

U.S. Army Center for Health Promotion and Preventive Medicine

RISK FACTORS FOR PARACHUTE INJURIES AND AIRBORNE STUDENT OBSERVATIONS ON THE PARACHUTE ANKLE BRACE

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14. ABSTRACT A questionnaire was administered to 1,956 students in Army Airborne training as part of an effort by the Military Training Task Force (MTTF) of the Defense Safety Oversight Council (DSOC) to evaluate the parachute ankle brace (PAB). Information provided by the questionnaire identified potential injury risk factors and comments on the PAB. Risk factors for injuries in the past year included service branch, Airborne recycling, less physical activity, older age, greater body weight, higher BMI, and (among Army personnel) slower 2-mile run time. Risk factors for jump week injuries included higher rank, longer time in service, older age, Airborne recycling, height, more body weight, not wearing the PAB, aircraft exit problems, an injury in the past year, and (for Army men) fewer push-ups and slower 2-mile run time. Students who had worn the brace were more likely to have favorable comments on the PAB compared with those who had not worn it. Most negative PAB comments were related to the heel strap and an improvement has been proposed and is in production. Students complained that the PAB rubbed on the legs, shin, ankle, and calf; this might be associated with the heel strap or pulling the ankle strap to tight; this problem might be alleviated by the strap improvement and/or better guidance on appropriate tightness for the ankle straps. Students also complained of difficulty in keeping the feet and knees together when wearing the PAB. This could be a matter of perception or some adaptation and accommodation may be required in this area.					
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EXECUTIVE SUMMARY
USACHPPM REPORT NUMBER 12-MA-01Q2-08B
RISK FACTORS FOR PARACHUTE INJURIES AND AIRBORNE STUDENT
OBSERVATIONS ON THE PARACHUTE ANKLE BRACE

1. INTRODUCTION. This report provides information on a survey completed by airborne students. The survey was initiated by the Military Training Task Force (MTTF) of the Defense Safety Oversight Council (DSOC) as part of a project to evaluate the effectiveness of a parachute ankle brace (PAB).

2. METHODS. Students attending the United States Army Airborne School (USAAS) completed a questionnaire after they had made four of the five parachute descents required for airborne qualification. The survey queried students about their demographic characteristics, physical fitness, physical characteristics (height, weight), physical activity, tobacco use, injuries in the past year, injuries during jump week, PAB wear, problems with aircraft exits, and airborne recycling. A final section solicited open-ended comments on the PAB. The survey was administered from June 2005 to January 2006, the period when the PAB was phased into the USAAS.

3. RESULTS. The questionnaire was completed by 1,956 service members (1,859 men, 105 women), about half of whom (55%) had worn the PAB on their jumps. Over 90% of respondents were Army men. The average±standard deviation (SD) age and time in service were 22±4 years and 2.4±2.9 years, respectively. The total sample comprised 58% enlisted members, 7% officers, and 33% cadets. About 8% reported being airborne recycles and about 3% reported aircraft exit problems. With regard to physical activity, 76% rated themselves as much more active or somewhat more active than others of their age and sex in the military; only 2% rated themselves as less active or much less active. Twenty-six percent were smokers. For Army men, average±SD push-ups, sit-ups and 2-mile run times were 67±15 repetitions, 73±13 repetitions, and 13.4±1.0 minutes, respectively; for Army women these values were 51±15 repetitions, 76±13 repetitions, and 14.9±1.3 minutes, respectively.

a. The rate of self-reported injuries in the year prior to jump school was 13.9 injuries/100 person-years. The most common injury sites were the legs (22%) ankles (21%), arms (15%), knees (15%), and feet/toes (11%). Univariate analysis showed that among the men, higher injury incidence was associated with service branch, Airborne recycling, less physical activity, older age, more body weight, higher BMI, and (among Army personnel) slower 2-mile run time. Multivariate analysis considering only Army men showed that older age, Airborne recycling, and slower 2-mile run times were independently associated with injury. In multivariate analysis considering all men (and omitting 2-mile run time), independent

injury risk factors included older age, Airborne recycling, higher BMI, and less physical activity.

b. The self-reported jump week injury rate for the first 4 jumps was 120 injuries/10,000 jumps. The legs (23%), ankles (19%), head (14%), and knees (14%) were the most common injury locations. Univariate analysis showed that greater risk of a self-reported jump week injury was associated with higher rank, longer time in service, older age, Airborne recycling, greater height, more body weight, not wearing a PAB, aircraft exit problems, an injury in the past year, and (for Army men) fewer push-ups or slower 2-mile run time. Multivariate analysis considering only Army men demonstrated that older age, Airborne recycling, push-ups, not wearing a PAB, aircraft exit problems, and an injury in the last year were independent injury risk factors. Multivariate analysis considering all men showed that older age, more body weight, Airborne recycling, not wearing the PAB, aircraft exit problems, and injuries in the past year were independent injury risk factors.

c. There were 757 service members (39% of those surveyed) who provided 994 open-ended comments on the PAB: 24% were provided by those who did not wear the PAB and 76% were provided by those who did wear the PAB. Among non-PAB wearers, 30% of comments were positive, 51% were negative, and 19% were neutral. Among the PAB wearers, 47% of comments were positive, 50% were negative, and 3% were neutral. The largest single category of negative comments among PAB wearers had to do with design issues, accounting for 33% of all negative PAB wearers' comments. Other categories with large numbers of negative comments had to do with comfort (16%), general comments (16%), and parachute landing falls (PLFs) (14%). Negative comments among non-PAB wearers were vaguer: 24% had to do with a general negative opinion of the brace, 23% said that they would not choose the brace for the Army, and 10% saying they would not choose to use the brace themselves.

4. DISCUSSION.

a. This study provided descriptive statistics (including physical fitness) on a sample of US Army Airborne students. Average Army Physical Fitness Test (APFT) raw scores in this sample were among the highest reported in any previous Army survey. The study also determined risk factors for injuries in the past year, injuries during jump week, and examined comments on the PAB. The service members who completed the questionnaire were an estimated 10% of all the participants in a larger study that examined the injury prevention capabilities of the PAB while it was being phased into the USAAS.

b. The self-reported injury rate in the year before jump school was about 14/100 person-years, which was considerably lower than rates of 54 to 223 injuries/100 person-years in other military occupational groups. This may illustrate the problem in obtaining accurate injury rate data when the recall period is long. Studies comparing injury rates over various recall periods have shown that as the recall period increases, self-reported injury rates decrease. Despite this, risk ratios comparing subgroups appear to be much less affected by possibly poor recall, presumably because the recall bias affects all risk groups similarly. Thus, caution is advised in interpretation of the injury rates, but risk ratios that identify

specific risk factors may be more valid. Previous studies have identified older age, high BMI, 2-mile run time, and less physical activity as injury risk factors. Airborne recycling is a newly identified risk factor and injury is the primary reason for airborne recycling suggesting a prior injury may mediated the relationship between self-reported injury and recycling.

c. About 5% of students reported a jump week injury. Based on the first 4 jumps made by each individual, this was an injury incidence of 120/10,000 jumps, which was more than twice rate of about 58/10,000 generally reported in other studies. In past studies, injury data were generally obtained from treatment records of medical personnel. In the current study, it is likely that students reported both minor injuries, for which no medical personnel were consulted, as well as more serious injuries, for which medical personnel were consulted. Older age, greater body weight, and not wearing a PAB, have previously been reported to be risk factors for airborne injuries. Newly identified risk factors included improper aircraft exit, airborne recycling, prior injury in the last year, height, lower push-up performance, and slower 2-mile run time.

d. Airborne students who did not wear the PAB had more negative comments than those who did, suggesting that once a service member has a chance to experience the brace during a jump, he or she may have a more favorable impression of it. Most negative PAB comments from individuals who wore the brace related to the fact that the heel strap did not seem to properly hold the PAB on the boot. An improvement of the PAB to eliminate this problem has been proposed and is in production. This improvement adds a strap over the superior dorsum of the foot to prevent slippage. Another group of negative comments had to do with comfort, primarily about the PAB rubbing on the legs, shin, ankle, and calf. Students may require better guidance on appropriate tightness for the ankle straps. Negative comments regarding parachute landing falls (PLFs) had to do with a perceived difficulty in keeping the feet and knees together when wearing the PAB. Several studies have reported that the PAB reduces ankle injuries without increasing the incidence of other injuries; like many new technologies, some adaptation and accommodations are required, especially with regard to PLFs.

6. CONCLUSIONS. Among male students attending the USAAS, risk factors for injuries in the past year included service branch, Airborne recycling, less physical activity, older age, more body weight, higher BMI, and (among Army personnel) slower 2-mile run time. Risk factors for jump week injuries included higher rank, longer time in service, older age, Airborne recycling, height, more body weight, not wearing the PAB, aircraft exit problems, an injury in the past year, and (for Army men) fewer push-ups or slower 2-mile run time. Students who had worn the brace had more favorable attitudes toward the PAB than those who had not worn it. Most negative PAB comments related to the heel strap and an improvement has been proposed and is in production. Students complained that the PAB rubbed on the legs, shin, ankle, and calf; this might be alleviated by improvements in the heel strap and/or better guidance on appropriate tightness for the ankle straps. Students complained of difficulty in keeping the feet and knees together when wearing the PAB. This may just be a matter of perception and/or some adaptation and accommodation may be required in this area.

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RISK FACTORS FOR PARACHUTE INJURIES AND AIRBORNE STUDENT
OBSERVATIONS ON THE PARACHUTE ANKLE BRACE

1. REFERENCES. Appendix A contains the scientific/technical references used in this report.

2. PURPOSE. This report provides information on a survey completed by Airborne students regarding their demographics, lifestyle characteristics, physical characteristics, physical fitness, aircraft exit problems, airborne recycling, and other factors. The report also examines risk factors for injuries in the past year, injuries during jump week, and attitudes toward the parachute ankle brace (PAB).

3. AUTHORITY. Under Army Regulation 40-5 (4), the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) is responsible for providing epidemiological consultation services upon request. This project was initiated by the Military Training Task Force (MTTF) of the Defense Safety Oversight Council (DSOC). USACHPPM took the responsibility for the project in coordination with the United States Army Research Institute of Environmental Medicine (USARIEM). Documents related to the project appear in Appendix B.

4. BACKGROUND.

a. Since World War II, military airborne operations have delivered troops to key areas of the battlefield, altering the tactical and strategic aspects of warfare. The idea of tactical military airborne operations was first proposed in 1919 by William (Billy) Mitchell and approved by General John J Pershing. However, with the quick end of World War I, the idea was never realized. In 1928, the United States (US) Army Air Corps staged a number of airborne demonstration jumps in Texas that were observed by foreign army representatives, but the Soviet Union was the first country to develop military airborne units in the 1930s. This was quickly followed by developments in Germany culminating in the first combat jumps, which spearheaded the German invasion into the Netherlands in May 1940. The US Army formed a platoon of airborne troops in July 1940 and initiated the first jump school at Fort Benning, Georgia, in April 1941 (25, 47).

b. There have been a number of studies on military risk factors for parachute-related injuries. Most focused on extrinsic factors, those that are part of the external environment. These studies indicated that injury risk is increased by higher wind speeds (23, 60, 81, 96), night jumps (31, 60, 76, 81), additional equipment (60, 81, 96), aircraft type (23, 81, 96), higher air temperatures (96), drop zone characteristics (31, 76), canopy size (96), mass exits

(30, 81), and not wearing an ankle brace (3, 60, 108, 110). Less well investigated are intrinsic parachute-related injury risk factors, those that are characteristics of the individual (such as age, fitness, and race). Studies of intrinsic risk factors have shown that higher injury risk is associated with higher body weight (23, 95), female gender (2, 15), and older age (15, 108).

c. The PAB has been shown to reduce ankle sprains and ankle injuries during military airborne operations (3, 110). Despite this, PAB use was discontinued by the United States Army Airborne School (USAAS) in 2000 because of the costs of maintaining the brace and anecdotal reports that it increased injuries in other parts of the lower body and complicated parachute entanglements. A study of students at the USAAS compared the period of PAB use (1994–2000) to the period after the PAB was discontinued (2000–2002) and showed that the risk of an ankle injury hospitalization was 1.7 times higher after the PAB was no longer used (108). In 2004, USACHPPM worked with USARIEM and the DSOC to reinstitute use of the PAB in military airborne operations. The DSOC required information to demonstrate that the PAB was still effective in light of changes in military equipment and uniforms. PABs were purchased for the USAAS and evaluated over a 21-month period. This evaluation demonstrated that, after controlling for wind speed, combat loads, and night jumps (factors known to increase airborne injuries), airborne students who did not wear the brace were 1.9 times more likely to experience an ankle sprain, 1.5 times more likely to experience an ankle fracture, and 1.8 times more likely to experience an ankle injury of any type. Injuries to other parts of the lower body (exclusive of the ankle) were not significantly influenced by the brace and the incidence of parachute entanglements was similar among students wearing and not wearing the PAB (60).

d. As part of this latter project (60), additional information was collected by questionnaire from a subsample of the students involved in the larger project. The purpose of this paper is to report on this information to characterize the airborne students, examine risk factors for injury, and explore the students' attitudes and opinions toward the PAB.

5. METHODS.

a. **Airborne School.** The USAAS at Ft Benning, Georgia, has responsibility for training all Soldiers, Marines, Sailors, and Airmen in the practical aspects of military parachuting. Students must successfully complete a three-week training course. The first two weeks involve training on aircraft-exit and ground-landing techniques. The third week involves actual parachute descents. To graduate from Airborne School, students must complete five parachute jumps from C-17 or C-130 aircraft from altitudes of 1,000 to 1,250 feet. The first jump is an individual effort with one second between jumpers and 10 jumpers exiting from each side of the aircraft. The other jumps are mass exits with 15 jumpers exiting in quick succession from each side of the aircraft.

b. **PAB Phase-In.** Batches of PABs were purchased for the USAAS from April 2005 to December 2006. Students who wore the PAB during parachute descents were instructed on fitting and wear and familiarized with the PAB during the first two weeks of training. There

were three sizes of the PAB (small, medium, and large) and separate braces for the right and left foot. About 80% of individuals wore the medium size.

c. Questionnaire. A questionnaire was developed by USACHPPM, USARIEM, and the Quality Assurance Office at Ft Benning. The questionnaire (included in Appendix C) collected information on student demographics, physical fitness test scores, self-rated physical activity, tobacco use, injuries in the past year, injuries during jump week, ankle brace wear, problems with aircraft exits, and airborne recycling (i.e., repeating airborne training because of problems on the first try). A final section solicited open-ended comments on the PAB. Between June 2005 and January 2006, the Quality Assurance Office at Fort Benning periodically administered this anonymous questionnaire to students after they had completed their fourth parachute jump. Questionnaires were completed by students in the “harness shed” at the Airborne School while seated on long stadium-style benches. Some students had worn the brace for all four jumps while others had not worn the PAB at all.

d. Data Analysis.

(1) Descriptive statistics were calculated for all variables. These included frequencies and proportions for ordinal/nominal data and means and standard deviations (SD) for continuous variables.

(2) Chi-square statistics were used to explore the univariate associations between the two injury questions (injuries in the last year and injuries during jump week) and the other independent factors on the questionnaire. For these analyses, all continuous variables were converted to ordinal variables based on the distribution of each variable. Variables examined for their association with the two injury questions included the demographics, fitness test scores, self-rated physical activity, tobacco use, handedness, recycling within the Airborne School, time in service, ankle brace wear, and problems with aircraft exits. In order to determine independent associations between injury and the other questionnaire variables, multivariate logistic regression was used with a backward stepping procedure. All independent variables with a p-value ≤ 0.10 in the univariate (chi-square) analysis were included in a multivariate logistic regression procedure (39).

(3) Responses to the open-ended question on the parachute ankle brace (Question 18) were examined by a panel of four individuals with prior experience with these types of data. A categorization scheme was developed based on the comments observed. Comments were placed into common categories and grouped as positive, negative, and/or neutral with regard to the PAB.

6. RESULTS.

a. Descriptive Statistics.

(1) The questionnaire was administered to and completed by 1,956 service members. Descriptive statistics for the ordinal/nominal data questionnaire variables are displayed in Table 1. Some service members did not answer every question so the number of missing

responses is shown. Over 90% of respondents were Army men. The total sample comprised 58% enlisted members, 7% officers, and 33% cadets. Less than 10% were airborne recycles. Almost 90% were right handed.. With regard to physical activity, 76% rated themselves as much more active or somewhat more active than others of their age and sex in the military; only 2% rated themselves as less active or much less active. Three-fourths of respondents were nonsmokers. A slightly larger number of respondents had worn the PAB compared to those who had not.

Table 1. Descriptive Statistics on Questionnaire Variables (Ordinal/Nominal Variables)

Category	Variable	Level of Variable	Cases (n)	Proportion of Variable (%)
Demographic	Gender	Men	1851	94.6
		Women	105	5.4
	Service	Army	1779	91.0
		Navy	76	3.9
		Air Force	61	3.1
		Marines	36	1.8
		Missing (no response)	4	0.2
	Rank	E1	251	12.8
		E2	300	15.3
		E3	238	12.2
		E4	171	8.7
		E5	123	6.3
		E6	39	2.0
		E7	20	1.0
		E8	1	0.1
		E9	1	0.1
		Cadet	652	33.3
		O1	82	4.2
		O2	22	1.1
		O3	33	1.7
O4		7	0.4	
O5		1	0.1	
WO1	2	0.1		
WO2	2	0.1		
Missing (no response)	11	0.6		
Dominant Hand	Dominant Hand Side	Right	1728	88.3
		Left	210	10.7
		Both	13	0.7
		Missing (no response)	5	0.3
Airborne Recycles	Recycled	No	1782	91.1
		Yes	164	8.4
		Missing (no response)	10	0.5
Lifestyle	Physical Activity	Much More Active	645	33.0
		Somewhat More Active	847	43.3
		About the Same	421	21.5
		Somewhat Less Active	32	1.6
		Much Less Active	5	0.3
		Missing (no response)	6	0.3
	Smoking	Smoker	507	25.9
		Never Smoked	1186	60.6
		Smoked but Quit in Last Year	234	12.0
		Missing (no response)	29	1.5
Brace	Wore Ankle Brace	No	854	43.7
		Yes	1083	55.4
		Missing (no response)	19	1.0

(2) Table 2 provides descriptive statistics on age, physical characteristics (height, weight, body mass index (BMI)), and time in service. Only 15% of respondents were over age 25; 5% were over age 30. Although time in service averaged about 2 years, the range was 0.2 to 22 years; 10% of the sample had over 5 years in service and 4% had over 10 years in service.

Table 2. Descriptive Statistics on Age, Physical Characteristics, and Time in Service

Variable	Men		Women	
	N	Mean±SD	N	Mean±SD
Age (yr)	1829	22 ±4	105	21 ±3
Height (in)	1833	70 ±3	105	64 ±3
Weight (lbs)	1832	172 ±21	104	132 ±17
BMI (kg/m ²)	1823	24.7 ±2.4	104	22.3 ±2.2
Time in Service (yr)	1776	2.4 ±3.0	97	2.1 ±2.2

(3) Table 3 shows the physical fitness test scores by service. The Army Physical Fitness Test (APFT) consisted of a 2-minute push-up event, a 2-minute sit-up event, and a 2-mile run. The Navy test consisted of a 2-minute push-up event, a 2-minute curl-up (sit-up) event, and a 1.5-mile run. The Marine test for men consisted of an untimed pull-up event, a 2-minute crunch event, and a 3-mile run. The Air Force test consisted of a 1-minute push-up event, a 1-minute sit-up event, and a 1.5 mile run (106). Although the questionnaire asked participants to list the most recent raw score for their own branch of service, many Marine and Air Force personnel completed the questions for sit-ups and the 2-mile run test scores; Marines also provided push-up scores in some cases. For the Air Force, it is not clear if the push-up and sit-ups were for 1 or 2 minutes, but the raw scores suggest that respondents were providing scores for a 2-minute test. Personnel from the Navy, Marines, and Air Force must take and pass the APFT before they can enter Airborne School and these respondents may have assumed that the questionnaire was soliciting those scores. Because of possible confusion on the questionnaire, the scores for services other than the Army should be considered unreliable.

Table 3. Physical Fitness Test Scores

Service	Test Event	Men		Women	
		N	Mean ±SD	N	Mean ±SD
Army (n: men=1,677 women=102)	Push-Ups (n)	1630	67 ±15	100	51 ±15
	Sit-Ups (n)	1632	73 ±13	101	76 ±13
	2-Mile Run (min)	1614	13.4 ±1.0	100	14.9 ±1.3
Navy (n: men=76 women=0)	Push-ups (n)	74	98 ±25	^a	^a
	Curl-Ups (n)	24	39 ±29	^a	^a
	Sit-Ups (n)	70	95 ±18	^a	^a
	1.5-Mile Run (min)	40	9.5 ±1.1	^a	^a
Air Force (n: men=58 women=3)	2-Mile Run (min)	46	12.2 ±0.9	^a	^a
	Push-ups (n)	57	74 ±18	3	54 ±8
	Sit-Ups (n)	55	74 ±12	1	61
	2-Min Crunches (n)	11	89 ±14	2	88 ±11
	1.5-Mile Run (min)	22	9.2 ±0.8	2	9.3 ±0.1
Marines (n: men=36 women=0)	2-Mile Run (min)	45	13.0 ±1.1	1	14.8
	Pull-Ups (n)	26	23 ±16	^a	^a
	Push-Ups (n)	17	64 ±19	^a	^a
	Sit-Ups (n)	16	76 ±13	^a	^a
	2-Mile Run (min)	16	13.2 ±1.0	^a	^a
	3-Mile Run (min)	26	19.7 ±1.6	^a	^a

^aThere were no female Navy or Marine personnel

(4) Table 4 shows the distribution of self-reported injuries in the year prior to jump school. The overall injury incidence rate was 13.9 injuries/100 person-years (272 injuries/1956 person-years*100). Almost half the service members did not provide a type of injury as requested on the questionnaire. Among those who did respond, sprains, fractures, and strains were the most common injury types. Almost all service members provided an anatomic location of injury. The legs, ankles, arms, knees and feet/toes were the most common sites. Lower body injuries (legs, knees, ankles, feet/toes) accounted for 69% of all self-reported

injuries in the last year. When the data was analyzed by gender, women were slightly more likely than men to report an injury in the past year (17.1% versus 13.7%, risk ratio=1.25, 95% confidence interval (95%CI)=0.81–1.93).

