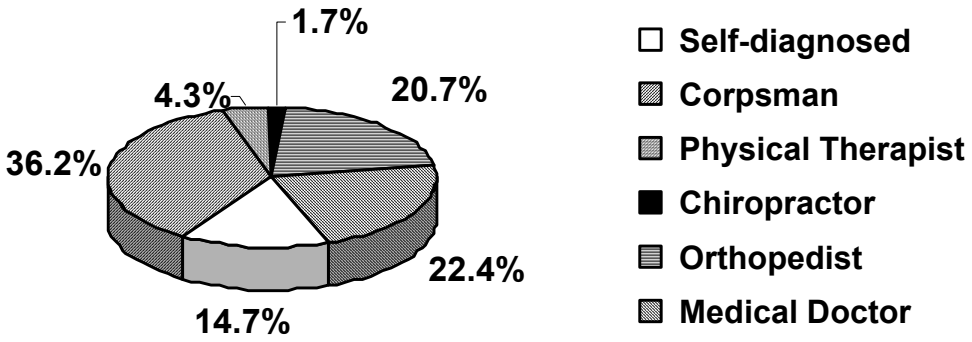

Figure 1. Distribution of diagnoses by health provider. N = 116 reports.

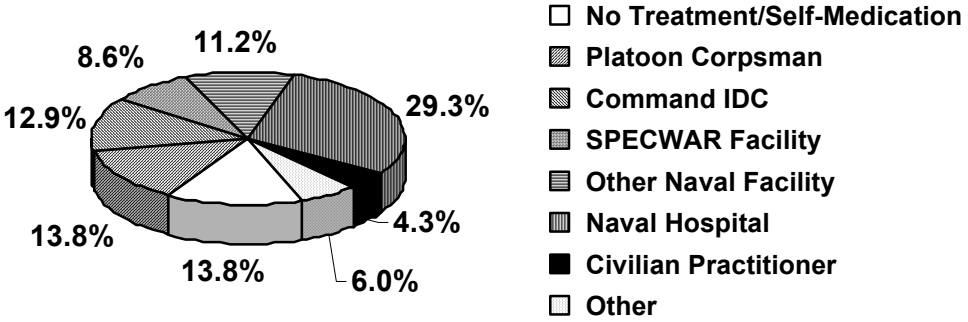

Figure 2. Distribution of diagnoses by treatment facility. N = 116 reports.

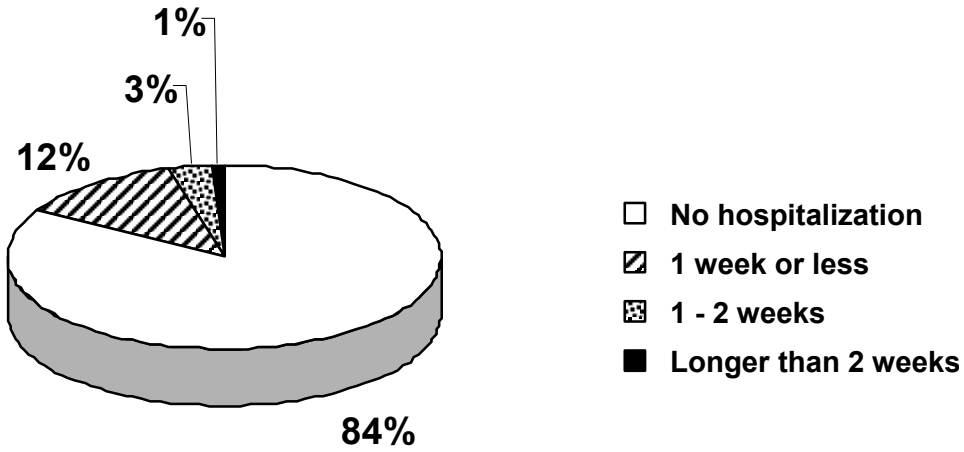

Figure 3. Distribution of hospitalization periods following injury.

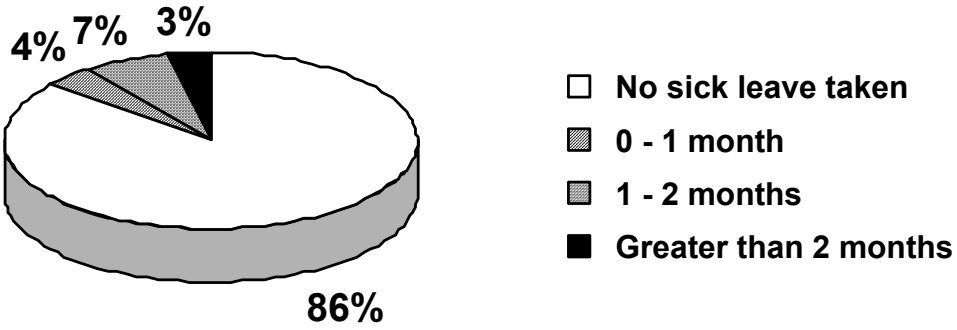

Figure 4. Distribution of number of days "Sick in Quarters".