Table 4. Injuries and Location of Injuries in the Last Year

Category	Variable	Response Category	Cases (n)	Proportion of Variable (%)
Injuries in the Past Year	Injured in Past Year	No	1684	86.1
		Yes	272	13.9
	Type of Injury	Stress Fracture	15	5.5
		Tendonitis	13	4.8
		Arthritis	2	0.7
		Bursitis	2	0.7
		Fasciitis	1	0.4
		Pinched Nerve	3	1.1
		Strain	16	5.9
		Sprain	37	13.6
		Pain	11	4.0
		Shin Splints	13	4.8
		Dislocation	5	1.8
		Fracture	18	6.6
		Abrasion/Cut	5	1.8
		Contusion	5	1.8
	Other	1	0.4	
	Missing (no response)	125	46.0	
	Anatomic Location	Head	9	3.3
		Ear	2	0.8
Arms		42	15.4	
Chest		7	2.6	
Abdomen		2	0.8	
Back		19	7.0	
Legs		59	21.7	
Knee		40	14.7	
Ankle		57	21.0	
Foot/Toes		31	11.4	
Missing (No Response)		4	1.5	
Side of Body	Right	106	39.0	
	Left	74	27.2	
	Not Applicable	25	9.2	
	Missing (no response)	67	24.6	
Injuries During Jump Week	Injured During Jump Week	No	1862	95.2
		Yes	94	4.8
	Type of Injury	Stress Fracture	3	3.2
		Tendonitis	1	1.1
		Strain	11	11.7
		Sprain	18	19.1
		Pain	6	6.4
		Shin Splints	3	3.2
		Dislocation	1	1.1
		Abrasion/Cut	5	5.3
		Contusion	17	18.1
		Missing (no response)	29	30.9
	Anatomic Location	Head	13	13.8
		Arms	7	7.4
		Chest	1	1.1
		Back	4	4.3
		Legs	22	23.4
		Knee	13	13.8
		Ankle	18	19.1
		Foot/Toes	8	8.5
Multiple		2	2.1	
Missing (No Response)	6	6.4		
Side of Body	Right	22	23.4	
	Left	24	25.5	
	Not Applicable	15	16.0	
	Missing (no response)	33	35.1	

(5) Table 4 also shows self-reported injuries during jump week. Since each respondent had four jumps, the injury incidence rate was 120 injuries/10,000 jumps (94 injuries/(1,956 people*4 jumps/person)*10,000). Almost one third did not report the type of injury they experienced, but among those who did report an injury type, sprains, contusions, and strains were the most common injury type. The legs, ankles, knees, and head were the most common injury locations. The lower body (legs, knees, ankles, feet/toes) accounted for 65% of all injuries. When the data was analyzed by gender, women had a slightly higher jump-week injury incidence than men (5.7% versus 4.8%, risk ratio=1.20, 95%CI=0.54–2.68).

(6) Table 5 shows the aircraft exit problems. Less than 3% of respondents reported problems exiting the aircraft. The most common problem was an aircraft strike. There were 15 “other” problems, which are included in Table 5 (See Appendix C, Question 17). These include 1) twisted risers (5 cases), 2) entanglement with another jumper while exiting (2 cases), 3) collision with another jumper on exit (2 cases), 4) whiplash from parachute opening, 5) inversion and flip through suspension lines, 6) rucksack caused weak exit, 7) weak exit, and 8) ankle brace dragged due to poor fit. In one case a respondent indicated “other” problems but provided no specifics. The term “weak exit” is vague in this context. Paratroopers are taught to forcefully hop off the jump platform out and away from the aircraft in order to make an appropriate aircraft exit. An exit that does not involve a forceful hop may be considered a “weak” exit.

Table 5. Aircraft Exit Problems

Question	Response Category	Cases (n)	Proportion of Variable (%)
Problem Exiting Aircraft	No	1893	96.8
	Yes	54	2.8
	Missing (no response)	9	0.5
Type of Exiting Problems	Struck Aircraft	21	38.9
	Static Line Problem	7	13.0
	Foot Caught in Suspension Lines	5	9.3
	Twisted Risers	5	9.3
	Entanglement With Other Jumper on Exit	2	3.7
	Collision with Other Jumper on Exit	2	3.7
	Whiplash from Parachute Opening	1	2.9
	“Weak Exit”	2	3.7
	Ankle Brace Drag	1	2.9
	Bad Exit But No Specifics Listed	8	14.8

b. Risk Factors for Injury in the Year Prior to Jump School.

(1) Table 6 shows the univariate associations between self-reported injury in the year prior to jump school and the other questionnaire variables. Among the men, higher injury incidence was associated with service branch, Airborne recycling, less physical activity, older age, greater body weight, higher BMI, and (among Army personnel) slower 2-mile run time. The sample size for the women was very small and the associations were presumably weak because of this but less physical activity was associated with an injury in the last year. Women were slightly more likely than men to report an injury in the last year (17.1% versus 13.7%, risk ratio=1.25, 95% confidence interval =0.81–1.93).

Table 6. Association Between Self-Reported Injury in the Last Year and Other Questionnaire Variables

Category	Variable	Men				Women			
		Level of Variable	N	Injured (%)	p-value	Level of Variable	N	Injured (%)	p-value
Demographics	Service Branch	Army	1677	13.5	0.01	Army	102	16.7	0.45
		Navy	76	18.4		Navy ^b	0	---	
		Air Force	58	22.4		Air Force	3	3.3	
		Marines	36	0.0		Marines ^b	0	---	
	Rank Group	E1	248	14.1	0.19	E1	3	0.0	0.39
		E2	289	13.5		E2	11	36.4	
		E3	232	11.6		E3	6	0.0	
		E4	168	19.6		E4	3	33.3	
		E5	120	11.7		E5	3	0.0	
		E6-E9	59	15.3		E6-E9	2	0.0	
Cadet		581	12.7	Cadet		71	18.3		
O1-O2		99	10.1	O1-O2		5	0.0		
Time In Service	O3-O5	41	24.4	0.32	O3-O5 ^b	0	---	0.71	
	>4 years	241	16.2		WO1-WO2 ^b	0	---		
	0.2-1 year	1067	12.5		0.2-1 year	49	18.4		
	1-2 years	255	13.7		1-2 years	25	16.0		
Dominant Hand	Side	2-4 years	213	16.0	2-4 years	18	22.2	0.90	
		>4 years	241	16.2	>4 years	5	0.0		
		Right	1638	13.5	Right	90	16.7		
Airborne Recycle	Recycled	Left	198	15.2	Left	12	17.8	0.86	
		Both	12	16.7	Both	1	0.0		
		No	1690	12.9	No	92	17.4		
Lifestyle	Physical Activity	Yes	151	21.2	<0.01	Yes	13	15.4	0.04
		Much More Active	621	12.6	Much More Active	24	20.8		
		Somewhat More Active	789	12.0	Somewhat More Active	58	8.6		
		About the Same	400	18.5	About the Same	21	33.3		
		Somewhat Less Active	30	20.0	Somewhat Less Active	2	50.0		
	Smoking	Much Less Active	5	20.0	Much Less Active ^b	0	---	0.15	
		Smoker	482	12.7	Smoker	25	8.0		
		Never Smoked	1114	13.8	Never Smoked	72	18.1		
		Smoked but Quit in Last Year	226	15.0	Smoked but Quit in Last Year	8	37.5		
		17-19 yrs	394	11.2	17-19 yrs	22	31.8		
Physical Characteristics	Age	20-24 yrs	1071	13.4	<0.01	20-24 yrs	75	14.7	0.15
		25-29 yrs	245	14.7	25-29 yrs	5	0.0		
		≥ 30 yrs	119	24.4	≥ 30 yrs	3	0.0		
		60-68 in	483	14.9	59-62 in	25	16.0		
	Height	69-70 in	503	13.9	0.81	63-64 in	30	13.3	0.84
		71-72 in	471	13.0		65-66 in	22	22.7	
		73-83 in	376	13.0		67-72 in	28	17.9	
		105-159 lbs	434	14.3		104-120 lbs	28	21.4	
	Weight	160-170 lbs	499	10.8	0.08	212-128 lbs	24	16.7	0.76
		171-184 lbs	379	13.5		129-140 lbs	27	11.1	
185-285 lbs		520	16.3	141-190 lbs		25	20.0		
17.35-22.97 kg/m ²		436	12.2	17.34-21.07 kg/m ²		27	18.5		
Physical Fitness	Push-Ups ^a	22.98-24.40 kg/m ²	425	10.8	<0.01	21.08-22.13 kg/m ²	27	14.8	0.96
		24.41-25.86 kg/m ²	502	13.1	22.14-23.76 kg/m ²	25	20.0		
		25.87-40.79 kg/m ²	458	19.0	23.77-27.50 kg/m ²	25	16.0		
		10-55 reps	387	13.7	19-41 reps	21	19.0		
		56-67 reps	421	14.0	42-49 reps	26	11.5		
	Sit-Ups ^a	68-77 reps	413	13.6	0.89	50-59 reps	24	25.0	0.59
		78-120 reps	392	12.2		60-84 reps	29	13.8	
		7-65 reps	441	13.6		52-67 reps	25	16.0	
		66-75 reps	398	14.8		68-77 reps	22	31.8	
		76-82 reps	410	13.2		78-84 reps	28	14.3	
2-Mile Run ^a	83-120 reps	383	12.0	0.71	85-114 reps	26	7.7	0.16	
	9.5-12.7 min	398	8.5		11.8-14.0 min	25	16.0		
	12.8-13.3 min	375	10.4		14.1-15.0 min	25	12.0		
	13.4-14.0 min	391	15.9		15.1-15.9 min	23	17.4		
Parachute Ankle Brace	Wore Brace	14.1-21.0 min	450	18.0	<0.01	16.0-17.3 min	27	22.2	0.81
		No	824	14.2	No	30	20.0		
		Yes	1008	13.6	Yes	75	16.0		
Aircraft Exit	Exit Problem	No	1792	13.7	0.65	No	101	17.8	0.35
		Yes	50	16.0		Yes	4	0.0	

^aArmy students only

^bNot considered in the analysis

(2) No multivariate analysis was run on the women because of the small sample size and the fact that the only variable meeting the entry criteria was physical activity. For men, two logistic regression models were developed with self-reported injury in the year prior to jump school as the dependent variable. For the first model, only Army men were selected so the 2-mile run times could be included. Service branch was not entered into this model since all men were in the Army. In the second model, 2-mile run time was omitted, but men in the other services were included.

(3) In the first logistic regression model, there were 1,546 men with complete data (92% of all Army men). Table 7 shows that older age, Airborne recycling, and slower 2-mile run times were independently associated with injury in the year prior to jump school. In the second model, there were 1,784 men with complete data (97% of all men). Table 8 shows that older age, Airborne recycling, higher BMI, and less physical activity were independently associated with injury in the year prior to jump school.

Table 7. Variables Independently Associated with Self-Reported Injury in the Last Year (Army Men Only; from Multivariate Logistic Regression)

Variable	Level of Variable	N	Odds Ratio (95% Confidence Interval)	p-value
Age	17–19 yrs	354	1.00	---
	20–24 yrs	915	1.25 (0.85–1.84)	0.26
	25–29 yrs	191	1.42 (0.84–2.40)	0.19
	≥ 30 yrs	86	2.82 (1.56–5.09)	<0.01
Airborne Recycle	No	1411	1.00	---
	Yes	135	1.73 (1.10–2.72)	0.02
2-Mile Run ^a	9.5–12.7 min	381	1.00	---
	12.8–13.3 min	361	1.12 (0.68–1.83)	0.66
	13.4–14.0 min	375	1.90 (1.21–2.97)	<0.01
	14.1–21.0 min	429	1.99 (1.28–3.07)	<0.01

Table 8. Variables Independently Associated with Self-Reported Injury in the Last Year (All Services Included, from Multivariate Logistic Regression)

Variable	Level of Variable	N	Odds Ratio (95% Confidence Interval)	p-value
Age	17–19 yrs	383	1.00	---
	20–24 yrs	1046	1.19 (0.82–1.72)	0.35
	25–29 yrs	241	1.15 (0.70–1.89)	0.59
	≥ 30 yrs	114	2.29 (1.31–3.97)	<0.01
Airborne Recycle	No	1636	1.00	---
	Yes	148	1.76 (1.15–2.71)	<0.01
BMI	17.35–22.97 kg/m ²	431	1.00	---
	22.98–24.40 kg/m ²	415	0.88 (0.57–1.34)	0.54
	24.41–25.86 kg/m ²	491	1.01 (0.68–1.50)	0.97
	25.87–40.79 kg/m ²	447	1.54 (1.05–2.27)	0.03
Physical Activity	Much More Active	598	1.00	---
	Somewhat More Active	763	0.89 (0.64–1.24)	0.50
	About the Same	388	1.47 (1.03–2.11)	0.03
	Somewhat Less Active	30	1.59 (0.62–4.06)	0.34
	Much Less Active	5	2.04 (0.22–18.70)	0.53

c. Risk Factors for Jump Week Injury.

(1) Table 9 shows the univariate associations between self-reported jump week injury and other questionnaire variables. Among the men, there was increased risk of a self-reported jump week injury among those who were of higher rank (E6–E9 or O3–O5), had longer time in service, were Airborne recycles, were older, taller, heavier, did not wear the PAB, had an aircraft exit problem, had an injury in the year prior to jump school, and (for Army men) performed fewer push-ups or ran slower. Sample sizes for women were very small, but jump week injuries were associated with physical activity, sit-up performance, aircraft exit problems, and an injury in the past year. Women had a slightly higher injury risk than men (5.7% versus 4.8%, risk ratio=1.20, 95% confidence interval=0.54–2.69).

Table 9. Association Between Self-Reported Jump Week Injury and Other Questionnaire Variables

Category	Variable	Men				Women				
		Level of Variable	N	Injured (%)	P-value	Level of Variable	N	Injured (%)	P-value	
Demographics	Service Branch	Army	1677	4.8	0.80	Army	102	5.9	0.67	
		Navy	76	3.9		Navy ^b	0	---		
		Air Force	58	6.9		Air Force	3	0.0		
		Marines	36	2.8		Marines ^b	0	---		
	Rank Group	E1	248	4.0	<0.01	E1	3	0.0	0.93	
		E2	289	5.2		E2	11	9.1		
		E3	232	3.4		E3	6	16.7		
		E4	168	5.4		E4	3	0.0		
		E5	120	5.8		E5	3	0.0		
		E6–E9	59	15.3		E6–E9	2	0.0		
Cadet		581	3.3	Cadet		71	5.6			
O1–O2		99	7.1	O1–O2		5	0.0			
O3–O5	41	9.8	O3–O5 ^b	0	---					
WO1–WO2	4	0.0	WO1–WO2 ^b	0	---					
Time In Service	0.2–1 year	1067	3.1	<0.01	0.2–1 year	49	6.1	0.60		
	1–2 years	255	6.7		1–2 years	25	0.0			
	2–4 years	213	5.2		2–4 years	18	5.6			
	>4 years	241	9.1		>4 years	5	0.0			
Dominant Hand	Dominant Hand Side	Right	1638	4.8	0.14	Right	90	4.4	0.23	
		Left	198	4.0		Left	12	16.7		
		Both	12	16.7		Both	1	0.0		
Airborne Recycle	Recycled	No	1690	4.3	<0.01	No	92	5.4	0.74	
		Yes	151	9.3		Yes	13	7.7		
Lifestyle	Physical Activity	Much More Active	621	4.0	0.21	Much More Active	24	8.3	0.03	
		Somewhat More Active	789	4.3		Somewhat More Active	58	5.2		
		About the Same	400	7.0		About the Same	21	0.0		
		Somewhat Less Active	30	3.3		Somewhat Less Active	2	50.0		
		Much Less Active	5	0.0		Much Less Active ^b	0	---		
	Smoking	Smoking	Smoker	482	4.8	0.78	Smoker	25	4.1	0.66
Never Smoked			1114	4.3	Never Smoked		72	6.9		
Smoked but Quit in Last Year			226	5.3	Smoked but Quit in Last Year		8	0.0		
Physical Characteristics	Age	17–19 yrs	394	4.1	<0.01	17–19 yrs	22	9.1	0.40	
		20–24 yrs	1071	4.0		20–24 yrs	75	4.0		
		25–29 yrs	245	5.3		25–29 yrs	5	2.0		
		≥ 30 yrs	119	13.4		≥ 30 yrs	3	0.0		
	Height	Height	60–68 in	483	3.7	0.10	59–62 in	25	8.0	0.90
			69–70 in	503	4.6		63–64 in	30	6.7	
			71–72 in	471	4.2		65–66 in	22	4.5	
			73–83 in	376	7.2		67–72 in	28	3.6	
	Weight	Weight	105–159 lbs	434	2.5	0.01	104–120 lbs	28	3.6	0.27
			160–170 lbs	499	5.4		212–128 lbs	24	12.5	
			171–184 lbs	379	3.7		129–140 lbs	27	7.4	
			185–285 lbs	520	6.9		141–190 lbs	25	0.0	
BMI	BMI	17.35–22.97 kg/m ²	436	3.7	0.12	17.34–21.07 kg/m ²	27	3.7	0.83	
		22.98–24.40 kg/m ²	425	4.9		21.08–22.13 kg/m ²	27	3.7		
		24.41–25.86 kg/m ²	502	4.0		22.14–23.76 kg/m ²	25	8.0		
		25.87–40.79 kg/m ²	458	6.8		23.77–27.50 kg/m ²	25	8.0		

Table 9. (continued)

Category	Variable	Men				Women			
		Level of Variable	N	Injured (%)	p-value	Level of Variable	N	Injured (%)	p-value
Physical Fitness ^a	Push-Ups ^a	10–55 reps	387	4.9	0.04	19–41 reps	21	9.5	0.39
		56–67 reps	421	4.3		42–49 reps	26	0.0	
		68–77 reps	413	6.8		50–59 reps	24	8.3	
		78–120 reps	392	2.6		60–84 reps	29	3.4	
	Sit-Ups ^a	7–65 reps	441	3.6	0.50	52–67 reps	25	0.0	0.01
		66–75 reps	398	4.5		68–77 reps	22	18.2	
		76–82 reps	410	5.9		78–84 reps	28	3.6	
		83–120 reps	383	4.7		85–114 reps	26	0.0	
	2-Mile Run ^a	9.5–12.7 min	398	2.3	0.01	11.8–14.0 min	25	8.0	0.91
		12.8–13.3 min	375	6.1		14.1–15.0 min	25	4.0	
		13.4–14.0 min	391	3.8		15.1–15.9 min	23	4.3	
		14.1–21.0 min	450	6.4		16.0–17.3 min	27	7.4	
Parachute Ankle Brace	Wore	No	824	6.1	0.02	No	30	0.0	0.11
	Brace	Yes	1008	3.7		Yes	75	8.0	
Aircraft Exit	Exit Problem	No	1792	4.5	<0.01	No	101	5.0	0.09
		Yes	50	14.0		Yes	4	25.0	
Injured in Last Year	Injury	No	1597	3.5	<0.01	No	87	3.4	0.03
		Yes	254	12.6		Yes	18	16.7	

^aArmy students only

^bNot considered in the analysis

(2) Two logistic regression models were run for the men with self-reported jump week injury as the dependent variable. For the first model, only Army men were selected so the 2-mile run times and push-up performance could be included. In the second model, the fitness variables were omitted, but men in the other services were included. Although the sample of women was small, several variables were statistically significant in the univariate analysis, so a single multivariate analysis was performed for the Army women.

(3) In the first male model, there were 1,523 men with complete data (91% of all Army men). Table 10 shows that older age, Airborne recycling, push-ups, not wearing the PAB, aircraft exit problems, and an injury in the last year were independently associated with jump week injuries. In the second male model, 1,767 men had complete data (95% of all men).

Table 10. Variables Independently Associated with Self-Reported Jump-Week Injuries (Army Men Only; from Multivariate Logistic Regression)

Variable	Level of Variable	N	Odds Ratio (95% Confidence Interval)	p-value
Age	17–19 yrs	350	1.00	---
	20–24 yrs	898	1.20 (0.62–2.32)	0.58
	25–29 yrs	189	1.09 (0.44–2.4)	0.85
	≥ 30 yrs	86	3.61 (1.52–8.55)	<0.01
Airborne Recycle	No	1389	1.00	---
	Yes	134	1.95 (0.97–3.92)	0.06
Push-Ups	10–55 reps	361	1.62 (0.72–3.65)	0.25
	56–67 reps	393	1.44 (0.64–3.25)	0.38
	68–77 reps	396	2.68 (1.26–5.67)	0.01
	78–120 reps	373	1.00	---
Parachute Ankle Brace	No	839	1.73 (1.06–2.83)	0.03
	Yes	684	1.00	---
Aircraft Exit Problem	No	1482	1.00	---
	Yes	41	3.63 (1.38–9.53)	<0.01
Injury in Past Year	No	1318	1.00	---
	Yes	205	3.09 (1.81–5.27)	<0.01

Table 11 shows that older age, more body weight, Airborne recycling, not wearing the PAB, aircraft exit problems, and an injury in the past year were independently associated with jump week injuries. In the female model, there were 101 women with complete data (99% of all Army women). Table 12 shows that aircraft exit problems and a self-reported injury in the last year were independently associated with jump week injuries.

Table 11. Variables Independently Associated with Self-Reported Jump-Week Injuries (All Service Men; from Multivariate Logistic Regression)

Variable	Level of Variable	N	Odds Ratio (95% Confidence Interval)	p-value
Age	17–19 yrs	330	1.00	---
	20–24 yrs	1035	1.13 (0.60–2.14)	0.70
	25–29 yrs	239	1.31 (0.58–2.92)	0.52
	≥ 30 yrs	113	3.34 (1.49–7.47)	<0.01
Weight	105–159 lbs	419	1.00	---
	160–170 lbs	483	2.11 (1.01–4.43)	0.05
	171–184 lbs	363	1.38 (0.61–3.15)	0.44
	185–285 lbs	502	2.45 (1.2–5.04)	0.01
Airborne Recycle	No	1620	1.00	---
	Yes	147	2.25 (1.20–4.23)	0.01
Parachute Ankle Brace	No	979	1.68 (1.07–2.65)	0.03
	Yes	788	1.00	---
Aircraft Exit Problem	No	1721	1.00	---
	Yes	46	4.18 (1.70–10.26)	<0.01
Injury in Past Year	No	1521	1.00	---
	Yes	246	3.48 (2.15–5.63)	<0.01

Table 12. Variables Independently Associated with Self-Reported Jump-Week Injuries (Army Women; from Multivariate Logistic Regression)

Variable	Level of Variable	N	Odds Ratio (95% Confidence Interval)	p-value
Aircraft Exit Problem	No	97	1.00	---
	Yes	4	13.17 (0.92–188.79)	0.06
Injury in Past Year	No	84	1.00	---
	Yes	17	8.46 (1.30–55.32)	0.03

(4) Airborne students reported 18 ankle injuries during jump week, making up 21% of all known injuries. Table 13 shows the association between PAB wear and ankle injuries. Although not statistically significant, there was a tendency for PAB wearers to have fewer injuries.

Table 13. Association Between PAB Wear and Self-Reported Jump Week Ankle Injuries

PAB Wear	N	Injury Incidence (ankle injuries/ 10,000 jumps)	Risk Ratio ^a (95% Confidence Interval)	p-value
No	852	117	1.58 (0.63–4.00)	0.33
Yes	1080	74		

^aNo PAB/PAB

d. Open Ended Comments on Parachute Ankle Brace.

(1) There were 757 service members who provided open-ended comments on the PAB (39% of those surveyed). Some individual responses were complex and referred to more than one factor. After reviewing the responses, they were placed into 12 categories. If a single individual provided a response referring to more than one category that was counted as a second or third comment. There were no comments that fit four categories.

(2) Table 14 shows the comments listed as positive, negative, or neutral. Appendix D lists each comment by category. Among the 757 service members who provided responses, there were a total of 994 individual comments that fit into the 12 categories. Of the 994 comments, 243 (24%) were provided by those who did not wear the PAB and 751 (76%) were provided by those who did wear the PAB. Among non-PAB wearers, 30% of comments were positive, 51% were negative, and 19% were neutral. Among PAB wearers, 47% of comments were positive, 50% were negative, and 3% were neutral. The largest single category of negative comments among the PAB wearers had to do with design issues, accounting for 34% of their negative comments. Other categories with large numbers of negative comments had to do with comfort (16% of all negative comments), general comments (16% of all comments), and PLFs (14% of all comments). Negative comments among non-PAB wearers were vaguer: 24% had to do with a general negative opinion of brace, 23% said that they would not choose the brace for the Army, and 10% said they would not choose to use the brace themselves.

Table 14. Open-Ended Comments on the PAB (+ = positive comment; - = negative comment; neutral = neutral comment)

Brace Wear	Comment Category	Comment 1			Comment 2			Comment 3			All Comments		
		+	-	Neutral	+	-	Neutral	+	-	Neutral	+	-	Neutral
No	Not Relevant	0	0	14	0	0	0	0	0	0	0	0	14
	General	29	39	12	2	1	0	0	0	0	31	30	12
	Design	3	9	0	0	1	0	0	0	0	3	10	0
	Comfort	0	3	0	0	3	0	0	0	0	0	6	0
	Medical/Safety	11	5	0	3	5	2	0	1	0	14	11	2
	PLF	2	2	10	1	1	8	0	1	0	3	4	18
	Tactical	0	6	0	0	1	0	0	0	0	0	7	0
	Handling	0	2	0	1	2	0	0	0	0	1	4	0
	Choose for Army	2	20	0	2	7	0	0	2	0	4	29	0
	Choose for Self	9	8	0	4	5	0	0	0	0	13	13	0
	Confidence/Security	1	3	0	2	1	0	0	0	0	3	4	0
Transport	0	6	0	0	0	0	0	1	0	0	7	0	
TOTAL	57	93	36	15	27	10	0	5	0	72	125	46	
Yes	Not Relevant	0	0	9	0	0	0	0	0	0	0	0	9
	General	127	57	15	10	5	0	0	1	0	139	61	15
	Design	54	89	0	8	34	0	4	2	0	66	125	0
	Comfort	5	46	0	3	14	0	1	1	0	9	61	0
	Medical/Safety	53	5	0	12	7	0	3	3	0	68	15	0
	PLF	10	38	1	8	13	0	0	3	0	18	54	1
	Tactical	0	0	0	0	1	0	0	0	0	0	1	0
	Handling	0	13	0	0	8	0	0	2	0	0	23	0
	Choose for Army	9	11	0	9	5	0	0	3	0	18	19	0
	Choose for Self	0	3	0	3	3	0	0	0	0	3	6	0
	Confidence/Security	24	2	0	9	1	0	0	1	0	33	4	0
Transport	0	0	0	0	1	0	0	1	0	0	2	0	
TOTAL	282	264	25	62	92	0	8	17	0	352	373	26	

7. DISCUSSION.

a. This study provided demographics, lifestyle characteristics, physical fitness, and injury information, as well as comments on the PAB in a group of airborne students. Service members surveyed were part of a larger investigation examining the injury prevention capabilities of the PAB (60). This larger study involved 102,784 jumps, but the actual number of participants was not known because denominator data was collected from Jump Status Reports, which recorded only the number of jumps and not individual jumpers. If the assumption was made that all individuals in the larger study had 5 jumps each, the total number of participants in the larger study was 20,557. Thus, it can be estimated that the service members surveyed in the present study represented 10% of this group (1957/20,557).

b. Individuals who completed the questionnaire were generally younger enlisted Army men, although there was a small proportion of women (5%) and students from other services (9%). The average age (22 years) of the sample was younger than that of the Army as a whole (26 years) and there were a larger proportion of men (95%) than found in the wider Army (86%) in 2005 (90). Almost a third of the survey sample was cadets since airborne training is an option offered at the US Military Academy at West Point. Exclusive of cadets, 89% of those surveyed were enlisted and 11% were officers, which is a similar proportion of enlisted (83%) and officers (14%) in the Army as a whole in 2005. (90).

a. Physical Fitness.

(1) We could not be sure that service members other than those in the Army had correctly responded to the question on their physical fitness tests, so only Army personnel were considered for the analysis of the fitness measures. Table 15 shows several studies that have obtained APFT scores on various Army military occupational groups with the results from the current study in the last row. With the exception of the present study, all investigations in Table 15 collected APFT scores directly from official records. In the present study, APFT scores were self-reported, but self-reported APFT scores have been shown to be valid estimates of actual APFT scores (45).

(2) In Table 15, the average male Airborne student's push-up performance exceeded most other groups other than the military police and 10th Mountain Division Infantry (Ft Polk, LA) samples. Sit-up and run performance of the male Airborne students was the highest of the other Army men surveyed. Among the female Airborne students, push-up and run performance was the highest among other female groups surveyed. Sit-up performance exceeded all other female groups other than the wheel vehicle mechanic sample. Army Airborne students appear to be among the highest performers on the APFT.

Table 15. Army Physical Fitness Test Scores in Different Army Groups^a

Type of Unit	Study (Reference Number)	Location, Year	Men				Women			
			N ^b	Push-Ups (n)	Sit-Ups (n)	2-Mile Run (min)	N ^b	Push-Ups (n)	Sit-Ups (n)	2-Mile Run (min)
Infantry	72	Ft Richardson AK (9 th Inf Div), 1989	76	62±9	64±9	13.5±1.3	c	c	c	c
	103	Ft Drum NY (10 th Mt Div), 1989–1990	181	65±13	69±14	13.5±1.1	c	c	c	c
	58	Ft Polk LA (10 th Mt Div), 2005	310	67±14	70±11	14.7±1.4	c	c	c	c
	58	Ft Polk LA (10 th Mt Div), 2005	183	62±14	67±11	14.5±1.3	c	c	c	c
Combat Engineers	101	Ft Drum NY (10 th Mt Div), 1989–1990	125	65±12	67±11	14.2±1.4	c	c	c	c
Field Artillery	101	Ft Drum NY, 1989–1990	188	65±13	68±11	14.9±3.5	c	c	c	c
Military Police	Previously Unpublished (33)	Ft Riley KS 2002	230	68±11	62±13	14.8±1.2	c	c	c	c
Wheel Vehicle Mechanics	Previously Unpublished (63)	Ft Bragg NC, 2004	99	63±14	65±10	14.7±1.3	5	42±16	76±14	17.7±1.4
US Army Band	66	Ft Myers VA, 2006	150	47±14	54±15	16.1±1.4	40	26±10	58±16	18.6±1.9
Ordnance School Students	52	Aberdeen Proving Ground MD, 2000–2001	2303	54±13	63±10	14.9±1.4	256	34±12	62±12	18.3±2.0
Senior Army Officers	68	Army War College PA, 2000	133	57±13	63±14	15.4±1.5	10	39±15	67±12	17.8±2.3
Army-Wide	50	14 US Army Installations, 1988	5346	50±13	59±13	15.1±1.7	676	28±11	59±13	18.3±2.1
Airborne Students	Present Investigation	Ft Benning, NC, 2005–2006	1614	67±15	73±13	13.4±1.0	100	51±15	76±13	14.9±1.3

^aAbbreviations: Ft=Fort, AK=Alaska, NY=New York, LA=Louisiana, KS=Kansas, NC=North Carolina, VA=Virginia, MD=Maryland, PA=Pennsylvania, NC=North Carolina, Inf=Infantry, Mt=Mountain, Div=Division, US=United States

^bSample sizes are approximate since they differed slightly depending on the APFT event

^cNo women in these groups

b. Injuries in the Year Before Jump School. The self-reported injury rate in the year before jump school was about 14/100 person-years (men and women combined). This is considerably lower than rates of 54 to 223 injuries/100 person-years documented from medical records in many military occupational groups, as shown in Table 16. This may illustrate the limitations of obtaining injury rate data from self-report when service members may have different definitions of injury and the recall period is long. Studies comparing injury rates over various recall periods have shown that as the period increases, self-reported injury rates decrease (78, 89, 127). Despite this, studies have shown that risk ratios comparing subgroups appear to be much less affected by lack of recall (78, 127), possibly because all risk groups are similarly affected by recall bias. One study found that over a one-year period, adjustment for recall time altered demographic injury-related risk ratios by -14% to +15%, with an average absolute difference of 8% (127). Thus, caution is advised in interpreting the injury rates, while risk ratios may be somewhat more valid.

Table 16. Outpatient Injury Rates, Clinic Visit Rates, and Limited Duty Rates of U.S. Army Soldiers in Various Military Occupational Specialties

Study	Year Data Collected	Type of Unit	Rate (events/100 person-years)		Limited Duty Rate (days/person-year) ^c	
			Injuries ^{c,d}	Clinic Visits for Injuries ^c		
Tomlinson et al. (118) ^a	1984–1985	Infantry	146	ND	ND	
		Infantry	223	ND	ND	
		Special Forces	145	ND	ND	
		Rangers	121	ND	ND	
		Aviation/Artillery	54			
Knapik et al. (51) ^b	1989–1990	Infantry	142	220	11.8	
Reynolds et al. (103)	1989–1990	Infantry	ND	181	6.1	
Reynolds et al. (101)	1996	Combat Engineers	ND	148	5.9	
		Artillery	ND	148	5.7	
Smith and Cashman (112)	1997–1998	Infantry	101	ND	15.7	
Hauret et al. (33)	2002	Military Police	110	230	32.5	
Darakjy et al. (19)	2002	Armor	68	132	15.8	
Knapik et al. (63)	2003–2004	Wheel Vehicle Mechanics	Men	124	Men	223
			Women	156	Women	238
Knapik et al. (67)	2004–2005	Wheel Vehicle Mechanics	Men	115	Men	197
Present Study	2005–2006	Airborne Students	Men	14	ND	ND
			Women	17		

^aAnnualized rates based on 8 weeks of data collection

^bAnnualized rates based on 6 months of data collection

^cND=No data

^dAn injury is the first visit for a particular type of physical damage to the body. A Soldier could have more than one injury

c. Risk Factors for Injuries in the Year before Jump School. Many risk factors for injury in the past year among the male Airborne students were similar to those reported in other studies. These included older age, high BMI, 2-mile run time, and less physical activity. Risk factors not previously reported were service branch and airborne recycling.

(1) Age

(a) In univariate analysis, men who were 30 or more years of age were 2.2 times more likely to report an injury in the last year compared with those who were 17–19 years of age; older age was independently associated with injury. Studies of infantry Soldiers (51) and predominately infantry Soldiers (118) have shown that younger age was an injury risk factor; however, in Basic Combat Training (BCT) older age was an injury risk factor (34, 44, 69). One explanation provided for this (51) is that, in the infantry, younger Soldiers may perform more of the arduous occupational tasks and thus be more susceptible to injury than older Soldiers, who are likely to have higher rank and be in supervisory or staff positions. BCT training differs from the operational infantry in that all individuals perform the same training tasks; under these conditions older individuals may be more susceptible to injury.

(b) Complicating this interpretation is a more recent study of a light infantry unit that showed that older age was an injury risk factor (59). This group of Soldiers was preparing for a deployment to Afghanistan and all individuals had apparently been training in a similar manner for this deployment. In other military occupational groups, findings with regard to injury and age are mixed. Older age increased injury risk among military police (33), but was not an injury risk factor among armor crewmen (19) or wheel vehicle mechanics (64). This suggests differences among military occupational specialties (MOS); in the present

study, individuals came from a wide variety of MOS. The civilian literature is unclear on the association between age and injury, with some studies of physically active individuals showing no association (14, 84, 85) while other studies indicated that older age was associated with injury (10, 38, 93, 114).

(c) The association between age and injuries in occupational groups may be complex for a number of reasons. Older individuals who remain in an occupational activity for a long period of time increase their exposure to potentially injury-producing events. Also, with aging there is a loss of muscle mass, muscle strength, muscular endurance, aerobic capacity, and flexibility (9, 62); these degenerative changes may also make injuries more likely. On the other hand, older workers may be more experienced with tasks, knowing potential injury-producing events and performing them more safely. Further, most occupations have a variety of different tasks and individuals can often select among them based on their interest, physical capacity, availability of help (mechanical or personal), and other factors. Thus, some tasks might be circumvented if they are beyond an individual's physical capacity and/or the tasks are known to be injury-producing for a particular individual. Individuals in particular occupations where injury-producing tasks cannot be precluded may self-select out of the occupation so that only "survivors" (older individuals who can perform the tasks with little injury risk) remain. These and other factors likely interact; specific investigations that partition them out may shed light on the association between age and injuries.

(d) Service members perform not only occupational activities but are also expected to maintain a high level of physical fitness by participating in group or individual exercise on a regular basis (94). Older service members are more likely to be of higher rank and have more individual control over their exercise duration and intensity. Younger service members are more likely to perform group exercises, where intensity and duration are similar for all participating individuals. Where the intensity and duration are similar for all individuals, it is likely that, for service members of lower fitness, the relative exercise intensity would be higher and this may make them more susceptible to injury (42, 57, 69). Younger service members more susceptible to exercise-induced injuries may self-select out of the military, leaving a larger population of older individuals who are less susceptible to exercise-induced injury.

(2) Aerobic Fitness.

(a) In the present study, Army men in the lowest quartile of aerobic fitness (2-mile run time) were about twice as likely to report an injury in the past year as individuals in the highest quartile of aerobic fitness. Aerobic fitness was also an independent injury risk factor. In consonance with these data, low aerobic fitness has been associated with increased injury risk among infantry Soldiers (51, 103), military police (33), armor crewmen (19), combat engineers (102), and basic trainees (42, 43, 55, 69, 70, 126). Individuals with lower aerobic capacity will likely experience greater physiological stress (higher heart rate, higher respiration, less efficiency) during longer-term tasks because they use a higher percentage of their maximal aerobic capacity compared with individuals with higher aerobic capacity. This may increase the likelihood of injury through a variety of hypothetical mechanisms. Individuals with lower aerobic capacity will perceive tasks as more difficult (28) and may

fatigue more rapidly for both cardiovascular and metabolic reasons (36, 37, 46). Fatigue may result in changes in gait (12), resulting in unaccustomed musculoskeletal stress on specific body areas (40, 87). The combined perceptual, cardiovascular, metabolic, and biomechanical stress could make injuries more likely.

(b) Interestingly, when 2-mile run times were removed from consideration in the logistic regression analysis, BMI and physical activity stepped into the model, suggesting that these two factors accounted for some of the injury risk associated with 2-mile run time. Both are related to 2-mile run time. Higher BMI indicates more weight for height and it has been shown that, as body weight increases, run times become slower (17, 18). Physical activity of the proper mode, intensity, frequency, and duration can increase aerobic fitness (1, 41, 77, 124) and individuals who regularly perform long-term physical activity using large muscle groups are likely to be more aerobically fit than their less active counterparts (1, 124).

(3) Body Mass Index. In the univariate analysis, men in the highest BMI quartile were 1.6 times more likely to report an injury in the last year than those in the lowest BMI quartile. BMI was an independent injury risk factor when 2-mile run was not included in the analysis. High BMI has been shown to be a risk factor among military police, armor crewmen, and wheel vehicle mechanics (19, 33, 64, 67), but the relationship was bimodal (higher risk at both BMI extremes) among infantry Soldiers (103). In the civilian literature, many studies indicate a relationship between higher BMI and injuries (22, 84, 91, 113, 117, 125), although some do not (10, 114, 116, 122). BMI adjusts body weight for the height of an individual, essentially removing the dependency of weight on height. The correlation between body fat and BMI was about 0.7 in both civilian and military samples (53, 67, 104). The greater weight for height may place greater forces on body tissues, especially during exercise and occupational tasks, possibly increasing the likelihood of injury.

(4) Physical Activity. Servicemen who reported that they were less physically active than others of their age and sex in the military were 1.6 times more likely to report an injury in the last year than those who said they were more physically active; low physical activity was an independent injury risk factor when 2-mile run was not included in the analysis. These findings are in agreement with other studies that report that low self-reported physical activity is associated with injuries among other military groups (29, 42–44, 65, 69, 70, 100, 111) and in various civilian groups (91, 98). Besides the effects on aerobic fitness noted above, physical activity of the proper mode, intensity, frequency, and duration can increase bone mineral density (75, 80), the strength and cross sectional area of muscle (7, 26), and the strength and cross sectional area of connective tissue (49, 86). These and other factors may lower susceptibility to injury.

(5) Service Branch. It is not clear why service branch was an injury risk factor. None of the Marines reported any injuries in the last year, while the Air Force personnel reported the highest injury incidence. Installation Injury Reports produced by the Army Medical Surveillance Activity (AMSA) (http://amsa.army.mil/AMSA/amsa_home.htm) provide the proportion of individuals in each military service who had an injury requiring medical attention for each calendar month. Table 17 shows these data compiled for the four services for each month queried by the survey (i.e., one year before the first administration of the survey to the last month of the survey). Contrary to the finding of the survey, the AMSA

data showed that the Army had the highest injury rate, the Navy had the lowest, and the Marines and Air Force had intermediate injury rates. The present study included few individuals from services other than the Army possibly resulting in an unrepresentative sample of Navy (n=76), Marine (n=36), and Air Force (n=58) personnel. It may be that only the fittest members of the other services apply for Airborne School and it has been demonstrated that those with higher fitness levels are at lower injury risk (19, 33, 51, 102, 103). Further, service branch was not an independent injury risk factor for injury, suggesting that it covaried with other factors.

Table 17. Proportion (%) of Service Members with an Injury Requiring Medical Attention from June 2004 to January 2006 (from the Army Medical Surveillance System)

	Army	Navy	Marines	Air Force
June 2004	10.1	5.6	7.5	8.1
July 2004	9.7	5.1	6.4	7.5
August 2004	9.7	5.4	6.9	7.6
September 2004	9.1	5.1	6.2	6.9
October 2004	8.8	5.1	6.0	6.7
November 2004	8.3	4.6	6.2	6.1
December 2004	6.7	3.9	5.6	5.7
January 2005	8.3	4.5	6.1	6.7
February 2005	7.3	4.2	5.7	6.0
March 2005	9.1	5.1	6.5	7.3
April 2005	9.1	5.4	6.7	6.9
May 2005	8.9	5.3	6.8	6.8
June 2005	8.9	5.3	7.3	7.3
July 2005	8.1	5.0	6.2	6.2
August 2005	9.3	5.9	7.2	7.4
September 2005	8.1	5.3	6.3	6.5
October 2005	8.4	5.6	6.3	7.1
November 2005	7.6	4.7	5.8	6.2
December 2005	6.2	4.1	5.8	6.2
January 2006	8.7	5.0	6.2	7.5
Mean±SD	8.5±1.0	5.0±0.5	6.4±0.5	6.8±0.6

(6) Airborne Recycling. In the univariate analysis, those who had been recycled during Airborne School were 1.6 times more likely to report a previous injury and Airborne recycling was independently associated with injury in the previous year. If a service member missed four or more hours of Airborne training that individual could be recycled. Recycling meant that the student did not complete Airborne School within the three-week training cycle but was allowed to try again. The most common reason for recycling was time taken for a medical visit (sick call) as a result of an injury. It has been shown that a previous injury increased the risk of another injury (27, 68, 74, 85, 88, 93, 99, 109, 120–122). If a student had been injured in the previous year, it is possible that he or she was more susceptible to an injury during Airborne School and that this mediated the relationship between self-reported injury and recycling.

(7) Gender. In this survey, women reported a slightly higher injury incidence than the men, but the difference was not large and the sample of women was relatively small. Studies in Army BCT show that injury rates among women are almost twice as high as those of men (61) but these differences are reduced in Advanced Individual Training (35, 61). In the operational Army, there are few studies comparing male and female injury rates. One study

of wheel vehicle mechanics found that women had about a 13% higher overall injury rate (63). Thus, limited data from the present study and from the vehicle mechanic's study suggest that in military operational activities overall injury incidence among women might be slightly higher than among men.

d. Jump Week Injuries.