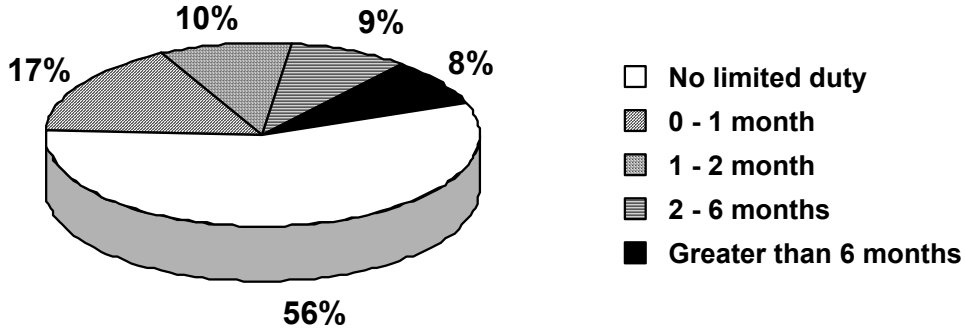

Figure 5 Distribution of number of limited duty days associated with injury events.

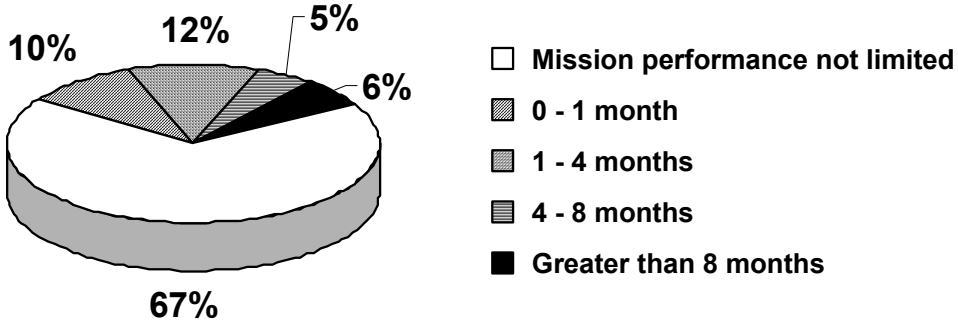

Figure 6. Distribution of periods of mission performance limitation following injury events.

Figure 7. Distribution of lost mission-training time following an injury event.

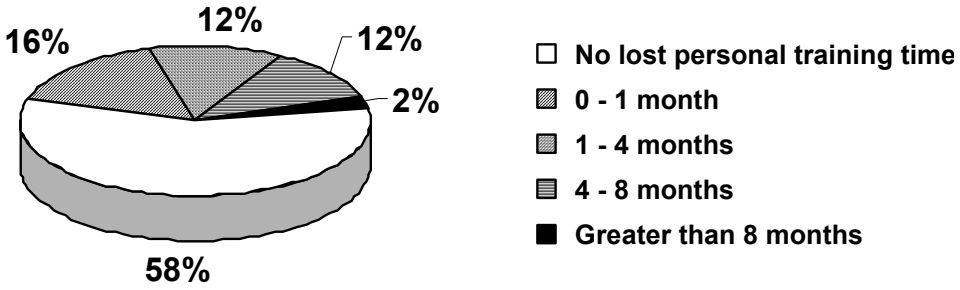

Figure 8. Distribution of lost personal training time following an injury event.

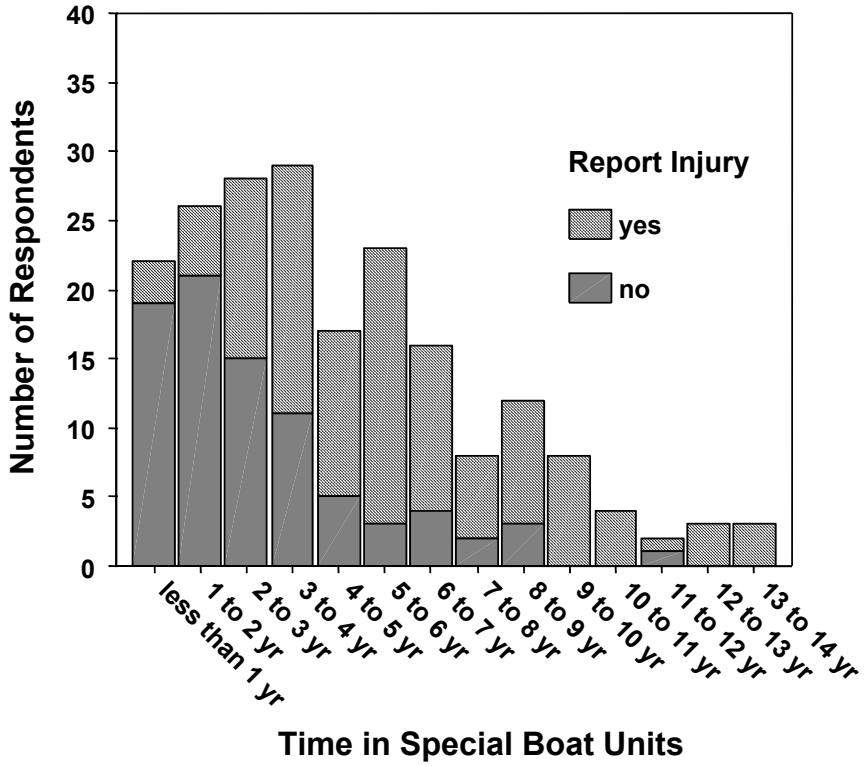

Figure 9. Distribution of injury status by time in Special Boat Units.