(1) About 5% of students reported a jump week injury and since there were 4 jumps/person, this was an injury rate of 120/10,000 jumps. This was more than twice the rate of 58/10,000 reported for the larger study (60) of which this analysis is a part. It is unlikely that this subsample of the larger study (10%) had twice the injury rate of the larger sample. The injury rate in the present study is also considerably higher than the estimate of 56 injuries/10,000 jumps based on a literature review of 13 post-1946 studies by Bricknell and Craig (11). In the larger study of which this was a part (60), injuries were collected by medics and senior non-commissioned officers (NCOs) on the drop zone. In the post-1946 studies reviewed by Bricknell and Craig (11), injuries were collected in a variety of ways, including on the drop zone (24, 31, 81, 105), from primary care or emergency room records (16, 83), from medical records (76), from questionnaires and interviews (115), and from existing databases (47, 96), although a few studies did not state how injury data was obtained (8, 92, 97). Thus, most injury data collected in past studies appear to be those in which the service member reported to a medical care provider. In the current study, the service members may have self-reported reported injuries of any type, whether or not they were treated by medical personnel. Recall would be less of a problem here (compared with asking about the last year) because the injury event would have been much more recent and thus easier to remember. Analysis of various recall times have suggested that four to five weeks or less is the optimal recall period for injury information (89, 123); the recall period for jump week injuries in the present study was less than 5 days. Thus, it is likely that the higher jump week injury rate found here is due to students reporting both minor injuries, for which no medical personnel were consulted, as well as more serious injuries, for which medical personnel may have been consulted.

(2) Table 18 shows a comparison of anatomic locations of airborne-related injuries in the larger study (60), where injuries were collected on the drop zone, and in the current study, where injuries were self-reported. Head injuries and ankle injuries made up a greater proportion of injuries in the larger study, while knee and leg injuries made up a greater proportion of injuries among the self-reports. If the assumption is made that short-term self-reports are more likely to contain minor injuries, service members may be experiencing more minor injuries (which did not require attention by a medical care provider) in the knee and leg regions.

Table 18. Comparison of Anatomic Location of Injuries in Larger Study and Current Study

	Larger Study (60)	Current Study	Difference (Larger Study – Current Study)
Head	21.5 ^a	13.8 ^b	7.7
Arms	11.4 ^c	7.4	4.0
Chest	1.2	1.1	0.1
Back	3.9	4.3	-0.4
Legs	13.8 ^d	23.4	-9.6
Knees	3.4	13.8	-10.4
Ankles	36.7	19.1	17.6
Foot/Toes	6.2	8.5	-2.3
Environmental	0.5	0.0	0.5
Multiple	0.0	2.1	-2.1
Missing	1.7	6.4	-4.7

^aIncludes head, face, and neck

^bIncludes head and ears

^cIncludes shoulders, elbow, hands, and arms

^dIncludes hips, pelvis, thigh, calf, and shin

e. Risk Factors for Jump Week Injuries. Among the male Airborne students, risk factors for jump week injury included older age, higher rank, longer service time, Airborne recycling, an injury in the past year, not wearing an ankle brace, aircraft exit problems, taller stature, higher body weight, and (among Army men) fewer push-ups, and slower 2-mile run time. The sample of women was small, making statistical power low and making it difficult to identify risk factors associated with injury. Despite this, aircraft exit problems and an injury in the past year emerged as independent injury risk factors among the women.

(1) Age, Rank, and Time in Service. Among the men, jump week injuries were associated with age, rank, and time in service, but in the multivariate model only age remained as an independent injury risk factor. Age, rank, and time in service would be expected to be related (collinear), since those with higher rank and more time in service are generally older. This is clearly indicated in Table 19, where a larger proportion of male service members reside in older age groups as either time in service or rank increases (within the enlisted or office corps). As noted above, older age has been shown to be an injury risk factor in BCT studies (34, 44, 69) and in BCT all individuals perform essentially the same tasks. Similarly, during jump week all individuals perform the same activities and under these circumstances it would appear that those of older age are at higher injury risk. Other investigations have also shown that older age is associated with injuries during Airborne training (107) and in operational Airborne units (15).

Table 19. Association of Age with Time in Service and Rank among Servicemen
(Values are % of individuals in row)

Variable		Level of Variable	Age Group				
			17–19 Years	20–24 Years	25–29 Years	≥30 Years	
Time In Service		0.2–1 year	32.3	56.8	8.8	2.1	
		1–2 years	15.1	82.2	2.3	0.5	
		2–4 years	3.4	76.1	17.0	3.4	
		>4 years	1.7	23.3	39.4	35.6	
Rank		E1	37.7	53.3	8.2	0.8	
		E2	41.2	51.3	6.1	1.4	
		E3	25.2	61.0	11.0	2.9	
		E4	1.8	52.3	35.1	10.8	
		E5	0.0	47.3	35.5	17.1	
		E6–E9	0.0	7.5	27.5	65.0	
		Warrant Officer	0.0	0.0	25.0	75.0	
		Officer	Cadet	21.9	74.9	3.2	0.0
			O1–O2	1.1	56.3	31.0	11.5
			O3–O5	0.0	10.3	37.9	51.7

(2) **Airborne Recycling.** Men who were recycled were 2.2 times more likely to report a jump week injury and recycling was an independent injury risk factor. As noted above, if service members missed four or more hours of training, they were recycled and the most common reason for recycling was time taken for a medical visit (sick call) as a result of an injury. (Failing to meet specific training requirements in the allotted time is a secondary reason.) It is possible that because of the wording of the injury question (i.e., “Were you injured during jump week?”), service members included injuries from a previous jump week that caused them to be recycled. Since Airborne recycling and an injury in the past year were independent injury risk factors, it is unlikely that an injury before Airborne School was a mediating factor in the association between recycling and jump week injury.

(3) **Prior Injury.** Men who reported an injury in the year prior to Airborne School were 3.6 times more likely to report an injury during jump week; women who reported an injury in the year prior to Airborne School were 4.9 times more likely to report an injury during jump week. A self-reported injury in the year prior to Airborne School was an independent risk factor for a jump-week injury among both men and women. Previous studies of military groups (68, 109), athletes (74, 85, 88, 93, 99, 120–122), and industrial workers (27) have reported that prior injuries were associated with current injuries, especially if an injury had occurred in the preceding year (85, 88, 99, 120–122). Many injuries may be chronic or recurrent, accounting for at least a part of this relationship.

(4) **Ankle Brace.**

(a) Men who did not wear the ankle brace were 1.6 times more likely to report a jump week injury. This effect was not seen among the women, but when men and women were combined the overall effect of the brace was still protective. This is shown in the last row of Table 20 (any injury), which compares the results of the present study with those reported by several other studies, including the larger study of which the present study was a part (3, 60, 108, 110). The brace tended to reduce the incidence of ankle injury in the present study but the effect was not statistically significant, presumably because of the small number of cases, exacerbated by the fact that many students did not report a type of injury.

Table 20. Comparison of Results from Investigations of the PAB

Investigation	Descents	Outcome Measure	Outcomes (injuries)	Injury Incidence (Injuries/10,000 jumps)		Risk Ratio- NoPAB/PAB (95% CI)
				No PAB	PAB	
Amoroso et al. 1998 (3)	3,674	Ankle Injury ^a	15	54.1	27.4	2.0 (0.7–5.8)
		Any Injury ^a	35	109.4	93.2	1.2 (0.6–2.2)
Schumacher et al. 2000 (110)	13,782	Ankle Injury	44	44.6	15.2	2.9 (1.4–6.1)
		Any Injury	210	168.0	131.6	1.3 (1.0–1.7)
Schmidt et al. 2005 (108) ^b	973,715 ^c	Hospitalized Ankle Injury	526	6.7	3.0	2.2 (1.8–2.7)
Knapik et al. 2007 (60)	102,784	Ankle Injury	219	25.2	13.2	1.9 (1.4–2.7)
		Any Injury	596	60.6	52.6	1.2 (1.0–1.4)
Present Study	7,828 ^d	Ankle Injury	18	29.3	18.5	1.6 (0.6–4.0)
		Any Injury	94	146.4	99.3	1.5 (1.0–2.2)

^aDerived from data in article

^bCompared only pre-brace period to brace period

^cEstimated from sample sizes assuming 5 jumps per service member

^dEstimated from sample sizes assuming 4 jumps per service member; includes both men and women

(b) The overall reduction in injuries associated with the PAB could be attributed in part to a reduction in ankle injuries, but it is intriguing to ask what other types of injuries tended to be lower among brace wearers. In the present study, an analysis by injury type might be misleading, since almost one third of respondents did not indicate the type of injury. On the other hand, only six service members failed to give an anatomic location, so an analysis by location is less susceptible to bias. Table 21 shows an analysis of injury location by brace wear. Leg and knee injuries tend to be lower in the brace wearers, suggesting that the brace may be protective for these areas also. If the assumption is made that the responses of the students include both minor and major injuries, perhaps the brace is protecting against some minor injuries in these areas. Caution in interpretation is suggested by the small sample size.

Table 21. Comparison of Injury Locations Among PAB Wearers and PAB Non-Wearers

Anatomic Location	Non-PAB		PAB		Incidence Difference (injuries/10,000 jumps) (Non-PAB – PAB) ^b
	N	Injury Incidence (injuries/10,000 jumps) ^a	N	Injury Incidence (injuries/10,000 jumps) ^a	
Head	6	17.6	7	16.2	1.4
Arms	4	11.7	3	6.9	4.8
Chest	0	0.0	1	2.3	-2.3
Back	1	2.9	3	6.9	-4.0
Legs	13	38.1	9	20.8	17.3
Knees	8	23.4	5	11.5	11.9
Ankles	10	29.3	8	18.5	10.8
Foot/Toes	4	11.7	4	9.2	2.5
Multiple	2	5.9	0	0.0	5.9
Missing	3	---	3	---	---
TOTAL ^c	48	140.5	40	92.3	48.2

^aAssumes 4 jumps/person; 4332 jumps for PAB group, 3416 jumps for non-PAB group

^bPositive number indicates PAB group had a lower incidence

^cDoes not include “missing”

(5) Aircraft Exit Problems. In the present study, a self-reported aircraft exit problem increased the risk of injury more than threefold, even after controlling for other risk factors. An aircraft exit problem was also an independent injury risk factor. There were only seven injuries associated with these exit problems. Assuming 4 jumps per person, the overall injury

incidence associated with an aircraft exit problems was 9 injuries/10,000 jumps (7/7,824*10,000), making this a rare event. In the medical literature, there have been anecdotal reports mentioning potential problems with static lines (20, 21, 47, 48, 92), parachute riser/suspension lines (13, 23, 48, 92), aircraft strikes (21, 47), and collisions between parachutists (20, 21, 47). However, only Craig and Lee (15) specifically examined what they called “altitude injuries,” which were defined as injuries occurring from aircraft exit to ground impact. Their study was a case series of 113 jump-related injuries obtained from emergency room records, but they had no denominator and so they could not calculate incidence. Table 22 compares data from Craig and Lee (15) with that from the current study. Craig and Lee found riser/suspension line problems, static line problems, and aircraft strikes to account for most of the injuries in their series. In the present study, there were no reported injuries listed with riser/suspension line problems, but static problems and aircraft strikes account for two injuries each in this small series of seven cases.

Table 22. Comparison of Altitude Injuries in Two Studies (values are % of all injuries)

	Craig and Lee (15) ^a	Current Study ^b
Aircraft Strike	21.2	28.6
Static Line	32.7	28.6
Risers/Suspension Lines	44.2	0.0
Deceleration	0.9	14.3
Equipment Strike	0.9	---
“Weak Exit”	0.0	14.3
Ankle Brace Dragged	0.0	14.3

^aThere were 113 injuries

^bThere were 7 injuries

(6) Physical Fitness.

(a) The association between push-up performance and jump week injuries among the men was not linear (i.e., progressively lower performance associated with progressively higher injury incidence), but those in the highest performance quartile did have a lower injury risk than those in the three lower push-up performance quartiles and push-up performance was an independent injury risk factor. It has long been an Airborne School tenet that high upper body strength is favorable for parachute operations. This belief stems from the assumption that more upper body strength allows the jumper to pull harder on the parachute risers and better control the direction of lateral drift. The 1973 Army Field Manual 21-20 (Physical Readiness Training) contains an Airborne Trainee Physical Fitness Qualification Test that included a pull-up test (6). This test was superseded in 1980 when all fitness tests across the Army were standardized to the current 3-event evaluation (push-ups, sit-ups, and 2-mile run) (5). However, since 1972, women have been graduating from Airborne School and women generally have about half the upper body strength of men (73, 79). The women’s average push-up score in the present study was 76% that of the average men’s score, suggesting that women who enter and are successful in Airborne School (they had completed most of their qualification jumps) have much higher upper body muscular endurance than average. Data from the present study does suggest that there may be some increased injury risk associated with lower upper body muscular endurance.

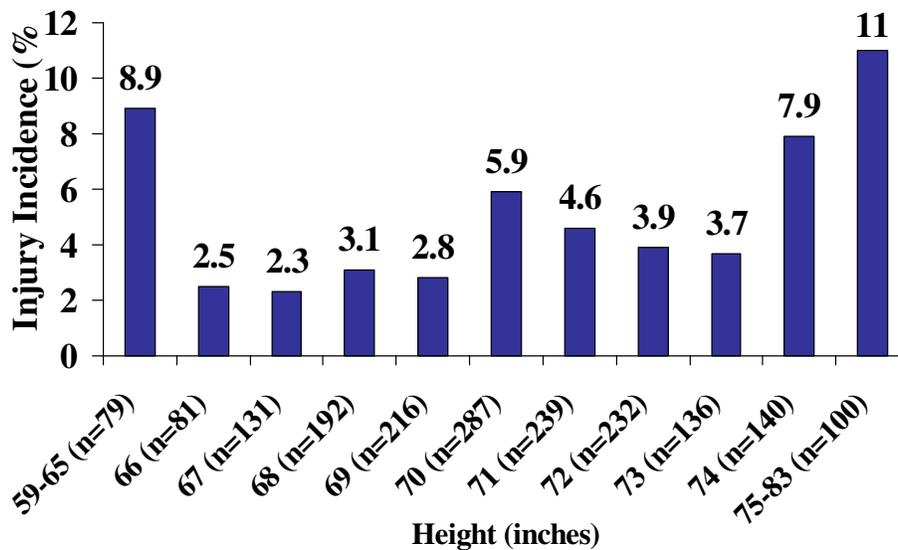
(b) Like push-ups, the association between jump week injuries and 2-mile run time was not linear, but students in the quartile that ran the slowest were 2.8 times more likely to report a jump week injury than students in the fastest quartile. Like upper body strength, aerobic fitness is considered important for airborne operations and runs are performed on a daily basis, culminating in a 5-mile run at the end of the second week. However, 2-mile run time was not an independent injury risk factor.

(7) Physical Characteristics.

(a) Men who were in the highest quartile of weight, height, or BMI were 2.8, 1.9, and 1.8 times, respectively, more likely to report a jump week injury than those in the lowest quartile of these variables. Weight has previously been shown to be associated with higher injury rates in the Belge Airborne School (95) and among paratroopers in a British Airborne Division (23). Greater weight would result in faster descent velocities, leading to higher ground impact forces and potentially higher injury incidence (54).

(b) Pirson and Pirlot (95) found that the Belge Airborne troops who were about 68–70 inches in height were at higher injury risk than individuals who were shorter (about 64–67 inches) or taller (about 71–75 inches). Figure 1 displays male heights broken down into smaller groups than those reported in Table 9. Contrary to Pirson and Pirlot (95), the present study indicated that Airborne students who were either shorter or taller were at elevated risk of injury compared with those in the more “central” height distributions

Figure 1. Association of Height with Jump Week Injuries (Men)



(chi-square $p=0.02$). Parachute harnesses are designed in small, medium, and large sizes to accommodate individuals of differing heights. These sizing differences may not be adequate for those at the extremes of the height distribution. For shorter individuals, the bulk of equipment may interfere with movement to a greater extent than for others in the central height distribution. Shorter students may also have more difficulty reaching up on the risers to reduce lateral drift (and reduce ground impact forces) on landing.

(8) Gender. Amoroso et al. (2) showed that parachute-related injury rates declined over the period 1985 to 1994, but rates for women declined much faster than rates for men. A secondary analysis of their data (Figure 1 in their report (2)) suggested that in 1985 the gender-specific risk ratio (women/men) was 2.6 and this had declined to 1.6 by 1994. If women's injury rates have continued to decline faster than men's, this could account for the smaller difference in men's and women's jump week injuries in the present study. The reasons for the more rapid decline in female injury rates are not clear but may have to do with improved fitness levels of women over the years (54, 71). Improved fitness could result in strengthening of bone, muscle and connective tissue (7, 26, 49, 75, 80, 86). It is also possible that more attention to female anatomy has brought about more gender-specific military equipment (32, 82, 119).

f. Comments on the PAB.

(1) Airborne students who did not wear the PAB had more negative comments than those who did wear the brace. This suggests that once a service member has a chance to experience the brace during parachute operations, he or she may have a more favorable impression of it. Students who did not wear the brace viewed it just prior to the survey; it is likely they also heard of the PAB from the cadre and others in the Airborne school.

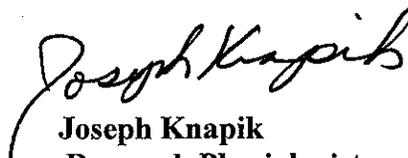
(2) Most of the negative PAB comments from individuals who wore the brace related to the heel strap (the strap that goes under the heel of the boot) and the fact that the brace did not seem to hold well on the boot or "fit" the boot properly. A previous investigation of PAB breakages (56) found that the majority of breakages occurred in the heel strap of the PAB and that this was most likely caused by recent changes to the military boot. The heel strap was originally designed for the older black combat boot, which had a heel. The heel strap fit in front of the heel where it was protected from abrasion on the ground and where it could seat against the anterior part of the heel and prevent the brace from slipping backward. The newer desert boot had a minimal heel area and when the PAB was placed on this boot the heel strap could move backward (posterior), slipping over the curved part of the heel. When the strap slipped down the heel the student would step directly on the strap and it would be abraded on the ground. The backward slippage of the heel strap also caused the body of the PAB to move backwards and this could interfere with walking. An improvement of the PAB to better keep the PAB on the new boot and avoid strap abrasion has been proposed and is in production (56). This change adds a strap over the dorsum of the foot to prevent slippage.

(3) Another category of comments had to do with comfort, and most of the negative comments in this category had to do with the PAB rubbing on the legs, shin, ankle, or calf. The PAB is well padded with closed cell foam on the lateral and medial sides and this would

be expected to reduce discomfort. However, when the heel strap slipped back over the heel, the brace was out of place and exposed surfaces (those not padded) may have rubbed on the leg. In addition, some students may have been pulling the ankle straps too tight, resulting in chaffing and constriction in the lower leg. Better instruction and guidance on appropriate tightness for the ankle straps may reduce some of these complaints.

(4) Negative comments regarding PLFs had to do with difficulty in keeping the feet and knees together when wearing the PAB. The PAB does add bulk to the ankles (about 1 cm on each ankle) and thus the ankles cannot be as close together during a PLF as they would be if the PAB were not worn. Further, the plastic is slippery and this may make it difficult to hold the feet together. Of the 54 individuals with negative comments relating to PLFs, two reported an injury (3.7%) and this did not differ (chi-square $p=0.99$) from the reported injuries in the remainder of the group (3.9%). Also, as noted above, other studies have reported that the PAB reduces ankle injuries without increasing the incidence of other injuries (3, 60, 110). Like all new technologies, some adaptation and accommodations are required for the PAB.

8. CONCLUSIONS. Among male students attending the USAAS, risk factors for injuries in the past year included service branch, Airborne recycling, less physical activity, older age, more body weight, higher BMI, and (among Army men) slower 2-mile run time. Risk factors for jump week injuries included higher rank, longer time in service, older age, Airborne recycling, greater height, more body weight, not wearing a PAB, aircraft exit problems, an injury in the past year, and (among Army men) fewer push-ups and slower 2-mile run time. Students who had worn the brace had more favorable attitudes toward it than those who had not worn the PAB. Most negative PAB comments were related to the heel strap and an improvement has been proposed and is in production. Another negative comment had to do with the PAB rubbing on the legs, shin, ankle, and calf. This might be alleviated by improvements in the heel strap and/or better guidance on appropriate tightness for the ankle straps. Students complained of difficulty in keeping the feet and knees together when wearing the PAB and some adaptation and accommodations appear to be required in this area.



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APPENDIX A
References

1. American College of Sports Medicine (1998). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Medicine and Science in Sports and Exercise*. 30: 975–991.
2. Amoroso PJ, Bell NS, and Jones BH (1997). Injury among female and male parachutists. *Aviation, Space and Environmental Medicine*. 68: 1006–1011.
3. Amoroso PJ, Ryan JB, Bickley B, Leitschuh P, Taylor DC, and Jones BH (1998). Braced for impact: reducing paratrooper’s ankle sprains using outside-the-boot braces. *Journal of Trauma*. 45: 575–580.
4. Army Regulation 40-5 (2005). Preventive Medicine. Washington DC: Headquarters, Department of the Army.
5. Army Field Manual 21-20 (1980). Physical Readiness Training. Washington DC: Headquarters, Department of the Army.
6. Army Field Manual 21-20 (1973). Physical Readiness Training. Washington DC: Headquarters, Department of the Army.
7. Atha J (1981). Strengthening muscle. In: *Exercise and Sports Science Reviews*. DI Miller (Ed.) Philadelphia: Franklin Institute Press.
8. Bar-Dayam Y, Shemer J, and Bar-Dayam Y (1998). Parachute injuries: a retrospective study of 43,542 military jumps. *Military Medicine*. 163: 1–2.
9. Barowclough F (1981). The process of aging. *Journal of Advanced Nursing*. 6: 319–325.
10. Bennell KL, and Crossley K (1996). Musculoskeletal injuries in track and field: incidence, distribution and risk factors. *Australian Journal of Science and Medicine in Sport*. 28: 69–75.
11. Bricknell MCM, and Craig SC (1999). Military parachute injuries: a literature review. *Occupational Medicine*. 49: 17–26.
12. Candau R, Belli A, Millet GY, George D, Barbier B, and Rouillon JD (1998). Energy cost and running mechanics during a treadmill run to voluntary exhaustion in humans. *European Journal of Applied Physiology*. 77: 479–485.
13. Ciccone R, and Richman RM (1948). The mechanism of injury and the distribution of three thousand fractures and dislocations caused by parachute jumping. *Journal of Bone and Joint Surgery*. 30A: 77–97.
14. Colbert LH, Hootman JM, and Macera CA (2000). Physical activity-related injuries in walkers and runners in the Aerobics Center Longitudinal Study. *Clinical Journal of Sport Medicine*. 10: 259–263.

15. Craig SC, and Lee T (2000). Attention to detail: injuries at altitude among U.S. Army military static line parachutists. *Military Medicine*. 165: 268–271.
16. Craig SC, and Morgan J (1997). Parachuting injury surveillance, Fort Bragg, North Carolina, May 1993 to December 1994. *Military Medicine*. 162: 162–164.
17. Cureton KJ, and Sparling PB (1980). Distance running performance and metabolic responses to running in men and women with excess weight experimentally equated. *Medicine and Science in Sports*. 12: 288–294.
18. Cureton KJ, Sparling PB, Evans W, Johnson SM, Kong UD, and Purvis JW (1978). Effects of experimental alterations in excess weight on aerobic capacity and distance running performance. *Medicine and Science in Sports*. 10: 194–199.
19. Darakjy S, Hauret KG, Canada SE, Knapik JJ, Wells J, Hoedebecke EL, Kenyon M, Marin RE, and Bullock SH (2003). Injuries and injury risk factors among armor battalion soldiers at Ft Riley, Kansas. *Medicine and Science in Sports and Exercise*. 35: S278.
20. Davis WR (1964). Parachute injuries: their prevention. *Military Medicine*. 129: 1071–1076.
21. Davison D (1990). A review of parachuting injuries. *Injury*. 21: 314–316.
22. Engkvist IL, Hjelm EW, Hagberg M, Menckel E, and Ekenvall L (2000). Risk indicators for reported over-exertion back injuries among female nursing personnel. *Epidemiology*. 11: 519–522.
23. Essex-Lopresti P (1946). The hazards of parachuting. *British Journal of Surgery*. 133: 1–13.
24. Farrow GB (1992). Military static line parachute injuries. *Australian and New Zealand Journal of Surgery*. 62: 209–214.
25. Flanagan EM (2002). *Airborne. A Combat History of American Airborne Forces*. New York: Ballantine Books.
26. Fleck SJ, and Kraemer WJ (1987). *Designing Resistance Training Programs*. Champaign IL: Human Kinetic Publishers.
27. Forde MS, Punnett L, and Wegman DH (2005). Prevalence of musculoskeletal symptoms in union ironworkers. *Journal of Occupational and Environmental Hygiene*. 2: 203–212.
28. Garcin M, Vautier JF, Vandewalle H, and Monod H (1988). Rating of perceived exertion (RPE) as an index of aerobic endurance during local and general exercise. *Ergonomics*. 41: 105–114.
29. Gardner LI, Dziados JE, Jones BH, Brundage JF, Harris JM, Sullivan R, and Gill P (1988). Prevention of lower extremity stress fractures: a controlled trial of a shock absorbent insole. *American Journal of Public Health*. 78: 1563–1567.

30. Hadley AT, and Hibst JD (1984). Reduction of military high-altitude parachute entanglements using the controlled alternating parachute exit system. *Aviation, Space and Environmental Medicine*. 55: 65–68.
31. Hallel T, and Naggan L (1975). Parachute injuries: a retrospective study of 83,718 jumps. *Journal of Trauma*. 15: 14–19.
32. Harper W, Knapik JJ, and Pontbriand Rd (1997) An investigation of female load carriage capability. Technical Report No. ARL-TR-1176, Aberdeen Proving Ground, MD: U.S. Army Research Laboratory.
33. Hauret KG, Darakjy S, Canada S, and Knapik JJ (2003). Injury incidence and risk factors for male military police (Army). *Medicine and Science in Sports and Exercise*. 35: S279.
34. Heir T, and Eide G (1997). Injury proneness in infantry conscripts undergoing a physical training programme: smokeless tobacco use, higher age, and low levels of physical fitness are risk factors. *Scandinavian Journal of Medicine and Science in Sports*. 7: 304–311.
35. Henderson NE, Knapik JJ, Shaffer SW, McKenzie TH, and Schneider GM (2000). Injuries and injury risk factors among men and women in US Army combat medic advanced individual training. *Military Medicine*. 165: 647–652.
36. Hickson RC, Foster C, Pollock ML, Galassi TM, and Rich S (1986). Reduced training intensities and loss of aerobic power, endurance, and cardiac growth. *Journal of Applied Physiology*. 58: 492–499.
37. Holloszy JO (1973). Biochemical adaptations to exercise: aerobic metabolism. In: *Exercise and Sports Science Reviews*. JH Wilmore (Ed.) New York: Academic Press, pp. 45–71.
38. Hootman JM, Macera CA, Ainsworth BA, Martin M, and Blair SN (2002). Predictors of lower extremity injury among recreationally active adults. *Clinical Journal of Sport Medicine*. 12: 99–106.
39. Hosmer DW, and Lemeshow S (1989). *Applied Logistic Regression*. New York: John Wiley & Sons.
40. Johnson RB, Howard ME, Cawley PW, and Losse GM (1998). Effect of lower extremity muscular fatigue on motor control performance. *Medicine and Science in Sports and Exercise*. 30: 1703–1707.
41. Jones AM, and Carter H (2000). The effect of endurance training on parameters of aerobic fitness. *Sports Medicine*. 29: 373–386.
42. Jones BH, Bovee MW, Harris JM, and Cowan DN (1993). Intrinsic risk factors for exercise-related injuries among male and female Army trainees. *American Journal of Sports Medicine*. 21: 705–710.
43. Jones BH, Bovee MW, and Knapik JJ (1992). Associations among body composition, physical fitness, and injuries in men and women Army trainees. In: *Body Composition*

and Physical Performance. BM Marriott, and J Grumstrup-Scott (Eds.) Washington, D.C.: National Academy Press, pp. 141–173.

44. Jones BH, Cowan DN, Tomlinson JP, Robinson JR, Polly DW, and Frykman PN (1993). Epidemiology of injuries associated with physical training among young men in the Army. *Medicine and Science in Sports and Exercise*. 25: 197–203.
45. Jones SB, Knapik JJ, Sharp M, Darakjy S, and Jones BH (2007). Validity of self-reported physical fitness test scores. *Military Medicine*. 172: 115–120.
46. Katch FI (1973). Optimal duration of endurance performance on the cycle ergometer in relation to maximal oxygen intake. *Ergonomics*. 16: 227–235.
47. Kiel FW (1965). Hazards of military parachuting. *Military Medicine*. 130: 512–521.
48. Kirby N (1974). Parachuting injuries. *Proceedings of the Royal Society of Medicine*. 67: 17–21.
49. Kjaer M (2004). Role of extracellular matrix in adaptation of tendon and skeletal muscle to mechanical loading. *Physiological Reviews*. 84: 649–698.
50. Knapik J, Banderet L, Bahrke M, O'Connor J, Jones B, and Vogel J (1994). Army Physical Fitness Test (APFT): normative data on 6022 soldiers. Technical Report No. T94-7, Natick, MA: U.S. Army Research Institute of Environmental Medicine.
51. Knapik JJ, Ang P, Reynolds K, and Jones B (1993). Physical fitness, age and injury incidence in infantry soldiers. *Journal of Occupational Medicine*. 35: 598–603.
52. Knapik JJ, Bullock SH, Canada S, Toney E, Wells JD, Hoedebecke E, Hauret KG, Rieger W, Palkoska F, VanCamp S, McMillian D, Edwards D, and Billet M (2003). The Aberdeen Proving Ground Injury Control Project: Influence of a multiple intervention program on injuries and fitness among Ordnance School students in Advanced Individual Training. Technical Report No. 12-HF-7990-03, Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine.
53. Knapik JJ, Burse RL, and Vogel JA (1983). Height, weight, percent body fat and indices of adiposity for young men and women entering the U.S. Army. *Aviation, Space and Environmental Medicine*. 54: 223–231.
54. Knapik JJ, Craig SC, Hauret KG, and Jones BH (2003). Risk factors for injuries during military parachuting. *Aviation, Space and Environmental Medicine*. 74: 768–774.
55. Knapik JJ, Cuthie J, Canham M, Hewitson W, Laurin MJ, Nee MA, Hoedebecke E, Hauret K, Carroll D, and Jones BH (1998). Injury incidence, injury risk factors, and physical fitness of U.S. Army basic trainees at Ft Jackson SC, 1997. Technical Report No. 29-HE-7513-98, Aberdeen Proving Ground, MD: U.S. Army Center for Health Promotion and Preventive Medicine.
56. Knapik JJ, Darakjy S, Grier T, Spiess A, Manning F, Livingstone E, Amoroso P, and Jones BH (2008) A survey of parachute ankle brace breakages. Technical Report No. 12-MA01Q2A-08, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.

57. Knapik JJ, Darakjy S, Hauret KG, Canada S, Scott S, Rieger W, Marin R, and Jones BH (2006). Increasing the physical fitness of low fit recruits prior to Basic Combat Training: an evaluation of fitness, injuries and training outcomes. *Military Medicine*. 171: 45–54.
58. Knapik JJ, Darakjy S, Jones SB, Marin RE, Hoedebecke EL, Mitchener TA, Rivera Y, Sharp MA, Grier T, Brown J, and Jones BH (2007). Injuries and physical fitness before and after a deployment by the 10th Mountain Division to Afghanistan for Operation Enduring Freedom. Technical Report No. 12-MA-05SD-07, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
59. Knapik JJ, Darakjy S, Marin R, Hoedebecke EL, Mitchener TA, Sharp MA, Rivera Y, Grier T, Brown J, and Jones BH (2007). Injuries and physical fitness before and after an Afghanistan deployment of the 10th Mountain Division. Technical Report No. 12-MA-05SD-07, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
60. Knapik JJ, Darakjy S, Swedler D, Manning F, Hauret KG, Amoroso P, and Jones BH (2007). The parachute ankle brace: entanglements and injuries after controlling for extrinsic risk factors. Technical Report No. 12-MA01Q2-07, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
61. Knapik JJ, Hauret KG, and Jones BH (2006). Primary Prevention of Injuries in Initial Entry Training. In: *Textbook of Military Medicine. Recruit Medicine*. MK Lenhart, DE Lounsbury, and RB North (Eds.) Washington DC: Borden Institute.
62. Knapik JJ, Jones BH, Vogel JA, Banderet LE, Bahrke MS, and O'Connor JS (1996). Influence of age and body mass index on measures of physical fitness in U.S. Army Soldiers. *Journal of Aging and Physical Activity*. 4: 234–250.
63. Knapik JJ, Jones SB, Darakjy S, Hauret K, Bullock SH, Sharp MA, and Jones BH (2007). Injury rates and injury risk factors among United States Army Wheel Vehicle Mechanics. *Military Medicine*. 172: 988–996.
64. Knapik JJ, Jones SB, Darakjy S, Hauret KG, Bullock S, Canada S, Morrison S, Hoedebecke E, Sharp MA, Burrell L, and Jones BH (2006). Injuries among Army wheel vehicle mechanics. Technical Report No. 12-MA-7193A-06, Aberdeen Proving Ground MD: Army Center for Health Promotion and Preventive Medicine.
65. Knapik JJ, Jones SB, Darakjy S, Hauret KG, Nevin R, Grier T, and Jones BH (2007). Injuries and injury risk factors among members of the United States Army Band. *American Journal of Industrial Medicine*. 50: 951–961.
66. Knapik JJ, Jones SB, Ohlin DW, Canham-Chervak M, Darakjy SS, Goddard DE, Hauret KG, Hadley JA, Twombly G, Harkins DK, Bullock SH, Drum J, Canada SE, Mitchner TA, Nevin RL, and Jones BH (2006). Injuries and injury prevention in the US Army Band. Technical Report No. 12-MA-01Q2A, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
67. Knapik JJ, Jones SB, Sharp MA, Darakjy S, Hauret KG, Burrell L, Goddard D, Nevin R, and Jones BH (2006). A prospective study of injuries and injury risk factors among

- United States Army wheel vehicle mechanics. Technical Report No. 2-MA-7193B-06, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
68. Knapik JJ, R. McCollam, Canham-Chervak M, Arnold S, Hoedebecke EL, and DuVernoy TS (2000). A second investigation of injuries among officers attending the US Army War College, Academic Year 2000. Technical Report No. 29-HE-2682-00, Aberdeen Proving Ground, MD: US Army Center for Health Promotion and Preventive Medicine.
 69. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF, and Jones BH (2001). Risk factors for training-related injuries among men and women in Basic Combat Training. *Medicine and Science in Sports and Exercise*. 33: 946–954.
 70. Knapik JJ, Sharp MA, Canham ML, Hauret K, Cuthie J, Hewitson W, Hoedebecke E, Laurin MJ, Polyak C, Carroll D, and Jones B (1999). Injury incidence and injury risk factors among US Army Basic Trainees at Ft Jackson, SC (including fitness training unit personnel, discharges, and newstarts). Technical Report No. 29-HE-8370-99, Aberdeen Proving Ground MD: US Army Center for Health Promotion and Preventive Medicine.
 71. Knapik JJ, Sharp MA, Darakjy S, Jones SB, Hauret KG, and Jones BH (2006). Temporal changes in the physical fitness of United States Army recruits. *Sports Medicine*. 36: 613–634.
 72. Knapik JJ, Staab J, Bahrke M, O'Connor J, Sharp M, Frykman P, Mello R, Reynolds K, and Vogel J (1990). Relationship of soldier load carriage to physiological factors, military experience and mood states. Technical Report No. T17-90, Natick, MA: United States Army Research Institute of Environmental Medicine.
 73. Knapik JJ, Wright J, Kowal D, and Vogel JA (1980). The influence of U.S. Army Basic Initial Entry Training on the muscular strength of men and women. *Aviation Space and Environmental Medicine*. 51: 1086–1090.
 74. Knowles SB, Marshall SW, Bowling JM, Loomis D, Millikan R, Yang J, Weaver NL, Kalsbeek W, and Miller FO (2006). A prospective study of injury incidence among North Carolina high school athletes. *American Journal of Epidemiology*. 29: 1209–1221.
 75. Kohrt M, Bloomfield SA, Little KD, Nelson ME, and Yingling VR (2004). Physical activity and bone health. Position stand of the American College of Sports Medicine. *Medicine and Science in Sports and Exercise*. 36: 1985–1996.
 76. Kragh JF, Amoroso PJ, Jones BH, and Heekin RD (1996). Parachuting injuries among Army rangers: a prospective survey of an elite airborne battalion. *Military Medicine*. 161: 416–419.
 77. Kubukeli ZN, Noakes TD, and Dennis SC (2002). Training techniques to improve endurance exercise performance. *Sports Medicine*. 32: 489–509.
 78. Landen DD, and Hendricks S (1995). Effect of recall on reporting of at-work injuries. *Public Health Reports*. 110: 350–354.

79. Laubach LL (1976). Comparative muscular strength of men and women: a review of the literature. *Aviation, Space and Environmental Medicine*. 47: 534–542.
80. Layne JE, and Nelson ME (1999). The effects of progressive resistance training on bone density: a review. *Medicine and Science in Sports and Exercise*. 31: 25–30.
81. Lillywhite LP (1991). Analysis of extrinsic factors associated with 379 injuries occurring during 34,236 military parachute descents. *Journal of the Royal Army Medical Corps*. 137: 115–121.
82. Ling W, V. Houston V, Tasi YS, Chui K, and Kirk J (2004). Women's load carriage performance using modular lightweight load-carrying equipment. *Military Medicine*. 169: 914–919.
83. Lowden IMR, and Wetherill MH (1989). Parachute injuries during training descents. *Injury*. 20: 257–264.
84. Macera CA, Jackson KL, Hagenmaier GW, Kronenfeld JJ, Kohl HW, and Blair SN (1989). Age, physical activity, physical fitness, body composition and incidence of orthopaedic problems. *Research Quarterly*. 60: 225–233.
85. Macera CA, Pate RR, Powell KE, Jackson KL, Kendrick JS, and Craven TE (1989). Predicting lower-extremity injuries among habitual runners. *Archives of Internal Medicine*. 49: 2565–2568.
86. Maffulli N, and King JB (1992). The effects of physical activity on some components of the skeletal system. *Sports Medicine*. 13: 393–407.
87. Mair SD, Seaber AV, Glisson RR, and Garrett WE (1996). The role of fatigue in susceptibility to acute muscle strain injury. *American Journal of Sports Medicine*. 24: 137–143.
88. Marti B, Vader JP, Minder CE, and Abelin T (1988). On the epidemiology of running injuries. The 1984 Bern Grand-Prix study. *American Journal of Sports Medicine*. 16: 285–294.
89. Massey JT, and Gonzalez JF (1976). Optimal recall period for estimating accidental injuries in the National Health Interview Survey. *Proceedings of the American Statistical Association*. 18: 584–588.
90. Maxwell BD (2005). Army Profile. Washington DC: Headquarters Department of the Army, Army G-1.
91. Nabeel I, Baker BA, McGrail MP, and Flottemesch TJ (2007). Correlation between physical activity, fitness, and musculoskeletal injuries in police officers. *Minnesota Medicine*. 90: 40–43.
92. Neel SH (1951). Medical aspects of military parachuting. *The Military Surgeon*. 108: 91–105.
93. Orchard JW (2001). Intrinsic and extrinsic risk factors for muscle strains in Australian football. *American Journal of Sports Medicine*. 29: 300–303.

94. US Army Field Manual (FM) 21-20 (1992). Physical Fitness Training. Washington, D.C.: Headquarters, Department of the Army.
95. Pirson J, and Pirlot M (1990). A study of the influence of body weight and height on military parachute landing injuries. *Military Medicine*. 155: 383–385.
96. Pirson J, and Verbiest E (1985). A study of some factors influencing parachute landing injuries. *Aviation, Space and Environmental Medicine*. 56: 564–567.
97. Pozner H (1946). Parachutists. *Journal of the Royal Army Medical Corps*. 86: 208–217.
98. Ratzlaff CR, Gillies JH, and Koehoorn MW (2007). Work-related repetitive strain injury and leisure-time physical activity. *Arthritis and Rheumatism*. 57: 495–500.
99. Rauh MJ, Koepsell TD, Rivara FP, Margherita AJ, and Rice SG (2006). Epidemiology of musculoskeletal injuries among high school cross-country runners. *American Journal of Epidemiology*. 163: 151–159.
100. Rauh MJ, Macera CA, Trone DW, Shaffer RA, and Brodine SK (2006). Epidemiology of stress fractures and lower extremity overuse injuries in female recruits. *Medicine and Science in Sports and Exercise*. 38: 1571–1577.
101. Reynolds K, Creedon J, Gregg R, and Zigmont T (2002). Injury occurrence and risk factors in construction engineers and combat artillery soldiers. *Military Medicine*. 167: 971–977.
102. Reynolds K, Knapik J, Hoyt R, Mayo M, Bremmer J, and Jones B (1994). Association of training injuries and physical fitness in U.S. Army combat engineers. *Medicine and Science in Sports and Exercise*. 26: S219.
103. Reynolds KL, Heckel HA, Witt CE, Martin JW, Pollard JA, Knapik JJ, and Jones BH (1994). Cigarette smoking, physical fitness, and injuries in infantry soldiers. *American Journal of Preventive Medicine*. 10: 145–150.
104. Roche AF, Siervogel RM, Chumlea WM, and Webb P (1981). Grading body fatness from limited anthropometric data. *American Journal of Clinical Nutrition*. 34: 2831–2838.
105. Roche CA (1960). Of men, medicine and military parachuting. *Military Medicine*. 125: 512–521.
106. Sackett PR, Armor DJ, Clark NM, Eitelberg MJ, Hansen BC, Hogan PF, Marras MS, Marshall SW, Pate RR, Rapmund G, Schwenk TL, Strickland WJ, Thomas SB, Wagner KD, A SM, and Keenan WE (2006). *Assessing Fitness for Military Enlistment*. Washington DC: National Academy Press.
107. Schmidt MD, Sulski SI, and Amoroso PJ (2004). Effectiveness of an external ankle brace in reducing parachute-related ankle injuries. *Medicine and Science in Sports and Exercise*. 36: S312.
108. Schmidt MD, Sulsky SI, and Amoroso PJ (2005). Effectiveness of an external ankle brace in reducing parachute-related ankle injuries. *Injury Prevention*. 11: 163–168.

109. Schneider GA, Bigelow C, and Amoroso PJ (2000). Evaluating risk of re-injury among 1,214 Army Airborne soldiers using a stratified survival model. *American Journal of Preventive Medicine*. 18(Suppl3): 156–163.
110. Schumacher JT, Creedon JF, and Pope RW (2000). The effectiveness of the parachute ankle brace in reducing ankle injuries in an airborne ranger battalion. *Military Medicine*. 165: 944–948.
111. Shaffer RA, Brodine SK, Almeida SA, Williams KM, and Ronaghy S (1999). Use of simple measures of physical activity to predict stress fractures in young men undergoing a rigorous physical training program. *American Journal of Epidemiology*. 149: 236–242.
112. Smith TA, and Cashman TM (2002). The incidence of injury in light infantry soldiers. *Military Medicine*. 167: 104–108.
113. Spaine LA, and Bollen SR (1996). “The bigger they come.” The relationship between body mass index and severity of ankle fractures. *Injury*. 27: 687–689.
114. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, and Zumbo BD (2003). A prospective study of running injuries: the Vancouver Sun Run “In Training” clinics. *British Journal of Sports Medicine*. 37: 239–244.
115. Thang LC (1995). Parachute injuries in a parachuting regiment of the Malaysian Armed Forces. *Journal of Occupational Medicine (Singapore)*. 7: 28–35.
116. Thomae MK, Porteous JE, Brock JR, Allen GD, and Heller RF (1998). Back pain in Australian military helicopter pilots: a preliminary study. *Aviation, Space and Environmental Medicine*. 59: 468–473.
117. Thomas NI, Brown ND, Hodges LC, Gandy J, Lawson L, Lord JE, and Williams DK (2006). Risk profiles of work-related injury among hospital employees. *AAOHN Journal*. 54: 61–68.
118. Tomlinson JP, Lednar WM, and Jackson JD (1987). Risk of injury in soldiers. *Military Medicine*. 152: 60–64.
119. US Army Medical Research and Development Command (1999). Health and performance research for military women: the 1994 Defense Woman’s Health Research Program. Technical Report No. 9, Ft Deterick MD: US Army Medical Research and Material Command.
120. VanMechelen W, Twist J, Molendijk A, Blom B, Snel J, and Kemper HCG (1996). Subject-related risk factors for sports injuries: a 1-yr prospective study in young adults. *Medicine and Science in Sports and Exercise*. 28: 1171–1179.
121. Volklander DC, Saunders LD, and Quinney HA (1998). Personal risk factors for injury in recreational and old-timer ice hockey. *Sports Medicine Training and Rehabilitation*. 8: 239–250.
122. Walters SD, Hart LE, McIntosh JM, and Sutton JR (1989). The Ontario cohort study of running-related injuries. *Archives of Internal Medicine*. 149: 2561–2564.

123. Warner M, Schenker N, Heinen MA, and Fingerhut LA (2005). The effect of recall on reporting injury and poisoning episodes in the National Health Interview Survey. *Injury Prevention*. 11: 282–287.
124. Wenger HA, and Bell GJ (1986). The interaction of intensity, frequency and duration of exercise training in altering cardiorespiratory fitness. *Sports Medicine*. 3: 346–356.
125. Werner RA, Franzblau A, Gell N, Ulin SS, and Armstrong TJ (2005). A longitudinal study of industrial and clerical workers: predictors of upper extremity tendonitis. *Journal of Occupational Rehabilitation*. 15: 37–46.
126. Westphal KA, Friedl KE, Sharp MA, King N, Kramer TR, Reynolds KL, and Marchitelli LJ (1995) Health, performance and nutritional status of U.S. Army women during basic combat training. Technical Report No. T96-2, Natick, MA: U.S. Army Research Institute of Environmental Medicine.
127. Zwerling C, Sprince NL, Wallace RB, Davis CS, Whitten PS, and Heringa SG (1995). Effect of recall period on the reporting of occupational injuries among older workers in the Health and Retirement Study. *American Journal of Industrial Medicine*. 28: 583–590.

APPENDIX B
MTTF/DSOC Initiatives on the Parachute Ankle Brace

From: Patton, James T Mr ASA-IE [<mailto:James.Patton@hqda.army.mil>]
Sent: Monday, May 16, 2005 9:09 AM
To: Angello Joseph J.CIV OSD-P&R; Aslinger, Jerry A. CTR OSD-P&R; Reinhard,Daniel E. CTR OSD-P&R
Cc: Gunlicks, James B Mr. HQDA DCS G-3/5/7; Jones, Bruce H Dr USACHPPM; Curry, Daniel R CW5 HQDA DCS G-3/5/7; Timms, Charles MSG (OCAR-OPS); Back, Joe T COL HQDA DCS G-3/5/7; Romero, Anain J Ms OASA (I&E); Fatz, Raymond J Mr ASA-I&E
Subject: Airborne Ankle Brace Update

Mr. Angello – attached is the Military Training Task Force update on the airborne ankle brace project. Please let us know if any additional information is needed.

Thanks, Jim
James T. Patton
Assistant for Safety
SAIE-ESOH
Room 3D453
110 Army Pentagon
Washington, DC 20310-0110
703/697-3123 (voice), 703/614-5822 (fax)

10 May, 2005

DEFENSE SAFETY OVERSIGHT COUNCIL MILITARY TRAINING TASK FORCE,
WASHINGTON, DC 20301

SUBJECT: Update on Parachute Ankle Braces Airborne Training Injury Prevention

1. Implementation for use of the parachute ankle brace (PAB) at the Army Airborne School is progressing well. After a couple of early delays in the schedule due to a prolonged acquisition process, the project is back on track. Delivery the first shipment of braces occurred May 10th and distribution at the School is now scheduled for mid-May. Progress milestones for Phase I of the PAB project at the Airborne School, Ft. Benning, GA since January 2005 include:

Phase I: Evaluation of PAB at Airborne School

- An onsite PAB evaluation coordinator (Mr. Fred Manning) was funded and hired at Ft. Benning in February, 2005

- Army Natick Soldier Center (ANSC) received funds of \$130K to purchase 2,000 pairs of braces in mid-February.
 - In late February, a request for bids to produce braces meeting ANSC specifications was written and opened for bids.
 - Aircast Corporation was awarded the contract on the 25th March 2005.
 - First delivery of braces was made to Ft Benning, GA 10 May 2005.
 - The Army Research Institute of Environmental Medicine (ARIEM) received partial funds to initiate ankle brace evaluation in mid-February.
 - ARIEM (COL Amoroso) has initiated the process for acquisition of Airborne School personnel data/student rosters, medical and safety data for ankle brace evaluation.
 - ARIEM and the Army Center for Health Promotion and Preventive Medicine (CHPPM) had conducted several teleconferences to coordinate activities with the Infantry Training Center QA Office (Ms Livingston) and the onsite PAB coordinator.
 - An Airborne School questionnaire has been developed to assess risk factors for jump-related injuries and injury outcomes at the end of each airborne class.
 - The questionnaire development involved ARIEM, CHPPM, USUHS and the Infantry School QA Office (Attachment file.).
 - Infantry Training Center will deliver the questionnaire/survey to establish baseline injury risk factors, injuries and near misses and to follow rates post-PAB implementation.
 - Baseline data will be collected until all airborne classes wear the PAB.
 - Evaluation/comparison of PAB and Non-PAB use will begin with distribution of braces at the Airborne School in May/June 2005.
 - Evaluation will be for 6 to 9 months post PAB distribution.
 - Briefings of results will be provided to the Airborne School, Infantry Training Center, and Defense Safety Oversight Council (DSOC) at the completion of the evaluation period and a written report will be produced for the DSOC.
2. Ground work for initiation of Phase II of PAB implementation in operational units at Ft. Bragg continues simultaneously with the above efforts at Ft. Benning. Milestones for Phase II include:

Phase II: Evaluation of PAB in Operational Units

- FORSCOM HQ and Ft Bragg Operational Airborne Unit briefings.
- PAB purchase, distribution and evaluation for operational units at Ft Bragg will follow a plan and timeline following brace acquisition similar to the Airborne School above.
- Evaluation of the PAB will continue for 6 to 9 months post PAB distribution to units at Ft Bragg.
- ANSC will produce an updated PAB requirements document 6–12 months post evaluation.
- Results from operational units at Ft. Bragg will be briefed to 18th Airborne Corps and 82nd Airborne Division unit Commanders following completion of Phase II evaluation there.

3. Following the conclusion of Phase II at Ft Bragg briefings will be given to the Military Training Task Force and Defense Safety Oversight Council (DSOC) and a final report with conclusions and recommendations regarding PAB implementation will be prepared and delivered to the DSOC.

Jim Gunlicks
Chairman, DSOC MTF



OFFICE OF THE SECRETARY OF DEFENSE

WASHINGTON, DC 20301

April 15, 2005

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY
(ENVIRONMENT, SAFETY AND OCCUPATIONAL HEALTH)
AVIATION SAFETY IMPROVEMENTS TASK FORCE CHAIR
MILITARY TRAINING TASK FORCE CHAIR
WORKERS' COMPENSATION TASK FORCE CHAIR

SUBJECT: Defense Safety Oversight Council (DSOC) Follow-up Actions

As discussed in our April 6, 2005 Integration Group meeting, we need to provide a status to the DSOC Chair on the four high priority projects directed in PBD 705. These include the efforts on Return to Work, Military Flight Operations Quality Assurance (MFOQA), Voluntary Protection Program (VPP), and Paratrooper Ankle Braces.

I ask that you submit a brief memorandum on your initiatives to me that includes a description of the process to implement the initiative, the steps taken to date, and future actions. Please also include a financial summary with the status of funds expended to date.

If you have questions or desire additional information, please contact Mr. Jerry Aslinger at 703-604-0838, or by email at Jerry.Aslinger.ctr@osd.mil.


Joseph J. Angello, Jr.
Executive Secretary
Defense Safety Oversight Council

cc: DSOC Integration Group Members
DSOC Task Force Chairs





MTTF Project 13

AIRBORNE TRAINING INJURY PREVENTION

Action Complete

Objective Description: Ankle injuries account for 30 to 60% of all parachuting injuries. Army Airborne trainees who trained during periods when the Parachute Ankle Braces (PABs) were not in use were twice as likely to sustain an ankle injury requiring hospitalization compared to paratroopers who trained while the PABs were in use. Reintroduce PABs in order to reduce frequency and severity of lower extremity injuries during basic airborne school training.

Performance Measure: Reduction in lost training time, clinic visits, hospitalizations, and non-graduation rates due to ankle and lower extremity injuries caused primarily from parachute landing falls during Basic Airborne Training. No increase in other injuries. Injury reduction begins immediately with use of braces. USARIEM has already established metrics for evaluation/assessment.

Return on Investment: Estimated savings of \$3.3 million in medical care costs annually due to 50% reduction in serious ankle injuries among trainees and estimated 75-80% reduction in mild ankle injuries; greater efficiency in training cycle; improved readiness.

Lead: MTTF/USARIEM

Action	Target Date	Actual Date	Lead
Develop Plan	Jul 2004	Nov 2004	MTTF
Manufacture, purchase, and delivery of PAB	Oct 2004		MTTF
Obtain Funding	Oct 2004	Dec 2004*	DSOC
Begin evaluation of ankle brace at Airborne School	Nov 2004	Pending Acquisition	MTTF
Evaluate brace in operational units	Pending Funds	Pending Funds	ARIEM
Upon success, field to all airborne units	Pending Funds		MTTF

Objective Assessment: GREEN

Current Status: GREEN

Pending coordination and purchase of braces.

Baseline data collection has been initiated. The Army Airborne School is prepared to launch the re-implementation phase as soon acquisition of braces has been completed.

Implementation in operational units awaits initiation at Airborne School and further coordination.

Key Actions

- Coordinate and plan implementation of brace at AB school
- Purchase braces and begin intervention at Airborne School
- Coordinate evaluation, purchase & implement PAB in operational units
- Conduct evaluation and analyses (USARIEM TAIHOD)
- If successful, procure 20,000 pair of braces (6-8 weeks to manufacture) and field to all Airborne units

Inhibitors

- Airborne community cultural resistance to change
- Cost of the Parachute Ankle braces (\$60/pair)

Resource Requirements

- \$300K evaluation and analysis of AB School & operational units (2005)
- \$1.2M to outfit school & operational units with braces (2005)
- \$600K/year out-years cost for brace replacements

*Potential PBD 705 Funding

Updated: February 2005

APPENDIX C.
Airborne Student's Questionnaire
Fort Benning, GA

*This questionnaire is anonymous. You will be asked about yourself, your lifestyle, and previous injuries.
Please answer each question to the best of your ability.*

DEMOGRAPHICS

1. Rank _____ 2. Male ___ Female ___ 3. Age: _____
5. Height _____ ft: in 6. Weight _____ lbs 6. Time (years) in service _____
7. Which is your dominate hand (the one you use most often)?
Right ___ Left ___ Neither (ambidextrous) ___
8. Are you an Airborne Training Recycle? ___ Yes/No

PHYSICAL FITNESS TEST SCORE

9. Which branch of service are you in? (Circle your branch)
- ARMY MARINES NAVY AIR FORCE
10. Date of last fitness test (month/year) ___/___/___
11. What were your most recent raw scores for your branch of service?
(Answer all that apply to your service; DO NOT enter alternate tests)
- | | | | | | |
|----------|-------|------|--------------|-------|----------|
| Sit-up | _____ | reps | 2-mile run | _____ | min: sec |
| Curl-up | _____ | reps | 1.5-mile run | _____ | min: sec |
| Push-up | _____ | reps | 3-mile run | _____ | min: sec |
| Pull-ups | _____ | reps | | | |
| Crunches | _____ | reps | | | |

PHYSICAL ACTIVITY

12. **OVERALL PHYSICAL ACTIVITY:** Overall, how would you rate yourself as to the amount of physical activity you perform, compared to others of your age and sex in the military?
- ___ Much more active
___ Somewhat more active
___ About the same
___ Somewhat less active
___ Much less active

TOBACCO USE

13. **SMOKING:** Which statement best describes your smoking habits in the last year?
- ___ I have never smoked
___ I smoked but quit
 ___ 6 months ago
 ___ 6 months to 1 year ago
 ___ more than a year ago
___ I smoke 10 or fewer cigarettes per day
___ I smoke more than 10 cigarettes per day

INJURIES

14. **INJURIES IN PAST YEAR:** Did you have an injury for which you saw a medical care provider or were given a profile in year prior to attending jump school? (list most serious injury only)

No

Yes -----> *Complete parts a through c below by circling the appropriate answer*

a. **Body part injured:** Head Arms Chest Abdomen Back Legs Knees Ankles Feet/toes
Other: _____

b. **Side of body injured:** Right Left Both Not Applicable

c. **Injury type:** StressFracture Tendonitis Arthritis Bursitis Fasciitis Pinched Nerve Strain
Sprain Shin Splints Abrasion/Cut Pain (unknown cause) Concussion Dislocation Fracture Blister
Bruise Heat/Cold Other

15. **INJURY DURING JUMP WEEK:** Were you injured during jump week (list most serious only)?

No

Yes -----> *Complete parts a through c below by circling the appropriate answer*

a. **Body part injured:** Head Arms Chest Abdomen Back Legs Knees Ankles Feet/toes
Other: _____

b. **Side of body injured:** Right Left Not Applicable

c. **Injury type:** StressFracture Tendonitis Arthritis Bursitis Fasciitis Pinched Nerve Strain
Sprain Shin Splints Abrasion/Cut Pain (unknown cause) Concussion Dislocation Fracture Blister
Bruise Heat/cold Other

AIRBORNE-SPECIFIC QUESTIONS

16. **ANKLE BRACE:** Did you wear an ankle brace during jump week?

No Yes

17. **AIRCRAFT EXIT:** Did you have any problems during your exits from the aircraft?

No

Yes -----> if yes, mark why you had a problem (mark all that apply)

Struck the aircraft

Static line problem

Foot caught in suspension lines

Other (list) _____

18. **Any additional comments about the ankle brace?**

Positive or Negative

Thank you

Appendix D Open-Ended Comments on the Parachute Ankle Brace

1. Of the 1,956 people surveyed about the parachute ankle brace, 757 (39%) wrote comments. These fell into 12 categories and were classed as positive, negative, or neutral. Where an individual's comments referred to several categories, they were counted in each category, up to a total of three. Tables D1 and D2 list the comments by category, separately for those who wore the brace and those who did not. Comments in several categories are listed in full in each of those categories. In Table D1, comments from those who wore the ankle brace, 25 comments appear three times, 129 appear twice, and 417 appear once. In Table D2, comments from those who did not wear the ankle brace, 5 comments appear three times, 46 appear twice, and 135 appear once. Note that some comments may fall into both the positive and the negative divisions of a category, as for example a design comment about good support and poor construction.

Table D1. Open-Ended Comments about the Parachute Ankle Brace by Those Who Wore the Brace

Category	Type of Comment	Comment
Design	Positive	<ul style="list-style-type: none"> ▪ They're pretty nice for support...and Airborne school isn't hard. Don't let the whiners tell you otherwise ▪ Stabilize feet for landing ▪ Helped protect my ankles ▪ Provides extra security ▪ Protected my ankles ▪ They gave good ankle support but put too much pressure on other joints ▪ These braces help keep my feet straight. I strongly recommend continued use of the braces. ▪ I found them helpful but uncomfortable. Good support ▪ Helps a lot and protects leg good. Every company should use them ▪ Did the job. Uncomfortable ▪ I thought they did help give extra support ▪ Worked great. ▪ I thought it helped a lot. No chance of rolling an ankle in it. ▪ Overall I feel they do keep your ankles more stable. One problem is that the bottom Velcro strap comes loose all of the time. They also prevent you from completely keeping your feet together. ▪ Provided support when landing, however occasionally became loose around feet and had the tendency to catch on the 34' tower when exiting. ▪ I liked and disliked the braces. They did give my ankles more support but on the braces there's little bumps that make your feet slide forward and backwards from each other. ▪ It seemed to do the job ▪ I liked them because they helped my feet stay parallel with the ground and they gave added leg security ▪ Give unlimited support ▪ Cheap Velcro. Helped in ankle stabilization. Boot strap under heel is poorly made ▪ Ankle brace helps with leg stability and landing. The bottom strap underneath the boot is inconvenient and always comes undone. ▪ More support obviously, but the downside is comfort & the durability. ▪ They work well but they will probably break within two class periods ▪ They protected my ankles when I hit the bricks during tower week ▪ They are more stable ▪ They helped a lot because I have weak ankles ▪ Supported my ankles ▪ They helped a lot by supporting my ankles ▪ Gave decent support to the ankle but did not really allow to do a PLF with your second point of contact. ▪ I have bad ankles and felt that the braces supported my ankles well during landings ▪ They work really well if you really shock a landing ▪ The ankle brace is a splendid piece of protective equipment ▪ They work well ▪ Seemed to help stabilize for a safer landing

Table D1. (continued)

Category	Type of Comment	Comment
Design	Positive	<ul style="list-style-type: none"> ▪ I liked them. I have weak ankles so I was glad to have the extra support ▪ Worked great ▪ I thought it gave extra support ▪ I believe that the braces offer extra support so I would recommend them to other jumpers. ▪ I believe the ankle supports gave me the support I needed. I am glad I was the one wearing them ▪ They seem to give the ankles extra support ▪ Felt like they gave additional support and helped with my confidence. ▪ The ankle braces helped stabilize my ankles ▪ I believe the ankle braces did help lessen the impact upon hitting the ground ▪ Prevents rolling of ankle and allowed more confidence when I land. ▪ Offer great support but tear up easy. ▪ Positive. Does not let you roll your ankle. ▪ Helped support ankle better. ▪ For the most part they worked. But they could have worked a lot better. ▪ Ensures that you will not roll your ankle. ▪ Positive! I was glad for the support. ▪ The braces are very efficient. ▪ Definitely helped support ankles. ▪ They are supportive but the bottom strap tears easily. ▪ Somewhat supportive. ▪ Ankle brace did not fit correctly on my boots but did help my ankles from rolling themselves. Did make it more difficult to put feet close together ▪ The bottom Velcro piece need to be reworked, otherwise they work well ▪ Screws began to rust after the first week. Good support and easy fitting. Honestly was afraid that braces would transfer shock to legs during landing. Risk was mitigated by wearing them for comfortable support. No negative consequences to report. ▪ During training it seemed to let your feet slide apart, but after jumping they seemed to help with the shock of the landing ▪ Never had ankle problems it is uncomfortable but it seems to work ▪ Positive. Comfortable and effective ▪ Easy to use. Comfortable when on. Appears to prevent ankles from rolling. ▪ I think they helped prevent a minor injury when I came down straight and didn't perform a good PLF. Kept ankles from buckling. ▪ Make it a little difficult to keep feet together. A little uncomfortable, but workable ▪ They made me more confident in my PLF because they supported my ankles substantially ▪ They were uncomfortable for training but during actual jump gave me peace of mind for the additional support my boots couldn't provide ▪ During training it is hard keep your feet together. But on jumping it is reassuring to help protect your ankles.
	Negative	<ul style="list-style-type: none"> ▪ Better straps on the bottom ▪ Ankle brace not made for the boot, I would rather have a knee brace ▪ Ankle brace needs improvement on strap that goes under the heel of the foot. ▪ They didn't stay in place and it is hard to keep the feet and knees together with them. ▪ They seem to break easily. ▪ They broke, glad it wasn't my ankle ▪ They are cumbersome and the Velcro heel strap breaks frequently. ▪ Bulky/useless ▪ Ankle braces kept coming undone. ▪ Negative. Didn't work well with combat boots ▪ Doesn't fit Army issued boots ▪ Strap didn't work ▪ Work if they stay on ▪ Braces do not fit new issue boots ▪ Ankle brace did not fit correctly on my boots but did help my ankles from rolling them selves. Did make it more difficult to put feet close together ▪ The ankle braces did not fit me properly and were more of an inconvenience than an aid. I would rather jump without them. ▪ They busted every time I hit the DZ. I see no point in them unless landing on a tarmac ▪ Heel strap is not adequate to hold the brace in place. Strap does not reach most heels on new boots; Velcro needs to be along entire strap to adjust it properly along with a strap perpendicular to it to go over the boot. The strap will not last long. Entire brace seems to be low quality. ▪ The ankle braces did not fit properly over the boot. They were a very cheap quality, but are a good idea. ▪ Riser were stuck on ankle braces and made it hard to adjust ▪ The bottom straps need a buckle instead of Velcro

Table D1. (continued)

Category	Type of Comment	Comment
Design	Negative	<ul style="list-style-type: none"> ▪ I think that the outside of the braces should be covered with a texture (i.e., rubber) that would make them less slippery. I find it hard to keep my feet together with just the hard plastic. ▪ Yes I think it bows you feet apart ▪ Not effective ▪ I really don't think they work because practice in the PLF they would always go up my calf. ▪ Need better bottom. I liked them a lot ▪ They should be made for all boots. With the new boot they are hard to stay on ▪ The bottom strap is bad. It always drags on the ground ▪ I'm not sure they helped. It was just another piece of equipment we had to carry ▪ Boot strap is poor design, comes undone, possible hazard ▪ Didn't stay on feet well. Bottom strap sucks ▪ Stirrups didn't stay on well ▪ The Velcro strap doesn't work when dirty. Use a button or witchlike design. Overall I like them – not for running ▪ Straps were hard to secure and a safety problem ▪ Strap broke on last week ▪ Had problems getting them to fit and the strap that goes under the boot always came loose ▪ Velcro straps over heel aren't durable ▪ They don't fit the boots well and fall off easily. They may help the ankles but cause other injuries in other parts of leg ▪ It was really hard to keep brace secured to my foot properly ▪ They need to be more sturdy/durable ▪ The bottom Velcro piece needs rework, otherwise they work well ▪ The bottom strap comes off way too easy ▪ Needs a better strap ▪ I don't think they actually helped at all and the Velcro straps that go under the feet need to be longer. ▪ Metal is already rusting and straps that go under boot don't hold and are a safety hazard on board the aircraft. ▪ Straps came undone. Does not fit our boots. ▪ Screws began to rust after the first week. Good support and easy fitting. Honestly was afraid that braces would transfer shock to legs during landing. Risk was mitigated by wearing them for comfortable support. No negative consequences to report. ▪ Ankle braces could be manufactured better. The heel strap is worthless and buckle breaks easily ▪ Ankle braces could be smaller and made more durable. They tear up very easily ▪ New way to strap them on gets in way while shuffling. ▪ They need a better design to accommodate the bottom of our boots ▪ They are only designed for the standard combat boot and cannot be properly fastened for other types ▪ Poor fit under heel strap ▪ They break after only three weeks of use ▪ A lace up sock would be better for support and protection to all ankle injuries. Brace does not support ankle to foot so the foot rotates around the stationary part of the ankle causing injury. ▪ They need to have a better snap device they come loose way too much ▪ The stirrups need to be made stronger. Several Soldiers' Velcro has separated from the stirrup ▪ The ankle braces were not effective as a preventative measure. They also impaired our ability to run from the drop zone. They are poorly constructed & the majority were broken during the first week. Granted I have no measure of comparison. I don't feel they were worth the investment. ▪ Braces do not stay on well and kept falling off at very inconvenient times. Need a new way to attach to ankles ▪ During training it seemed to let your feet slide apart, but after jumping they seemed to help with the shock of the landing ▪ They didn't fit and moved out of place as soon as I took a step ▪ They are a waste. I don't think they serve the intended purpose. ▪ One of mine broke during the landing on my #2 jump ▪ There wasn't any instruction on how to properly fit and adjust the ankle brace ▪ The heel straps would keep coming loose ▪ No ankle support ▪ They were poor quality and don't stay fit to boots while you wear them. They gave descent support, but never were on right. ▪ I had repeated problems with the heel strap ▪ If worn with old issue boots they work great. If worn with new issue boots they suck. ▪ The ankle brace did not help and did more harm than good ▪ They worked somewhat but the straps at the bottom areas do not connect to the new combat boots ▪ The buckles are positioned on the inside of the feet when worn correctly, these buckles catch on each other while standing or walking they hook on each other

Table D1. (continued)

Category	Type of Comment	Comment
Design	Negative	<ul style="list-style-type: none"> ▪ They did not fit the new issue boots ▪ I had problems with the heel strap in that it was not long enough to stay tight. ▪ They don't work, they are uncomfortable and unnecessary ▪ Straps that go in front of the heel need to be redesigned. They keep breaking. ▪ They do not stay on that well. ▪ Cheap straps on heel portion. ▪ Heel straps don't work well with new style boots. ▪ Ankle brace straps not long enough, had to tie. ▪ They would be more effective if there was a strap around the front of the ankle to keep it on. ▪ They broke easily. But they kept legs from breaking. ▪ Velcro on leather strap is weak. ▪ Mine broke in half and SGT AIRBORNE told me not to replace them because "they won't ***** help anyway!!" ▪ They don't stay on very well. Bottom strap comes off heel easily. ▪ The heel strap wears out pretty quickly when we run in the braces. ▪ Instep strap doesn't fit. ▪ Worked well with traditional black boots because of the distinguished heel. Does not stay secure in desert boots because of the gradual heel. ▪ Some of the braces were in bad shape. ▪ The ankle braces were just an annoyance and they did not seem to fit over my boots. I do not believe they provided any additional support because a fellow student broke his ankle while wearing them. ▪ I feel they helped, but didn't fit the new Army issue boots very well. ▪ Good idea but needs work. They do not fit the ankle properly and therefore are not providing the proper support ▪ They are good but need to be secured on the foot better ▪ Overall a good product. Needs improvement on the bottom. ▪ I like the idea of having braces, but I think we could have better ones. Wrap type braces would still provide support, and would be less cumbersome ▪ I thought they were good. The lower ground strap needs to be removed or have Velcro replaced with a permanent fix ▪ Good idea. Plastic good but need more foot to ankle support. Bottom strap is worthless ▪ Great idea...terrible design! ▪ I think they are good but the heel strap could be improved. ▪ Overall I feel they do keep your ankles more stable. One problem is that the bottom Velcro strap comes loose all of the time. They also prevent you from completely keeping your feet together. ▪ Provided support when landing, however occasionally became loose around feet and had the tendency to catch on the 34' tower when exiting. ▪ I liked and disliked the braces. They did give my ankles more support but on the braces there's little bumps that make your feet slide forward and backwards from each other. ▪ Cheap Velcro. Helped in ankle stabilization. Boot strap under heel is poorly made ▪ They work well but they will probably break within two class periods ▪ Offer great support but tear up easy. ▪ For the most part they worked. But they could have worked a lot better. ▪ They are supportive but the bottom strap tears easily. ▪ They hurt, don't work ▪ Uncomfortable and not sure if they work well ▪ It's hard to gauge the effectiveness of the braces, but I do know they don't fit correctly. I feel as if they don't do much either. Its more unnecessary equipment ▪ Blisters are not helping any with the running. It seems the heel strap is useless (won't stay tight). However I do see a positive No broken bones. ▪ Extremely uncomfortable. Did not fit well. In poor condition when issued ▪ Ankle braces were comfortable. Better heel straps they are too weak ▪ Don't see the point. People still broke their ankles. Equipment broke easily. ▪ I felt more scared of my past injuries with the braces on. The strap under the boot could be better manufactured/ make it work better and actually stay on the boot. Not too uncomfortable but a hassle. ▪ Ankle brace seemed to aggravate my existing shin splints. Heel straps are too short to fit across boots. Uncomfortable and made me feel complacent about my landings. ▪ They make it harder to keep feet and knees together. The feet would slide. They did not give noticeable ankle support ▪ It hampered the ability to keep feet together and overall did not seem effective ▪ Can't keep your knees together as easily and is harder for a tight fit. ▪ They helped out with my landings I believe. Problem was the straps never stayed where they were suppose to. ▪ I think it helped with keeping the ankles straight when performing the PLF, although not that much. The small size were too small even for the smallest female feet

Table D1. (continued)

Category	Type of Comment	Comment
Design	Negative	<ul style="list-style-type: none"> ▪ I felt that you were more likely to trip in the plane than for it to protect your ankles ▪ Clips on inner heels catches and restricts movement ▪ More support obviously, but the downside is comfort & the durability. ▪ Ankle brace helps with leg stability and landing. The bottom strap underneath the boot is inconvenient and always comes undone.
	Neutral	---
Comfort	Positive	<ul style="list-style-type: none"> ▪ I wore a brace on both ankles after the first jump and my ankles felt a lot better than the first jump with no brace. ▪ Positive. Comfortable and effective ▪ I didn't mind them. I couldn't tell they were even there and my ankles didn't break so I like them. ▪ Ankle braces were comfortable. Better heel straps they are too weak ▪ Easy to use. Comfortable when on. Appears to prevent ankles from rolling. ▪ Good idea to use them. Didn't even notice they're there ▪ I've always had easily sprained ankles and was very concerned, but thanks to the ankle braces I'm doing great. They fit well too ▪ It was great and everyone should wear one. The new boots are garbage and I was really happy and comfortable because the brace is designed for the old boot ▪ I felt more scared of my past injuries with the braces on. The strap under the boot could be better manufactured/ make it work better and actually stay on the boot. Not too uncomfortable but a hassle
	Negative	<ul style="list-style-type: none"> ▪ They hurt, don't work ▪ Uncomfortable ▪ The ankle braces are too stiff and prevent proper PLF ▪ Uncomfortable, but no ankle injury, so good! ▪ You should shorten the overall height. I was tearing up my calves ▪ uncomfortable ▪ The ankle braces are not comfortable but they did help because I did not get injured ▪ They are painful on the shins and make it difficult to keep heels and toes together because they are a bit bulky, but I did not have an ankle injury. ▪ Uncomfortable ▪ Never had ankle problems. It is uncomfortable but it seems to work ▪ I think they are a bit uncomfortable, but help a lot for your landing. I think they saved me from breaking my ankle on the first jump. They are very useful. ▪ Uncomfortable, cheap ▪ Uncomfortable and not sure if they work well ▪ Uncomfortable. Hard to keep feet and knees together. ▪ Could be longer ▪ Cumbersome during training and I did not see the benefit ▪ Too constrictive but felt it helped some ▪ Braces are more painful than helpful ▪ Cause blisters above my ankles on both sides ▪ They suck! They dig into the ankles. Pain in the ass. Pointless ▪ It's hard to gauge the effectiveness of the braces, but I do know they don't fit correctly. I feel as if they don't do much either. Its more unnecessary equipment ▪ It rubbed against my calf a whole lot. Outside of that it was just an irritant ▪ The braces caused pain in my shins just short of injury ▪ Pain in the fourth point of contact – Same with the hairnets ▪ They gave blisters ▪ Blisters are not helping any with the running. It seems the heel strap is useless (won't stay tight). However I do see a positive No broken bones. ▪ Jab at the side of my ankle when doing a side PLF ▪ They were uncomfortable for training but during actual jump gave me peace of mind for the additional support my boots couldn't provide ▪ Ankle braces bruise your shins ▪ A few of the trainees received small sizes that didn't fit correctly ▪ They didn't fit correctly and didn't stay on my ankles where they were suppose to. They also didn't allow you to keep your feet and knees together... It might have helped if we had trained with them first so we could get used to them. ▪ They irritate the ankles ▪ They hurt my ankles after about an hour of wearing them ▪ They make my shin bones hurt worse. Ankles are OK ▪ Extremely uncomfortable. Did not fit well. In poor condition when issued ▪ They are uncomfortable and hard to maintain a proper PLF position ▪ The ankle braces put too much pressure on my legs ▪ Although uncomfortable they give an advantage to avoiding injury

Table D1. (continued)

Category	Type of Comment	Comment
Comfort	Negative	<ul style="list-style-type: none"> ▪ Extremely uncomfortable. ▪ Hurts ▪ They rubbed too much on the ankle. ▪ Hurts ▪ They are annoying and rubbed my ankle into my boot. If we wear them only when we needed them, they would be good. ▪ I did not like them, they hurt my shins. ▪ Size selection inadequate. Need more larges. ▪ Don't like them they are uncomfortable and do more harm than good. ▪ They don't work, they are uncomfortable and unnecessary ▪ They gave good ankle support but put too much pressure on other joints ▪ I found them helpful but uncomfortable. Good support ▪ Did the job. Uncomfortable ▪ More support obviously, but the downside is comfort & the durability. ▪ Make it a little difficult to keep feet together a little uncomfortable, but workable ▪ The ankle brace did not work for me. I believe it made my landing harder. It also hurt my legs. I would not recommend anyone to use them. ▪ Hard to keep feet and knees together, uncomfortable ▪ Tend to hinder walking... Uncomfortable ▪ Very uncomfortable to run in and wear for any length of time. ▪ I believe the ankle braces are an unnecessary, cumbersome piece of equipment that should be optional to the airborne student. ▪ It seems unnecessary and cumbersome ▪ Haven't jumped without them, so no comparison. They give a feeling of security however somewhat uncomfortable ▪ Ankle brace seemed to aggravate my existing shin splints. Heel straps are too short to fit across boots. Uncomfortable and made me feel complacent about my landings.
	Neutral	---
Medical/Safety	Positive	<ul style="list-style-type: none"> ▪ I didn't break my ankle so I guess it works ▪ I think they did their job because I did not get hurt. ▪ No idea. My ankles still work though. ▪ Injuries tend to be leg injuries. Ankle braces are a smart idea. ▪ Made jumps safer ▪ I think the anklet bracelet helped to prevent twisting and sprains ▪ I think it was good because I didn't hurt my ankle ▪ I think they are good because without them ankles could be broken at point of impact ▪ I believe they aided in keeping the ankle and lower leg secure but I feared they may cause a higher rate of femur fractures. I think this should be researched. ▪ I didn't mind them and think they saved my ankles on my crash landings ▪ They saved my ankles ▪ I didn't break my ankles, so I guess they did their job. ▪ They kept me healthy. ▪ Still walking ▪ Positive – Make you more safety ▪ I've always had easily sprained ankles and was very concerned, but thanks to the ankle braces I'm doing great. They fit well too ▪ I think they helped prevent a minor injury when I came down straight and didn't perform good PLF. Kept ankles from buckling. ▪ I didn't break anything while wearing them but I've never jumped without them ▪ I think they saved may ankle on my 4th jump ▪ I liked the ankle brace. I felt they helped out by preventing sprained ankles ▪ More pressure on the major bones of the leg. The ankles may be safe, but the leg is at risk for a break. ▪ I hurt myself and the ankle brace held me. ▪ OK Prevent injuries ▪ Prevented injury, caused tripping ▪ May be good to keep troops fit to fight in training but may not provide true example of how to land in real world operation: train like you fight. ▪ Didn't get injured so I guess they were a success. ▪ I did not break my ankles ▪ When I hurt my ankles they seemed to help a lot ▪ Probably saved my ankles a couple of times. Good safety measure ▪ I haven't jumped without them, but I never hurt my ankles with them on ▪ Helped me not mess up my ankle on the first jump ▪ They helped keep our ankles strong during training so we didn't go into jump week with stress fractures or weak ankles

Table D1. (continued)

Category	Type of Comment	Comment
Medical/Safety	Positive	<ul style="list-style-type: none"> ▪ If they prevent Soldiers from shattering ankles then I am for it ▪ They were great. Helped out a lot. Probably would have hurt ankles on last jump without them ▪ I liked the ankle brace because I had ankle injury before from basketball. It gave me a sense of relief knowing that I had protection on my ankles. ▪ They worked good for me, especially since I have weak ankles and are prone to injuries ▪ I didn't break my ankle so I would say they work ▪ Helped prevent injury ▪ I didn't get injured so I guess they must work ▪ Helped prevent ankle sprains. I like them but they should be optional. ▪ Loved them. Felt they provided a certain safety cushion in case of a less than perfect landing, especially for the big guy. ▪ The brace did seem to prevent injury. They didn't hinder my ability to perform ▪ Did not break ankle, must be a positive. ▪ It probably saved my ankles when I landed on my heels. ▪ They save ankles from breaking. Hooah! ▪ Keeps you from breaking your ankle. ▪ An important tool. Continue to use it. ▪ During my second jump I snapped my right ankle brace. Had I not been wearing it I may have sustained significant injury. Thanks to the brace I was able to return to my command injury-free. Keep implementing ▪ I think had I not been wearing it I would definitely have broken it. ▪ It saved my ankle on the first jump. ▪ Good. Helped prevent injury. ▪ I believed they helped both physically and mentally. ▪ I was impressed with them and protected from possible injury. ▪ They broke, glad it wasn't my ankle ▪ They broke easily. But they kept legs from breaking. ▪ Seemed to help stabilize for a safer landing ▪ Uncomfortable, but no ankle injury, so good! ▪ The ankle braces are not comfortable but they did help because I did not get injured ▪ Although uncomfortable they give an advantage to avoiding injury ▪ I didn't mind them. I couldn't tell they were even there and my ankles didn't break so I like them. ▪ Ankle brace helped with landings and saved me from several injuries ▪ I felt awkward with them, but I feel it might have saved me from injury ▪ I think they should be worn. I think I would have twisted my ankles several times, but not having jumped without them I don't know the difference. ▪ Positive reinforcement and enjoyed them for their safety. ▪ I felt more confident wearing the braces because I have weak ankles from prior injuries. They were not a problem for me at all. I feel it is better to break a leg that can heal faster and is easier to fix than an ankle which generally requires more surgical measures and generally takes longer to heal. ▪ Blisters are not helping any with the running. It seems the heel strap is useless (won't stay tight). However I do see a positive No broken bones. ▪ They are painful on the shins and make it difficult to keep heels and toes together because they are a bit bulky, but I did not have an ankle injury. ▪ I think they are a bit uncomfortable, but help a lot for your landing. I think they saved me from breaking my ankle on the first jump. They are very useful.
	Negative	<ul style="list-style-type: none"> ▪ Could cause injury ▪ Don't see the point. People still broke their ankles. Equipment broke easily. ▪ I felt more scared of my past injuries with the braces on. The strap under the boot could be better manufactured/ make it work better and actually stay un the boot. Not too uncomfortable but a hassle. ▪ I hate them. They almost broke my legs ▪ Ankle brace seemed to aggravate my existing shin splints. Heel straps are too short to fit across boots. Uncomfortable and made me feel complacent about my landings. ▪ Great tool, but probably transfers injuries from ankle to knees. ▪ Boot strap is poor design, comes undone, possible hazard ▪ Straps were hard to secure and a safety problem ▪ They don't fit the boots well and fall off easily. They may help the ankles but cause other injuries in other parts of leg ▪ A lace up sock would be better for support and protection to all ankle injuries. Brace does not support ankle to foot so the foot rotates around the stationary part of the ankle causing injury. ▪ I believe they aided in keeping the ankle and lower leg secure but I feared they may cause a higher rate of femur fractures. I think this should be researched.

Table D1. (continued)

Category	Type of Comment	Comment
Medical/Safety	Negative	<ul style="list-style-type: none"> ▪ More pressure on the major bones of the leg. The ankles may be safe, but the leg is at risk for a break. ▪ The ankle braces were just an annoyance and they did not seem to fit over my boots. I do not believe they provided any additional support because a fellow student broke his ankle while wearing them. ▪ Metal is already rusting and straps that go under boot don't hold and are a safety hazard on board the aircraft. ▪ I jumped both brace and no brace and prefer no brace because stronger exit and I could feel my feet and knees squeeze together better. I do not believe they added to the safety of my ankle.
	Neutral	---
PLF	Positive	<ul style="list-style-type: none"> ▪ Great for landing – felt very protected & helped with shock ▪ Make feet and ankles more rigid for a good PLF, but make it harder to keep toe to toe heel to heel contact. ▪ They helped out with my landings I believe. Problem was the straps never stayed where they were suppose to. ▪ Made it easier to keep feet together for landing ▪ I think it helped with keeping the ankles straight when performing the PLF, although not that much. The small size were too small even for the smallest female feet ▪ No problems. Really helps with your landing ▪ I believe the ankle braces helped a lot on the landing ▪ Positive it helped PLFs by allowing me to keep proper form ▪ Ankle brace helped with landings and saved me from several injuries ▪ I liked them while we were training at first because it helped with maintaining good positioning and landing but then I would have liked to have taken them off to get the feel of what it would have been like to train in the real world ▪ Hassle and no positive benefit during training weeks; helped on landings during jump week. ▪ Felt they helped...could have been mental, nevertheless helped with my landing PLF ▪ Ankle brace helps with leg stability and landing. The bottom strap underneath the boot is inconvenient and always comes undone. ▪ I think they are a bit uncomfortable, but help a lot for your landing. I think they saved me from breaking my ankle on the first jump. They are very useful. ▪ Horrible for your ankles and legs when running from the LZ, but good for PLF ▪ They make it harder to run/double time. More prone to trip, etc. They probably helped during the PLF. ▪ They made me more confident in my PLF because they supported my ankles substantially
	Negative	<ul style="list-style-type: none"> ▪ Problem keeping feet and knees together ▪ Could not keep feet and knees together as well. ▪ Made PLF worse ▪ Hard to keep legs together ▪ Hard to keep legs together ▪ Prevent feet staying together ▪ Ankle braces don't allow you to put your feet and knees together ▪ Ankle brace is an expensive item with little benefits. Restricts the ability to keep feet together; heel to heel/toe to toe. For expensive as they are the braces are cheaply constructed. ▪ The hard plastic outside make it very hard to keep your feet together during the entire descent ▪ Sometime hard to get feet all the way together ▪ It is too hard to keep your feet together with them on ▪ Ankle braces suck. Makes it hard to keep feet and knees together ▪ During training it is hard keep your feet together. But on jumping it is reassuring to help protect your ankles. ▪ Make it a little difficult to keep feet together a little uncomfortable, but workable ▪ Could not keep feet together because of the braces ▪ They didn't feel like they helped and made it more difficult to keep feet and legs together ▪ They caused more problems. Couldn't get my feet together as well as I would have liked ▪ The ankle brace did not work for me. I believe it made my landing harder. It also hurt my legs. I would not recommend anyone to use them. ▪ It is easier to keep your feet and knees together without them because the plastic doesn't click. Can't feel knees and feet together ▪ The ankle braces are made of plastic so when we hit the ground our legs came apart because is hitting each other ▪ Hard to keep feet and knees together, uncomfortable ▪ You can't feel your ankles together. It is harder to put your knees together ▪ They made it more difficult to keep feet together. Did not like them ▪ They make it harder to keep feet and knees together. The feet would slide. They did not give noticeable ankle support ▪ It makes it where you cannot put your feet totally together.

Table D1. (continued)

Category	Type of Comment	Comment
PLF	Negative	<ul style="list-style-type: none"> ▪ The brace make it difficult to keep your knees together. Very unsettling. I jumped with and without. Without is a more secure feeling ▪ Hard to keep heel-to-heel and toe-to-toe contact ▪ Hard to keep feet together. They're stupid ▪ They often get suspension wires caught in them during PLFs ▪ Hard to keep feet tight together ▪ They prevent proper PLF position ▪ Hard to keep ankles and knees together for proper PLF ▪ It hampered the ability to keep feet together and overall did not seem effective ▪ I jumped both brace and no brace and prefer no brace because stronger exit and I could feel my feet and knees squeeze together better. I do not believe they added to the safety of my ankle. ▪ Could not feel if my ankles were tight together ▪ Can't keep your knees together as easily and is harder for a tight fit. ▪ Not able to keep feet and knees fully together because of braces. ▪ I would prefer to jump w/o the braces because I think I could keep my feet and knees together better. ▪ I did not LIKE them. Made it hard to hold ankles together ▪ Good idea but made it difficult sometimes to keep toe to toe and heel to heel contact. ▪ Difficult to train in but good on the jumps. Also difficult to feel feet closeness ▪ They didn't stay in place and it is hard to keep the feet and knees together with them. ▪ I think that the outside of the braces should be covered with a texture (i.e., rubber) that would make them less slippery. I find it hard to keep my feet together with just the hard plastic. ▪ Gave decent support to the ankle but did not really allow to do a PLF with your second point of contact. ▪ The ankle braces are too stiff and prevent proper PLF ▪ They are painful on the shins and make it difficult to keep heels and toes together because they are a bit bulky, but I did not have an ankle injury. ▪ Uncomfortable. Hard to keep feet and knees together. ▪ They didn't fit correctly and didn't stay on my ankles where they were suppose to. They also didn't allow you to keep your feet and knees together... It might have helped if we had trained with them first so we could get used to them. ▪ They are uncomfortable and hard to maintain a proper PLF position ▪ Make feet and ankles more rigid for a good PLF, but make it harder to keep toe to toe heel to heel contact. ▪ I would have liked to have jumped without them, because the ankle brace do not allow you to keep your feet together. ▪ Didn't really care for them, but I can see how they would be good. It seems harder to keep your feet together too. ▪ Overall I feel they do keep your ankles more stable. One problem is that the bottom Velcro strap comes loose all of the time. They also prevent you from completely keeping your feet together. ▪ Ankle brace did not fit correctly on my boots but did help my ankles from rolling themselves. Did make it more difficult to put feet close together
	Neutral	<ul style="list-style-type: none"> ▪ I don't know the difference between wearing braces and not wearing braces, but they didn't affect my PLF.
Tactical	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ Have not landed without braces so it is difficult to measure the effect. I would say that it is a good piece of equipment for training however, it would be a hindrance for real operations.
	Neutral	---
Handling	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ Annoying to run with, but glad I had them for the jump ▪ I felt that you were more likely to trip in the plane than for it to protect your ankles ▪ I can see how the braces can affect aircraft exits. They tripped me twice on my way out of the bus. I do believe they help especially in training. I wouldn't think it was worth carrying in my ruck in airborne infantry ▪ Tend to hinder walking... Uncomfortable ▪ I felt awkward with them, but I feel it might have saved me from injury ▪ Clips on inner heels catches and restricts movement ▪ Horrible for your ankles and legs when running from the LZ, but good for PLF ▪ They make it harder to run/double time. More prone to trip, etc. They probably helped during the PLF. ▪ Very unproductive running ▪ They hurt to run in ▪ Good they really are bad to walk in but to land I really do want to wear them. ▪ Combat equipment got caught on ankle brace upon release ▪ Very uncomfortable to run in and wear for any length of time. ▪ Hard to explain but they cut time and hard to run with

Table D1. (continued)

Category	Type of Comment	Comment
Handling	Negative	<ul style="list-style-type: none"> ▪ I don't mind jumping with them, but I don't like running with them. So I wouldn't want to see them in the regular Army ▪ Great idea...just stop making us run in them. ▪ Metal is already rusting and straps that go under boot don't hold and are a safety hazard on board the aircraft. ▪ The ankle braces were not effective as a preventative measure. They also impaired our ability to run from the drop zone. They are poorly constructed & the majority were broken during the first week. Granted I have no measure of comparison. I don't feel they were worth the investment. ▪ The buckles are positioned on the inside of the feet when worn correctly, these buckles catch on each other while standing or walking they hook on each other ▪ Prevented injury, caused tripping ▪ I jumped both brace and no brace and prefer no brace because stronger exit and I could feel my feet and knees squeeze together better. I do not believe they added to the safety of my ankle. ▪ The Velcro strap doesn't work when dirty. Use a button or watch like design. Overall I like them – not for running ▪ Provided support when landing, however occasionally became loose around feet and had the tendency to catch on the 34' tower when exiting.
	Neutral	---
Choose for Army	Positive	<ul style="list-style-type: none"> ▪ It was great and everyone should wear one. The new boots are garbage and I was really happy and comfortable because the brace is designed for the old boot ▪ Would recommend them to all personnel & Soldiers jumping ▪ I think they should be worn. I think I would have twisted my ankles several times, but not having jumped without them I don't know the difference. ▪ I think they are not necessary during training. Just during the jumps. ▪ In my opinion the brace isn't needed during the first two weeks, but a must for jump week ▪ KEEP THEM ▪ Keep using them. ▪ Company needs to get new ones. ▪ Keep using them. ▪ Good. Should train with them during the first two weeks ▪ A very good thing to have on all jumps ▪ Good thing to have on all jumps ▪ I love it. Do not get rid of it. ▪ These braces help keep my feet straight. I strongly recommend continued use of the braces. ▪ Helps a lot and protects leg good. Every company should use them ▪ I believe that the braces offer extra support so I would recommend them to other jumpers. ▪ An important tool. Continue to use it. ▪ During my second jump I snapped my right ankle brace. Had I not been wearing it I may have sustained significant injury. Thanks to the brace I was able to return to my command injury-free. Keep implementing
	Negative	<ul style="list-style-type: none"> ▪ Get rid of them ▪ Get rid of it ▪ Get rid of them ▪ Get rid of them ▪ Get rid of it ▪ I believe the ankle braces are an unnecessary, cumbersome piece of equipment that should be optional to the airborne student. ▪ Need to go ▪ No need to wear them ▪ It seems unnecessary and cumbersome ▪ Should be personal preference not all or none. We all volunteered to join the service as adults and we can make those decisions on our own. ▪ Unnecessary, and a waste of government money ▪ I thought they were a nuisance most of the time. I think it would be better to not use them for most of the training to include jumps ▪ Not needed for training, get rid of it. ▪ OK but not necessary ▪ Seems to be good for beginning jumper, but should not be used on all 5 jumps as it becomes a crutch. ▪ Helped prevent ankle sprains. I like them but they should be optional. ▪ They don't work, they are uncomfortable and unnecessary
	Negative	<ul style="list-style-type: none"> ▪ The ankle brace did not work for me. I believe it made my landing harder. It also hurt my legs. I would not recommend anyone to use them. ▪ I don't mind jumping with them, but I don't like running with them. So I wouldn't want to see them in the regular Army
	Neutral	---

Table D1. (continued)

Category	Type of Comment	Comment
Choose for Self	Positive	<ul style="list-style-type: none"> ▪ They are good I thought they helped a lot I would wear them if I jumped again ▪ I believe the ankle supports gave me the support I needed. I am glad I was the one wearing them
	Negative	<ul style="list-style-type: none"> ▪ Good they really are bad to walk in but to land I really do want to wear them. ▪ Better off without them ▪ Don't need them ▪ I would have liked to have jumped without them, because the ankle braces do not allow you to keep your feet together. ▪ The ankle braces are not very good. I would rather not have worn them ▪ The ankle braces did not fit me properly and were more of an inconvenience than an aid. I would rather jump without them. ▪ I would prefer to jump w/o the braces because I think I could keep my feet and knees together better.
	Neutral	---
Confidence/Security	Positive	<ul style="list-style-type: none"> ▪ Positive reinforcement and enjoyed them for their safety. ▪ Helps with confidence ▪ It made me feel more confident but I really don't know what it is like without them ▪ I felt like it raised my confidence in jumping ▪ Great training aid. Gives jumpers much more confidence that no injuries will occur. ▪ Provided confidence and awareness of my feet and knees ▪ Great help. They took my mind off landing wrong. ▪ Since I've never jumped without the brace I'm unsure of whether it actually prevented any injuries. That being said I know I had more mental confidence in my ability to land safely while wearing them. ▪ Makes me more confident about landing ▪ Having them on at least made me feel safer during PLFs ▪ Extra comfort for me mentally ▪ Haven't jumped without them, so no comparison. They give a feeling of security however somewhat uncomfortable ▪ They made me feel safer during my jumps ▪ While the ankle brace may not provide exceptional protection from ankle or leg injuries it does provide a sort of mental reassurance. ▪ I felt confidence during landings ▪ I felt more confident wearing the braces because I have weak ankles from prior injuries. They were not a problem for me at all. I feel it is better to break a leg that can heal faster and is easier to fix than an ankle which generally requires more surgical measures and generally takes longer to heal. ▪ They made me more confident in my PLF because they supported my ankles substantially ▪ Confidence was instilled after each jump. ▪ I liked the ankle brace, and had more confidence for my landing with it on. ▪ I like them because when I was landing I didn't worry about my ankles ▪ Good idea made me feel more secure about ankles ▪ I think the ankle brace gives the jumper better confidence. ▪ It gave me more confidence in my ability to land safely. ▪ Positive. Allowed me to not worry about ankles which otherwise be my biggest concern. More confident, less nervous. ▪ Ankle brace more positive and I felt more secure with them on ▪ I liked them & felt more comfortable in landing ▪ Felt like they gave additional support and helped with my confidence. ▪ Prevents rolling of ankle and allowed more confidence when I land. ▪ They were uncomfortable for training but during actual jump gave me peace of mind for the additional support my boots couldn't provide ▪ I liked the ankle brace because I had ankle injury before from basketball. It gave me a sense of relief knowing that I had protection on my ankles. ▪ I believed they helped both physically and mentally. ▪ During training it is hard keep your feet together. But on jumping it is reassuring to help protect your ankles. ▪ Great for landing – felt very protected & helped with shock

Table D1. (continued)

Category	Type of Comment	Comment
Confidence/Security	Negative	<ul style="list-style-type: none"> ▪ I believe the jump brace implements false security in your ankles. ▪ Gives great false sense of security ▪ The brace make it difficult to keep your knees together. Very unsettling. I jumped with and without. Without is a more secure feeling ▪ Screws began to rust after the first week. Good support and easy fitting. Honestly was afraid that braces would transfer shock to legs during landing. Risk was mitigated by wearing them for comfortable support. No negative consequences to report.
	Neutral	---
Transport	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ I'm not sure they helped. It was just another piece of equipment we had to carry ▪ I can see how the braces can affect aircraft exits. They tripped me twice on my way out of the bus. I do believe they help especially in training. I wouldn't think it was worth carrying in my ruck in airborne infantry
	Neutral	---
General	Positive	<ul style="list-style-type: none"> ▪ They help sometimes. ▪ Ankle braces were good. ▪ They are great ▪ Felt they helped...could have been mental, nevertheless helped with my landing PLF ▪ I liked the ankle brace. No complaint ▪ Positive. Only problem is I'm used to it now. Won't always be jumping with it so got to get used to that ▪ Great ▪ OK ▪ They helped ▪ OK ▪ I feel they helped, but didn't fit the new Army issue boots very well. ▪ Thanks, it helped a lot. ▪ It seemed useful, but I'd rather train as I fight. ▪ The ankle brace was great, Thanks. ▪ Helpful ▪ Good ▪ Good for jump. Bad for training ▪ Good for jump/bad for training ▪ Good ▪ Liked it ▪ They work good. Felt better about them when jumping ▪ OK but not necessary ▪ Good idea but needs work. They do not fit the ankle properly and therefore are not providing the proper support ▪ Positive. Ankle braces are a very good idea to keep the longevity of Soldiers up. ▪ They were good ▪ I liked them. ▪ Good idea but made it difficult sometimes to keep toe to toe and heel to heel contact. ▪ Glad we had them ▪ OK ▪ Good when properly used ▪ Good ▪ Helpful ▪ Ankle brace more positive and I felt more secure with them on ▪ They are good but need to be secured on the foot better ▪ Not sure. They seemed to help but I haven't jumped without them. ▪ Use often ▪ GOOD STUFF ▪ Good for jump bad for training ▪ Cool ▪ Seemed OK ▪ They were great ▪ Ankle braces work well ▪ Have not landed without braces so it is difficult to measure the effect. I would say that it is a good piece of equipment for training however, it would be a hindrance for real operations. ▪ They work OK for me. ▪ Seemed fine but had nothing to compare landings with without them ▪ Are somewhat helpful ▪ I think they are OK ▪ I think they are a good idea but can get in the way ▪ Ankle brace helped for training purpose.

Table D1. (continued)

Category	Type of Comment	Comment
General	Positive	<ul style="list-style-type: none"> ▪ Overall a good product. Needs improvement on the bottom. ▪ I think the ankle braces were good ▪ I like the idea of having braces, but I think we could have better ones. Wrap type braces would still provide support, and would be less cumbersome ▪ Would be a good idea for tower & jump week only. No need for them in ground week ▪ I think they worked OK ▪ Difficult to train in but good on the jumps. Also difficult to feel feet closeness ▪ I think the ankle braces are a good idea there are just a lot better braces on the market in my opinion ▪ I think it is a good idea but we should do at least the last jump without them to have an idea about our further jumps. ▪ I like them. They work good with my weak ankles ▪ Couldn't really tell. Good overall ▪ I thought they were good. The lower ground strap needs to be removed or have Velcro replaced with a permanent fix ▪ They were good ▪ Good idea. Plastic good but need more foot to ankle support. Bottom strap is worthless ▪ It worked ▪ Good idea ▪ I liked them ▪ I liked them & felt more comfortable in landing ▪ They're OK ▪ I liked it ▪ Didn't really care for them, but I can see how they would be good. It seems harder to keep your feet together too. ▪ Good idea especially for first jump ▪ Good. Should train with them during the first two weeks ▪ They're OK. I can't compare them to any other jumps since I never jumped without one. ▪ Seems to be good for beginning jumper, but should not be used on all 5 jumps as it becomes a crutch. ▪ I don't mind jumping with them, but I don't like running with them. So I wouldn't want to see them in the regular Army ▪ Good idea to use them. Didn't even notice they're there ▪ They were good for training ▪ Good to have ▪ They seemed to help but I haven't jumped without them ▪ A very good thing to have on all jumps ▪ Bulky but useful ▪ Good thing to have on all jumps ▪ The braces worked great ▪ Great idea ▪ The ankle braces were helpful ▪ They really helped a lot ▪ They are good I thought they helped a lot I would wear them if I jumped again ▪ Positive. Good idea. ▪ Positive. Helps ankle a lot on combat jump. ▪ Good to train with ▪ Works fine so far. ▪ Worked well. Had no problem. ▪ Positive ▪ I love it. Do not get rid of it. ▪ Nice but annoying ▪ They are great, I was glad to have them. ▪ They helped out a lot. ▪ They were helpful. ▪ Felt positively about them. ▪ They help. ▪ Positive assessment. ▪ I have never jumped without them, so I have no basis for comparison. I'm sure they help weaker or heavier people. ▪ Great idea...terrible design! ▪ Great tool, but probably transfers injuries from ankle to knees. ▪ Great idea...just stop making us run in them. ▪ Awesome!! ▪ I had no problem with ankle braces. ▪ They help. ▪ Positive

Table D1. (continued)

Category	Type of Comment	Comment
General	Positive	<ul style="list-style-type: none"> ▪ Positive...but I don't know what it's like without them. ▪ I thought they definitely helped out! ▪ Good overall. Good overall training. I learned a lot and the SGT. AIRBORNEs maintained professionalism in B Co. ▪ I think they are good but the heel strap could be improved. ▪ Didn't mind wearing them. ▪ I liked them. ▪ They help. ▪ Positive. ▪ Beneficial. ▪ Worked good for me. ▪ I thought they were very practical and useful. ▪ Good idea. ▪ It helped. ▪ I felt that they helped. ▪ I think that the ankle braces are a good idea for new paratroops. ▪ I liked them. ▪ Very big help. Good deal. ▪ Good gear. ▪ Positive. ▪ Ankle braces are a good idea. ▪ They were a pain to put on and off but I had no problems with them ▪ Didn't really care for them, but I can see how they would be good. It seems harder to keep your feet together too. ▪ The ankle braces did not fit properly over the boot. They were a very cheap quality, but are a good idea. ▪ Need better bottom. I liked them a lot ▪ The Velcro strap doesn't work when dirty. Use a button or watch like design. Overall I like them – not for running ▪ Too constrictive but felt it helped some ▪ They are annoying and rubbed my ankle into my boot. If we wear them only when we needed them, they would be good. ▪ Pain in the ass to run with, but glad I had them for the jump ▪ I can see how the braces can affect aircraft exits. They tripped me twice on my way out of the bus. I do believe they help especially in training. I wouldn't think it was worth carrying in my ruck in airborne infantry
General	Negative	<ul style="list-style-type: none"> ▪ Don't like them ▪ It took too much time to put on and take off. ▪ Annoying ▪ I did not LIKE them. Made it hard to hold ankles together ▪ Braces are bad. More bad than good ▪ Disliked, not real life ▪ Irritating ▪ I disliked them. We did not train with them so jumping with them was an adjustment. ▪ My ankles hurt today even with the braces. ▪ Braces are bad ▪ Waste of taxpayers' money. 65 years without them have been OK ▪ Not good ▪ Bad ▪ Bad ▪ NO ▪ No good ▪ Hurt more than helped ▪ Did not like them. Waste of time ▪ Didn't like it ▪ Bad ▪ I thought they were useless ▪ Hard to explain but they cut time and hard to run with ▪ Ankle braces are bad ▪ Not very useful ▪ They were a pain to put on and off but I had no problems with them ▪ The ankle braces were just an annoyance and they did not seem to fit over my boots. I do not believe they provided any additional support because a fellow student broke his ankle while wearing them. ▪ Just seemed to get in the way, but have never jumped without them

Table D1. (continued)

Category	Type of Comment	Comment
General	Negative	<ul style="list-style-type: none"> ▪ I thought they were a nuisance most of the time. I think it would be better to not use them for most of the training to include jumps ▪ They are bad ▪ Did not seem helpful at all ▪ The ankle braces are not very good. I would rather not have worn them ▪ Not a big fan seriously ▪ Not very practical ▪ They do not help anything. They are just in the way ▪ Didn't think they helped at all ▪ I feel they wouldn't have helped much at all. They are just something to get in the way ▪ They are bad ▪ Waste of time ▪ A waste of money. You don't jump in combat with ankle braces ▪ The ankle brace didn't seem to help at all. If you are going to make us wear them, then have us train with them. ▪ I think they are pointless ▪ They are not practical ▪ Hassle and no positive benefit during training weeks; helped on landings during jump week. ▪ They are worthless ▪ I did better without them ▪ Don't like them they are uncomfortable and do more harm than good. ▪ Get some new ones. ▪ Did not enjoy the ankle brace. It was in the way. ▪ Did not see benefits of braces. ▪ Not needed for training, get rid of it. ▪ Ankle braces hurt worse than they helped ▪ Pointless! ▪ They're cheap! ▪ They s@#k, but I've always used them. ▪ More of a hassle than a benefit. ▪ Good for jump. Bad for training ▪ Good for jump/bad for training ▪ I think they are a good idea but can get in the way ▪ Nice but annoying ▪ It rubbed against my calf a whole lot. Outside of that it was just an irritant ▪ Don't like them. Will not be used after airborne school, so training with them here is not realistic ▪ Cumbersome during training and I did not see the benefit
	Neutral	<ul style="list-style-type: none"> ▪ No difference ▪ I couldn't really tell if they helped. ▪ Each class should do two jumps with the braces and three without the braces in order to determine effects/impacts of the braces. ▪ I cannot rate the effectiveness of ankle braces because I have never jumped without them. ▪ Can't compare since haven't jumped without them ▪ We really don't know if they work because we never jumped without them ▪ I got a chance to jump with them and without them. Feels the same to me ▪ The ankle brace neither assisted nor hindered my performance ▪ We never jumped without them. But why jump with them if you are not going to jump into combat like that ▪ No noticeable difference. I did not wear them during some of my falls. ▪ Think it would have been more beneficial if an airborne unit were to test the ankle braces, so that they could compare to the jumps without ankle braces. I thought they were helpful, but did not have anything to compare to. ▪ My first four jumps I used the brace. The last one I didn't and could not tell the difference ▪ I don't know if it helped or not, but I was concerned about rumors regarding broken legs ▪ If you got hurt you got dropped from the course. You don't wear them to wear ▪ Any advantages were unseen by me at this time
Not Relevant		<ul style="list-style-type: none"> ▪ Neutral, didn't feel anything towards them. Part of the training. ▪ don't care either way ▪ life saver ▪ Straps that ran ▪ Doesn't matter ▪ So far so good ▪ I thought the hair nets were annoying ▪ Black hat knows best ▪ Don't put the Navy in charge of every stick, mix them up!

Table D2. Open-Ended Comments about the Parachute Ankle Brace by Those Who Did Not Wear the Brace

Category	Type of Comment	Comment
Design	Positive	<ul style="list-style-type: none"> ▪ I thought it helped on impact ▪ I like the feel of the extra support ▪ The ankle braces gave me good support
	Negative	<ul style="list-style-type: none"> ▪ Think they are awkward and are unnecessary new piece of equipment. ▪ They look too bulky ▪ Look like would break easily ▪ They fit the old issue boot but not the new issue ones ▪ They didn't help a thing while I wore them ▪ They do not fit correctly on 90% of students in training unattached straps could cause hazards. ▪ They don't stay on and they hurt ▪ I don't think they did anything ▪ The braces did not fit right and kept coming loose ▪ It seems like a good project, just needs to be more compatible.
	Neutral	---
Comfort	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ Uncomfortable. No flexibility ▪ If you pull them tight they hurt the shins ▪ I did not wear them during jump week. They were very uncomfortable during ground and tower week. ▪ I felt my landings did not differ with or without the ankle braces. I actually felt less stress to my legs without the braces during jump week than I did during ground and tower week with them ▪ Thankfully I didn't have to use it. It seems like it would do more harm than good. It didn't fit well ▪ They don't stay on and they hurt ▪ Need more instruction on proper wear and sizing. Difficult to keep knees together without extra effort while wearing braces. Straps are not very durable. ▪ Uncomfortable. No flexibility ▪ If you pull them tight they hurt the shins ▪ I did not wear them during jump week. They were very uncomfortable during ground and tower week. ▪ I felt my landings did not differ with or without the ankle braces. I actually felt less stress to my legs without the braces during jump week than I did during ground and tower week with them ▪ Thankfully I didn't have to use it. It seems like it would do more harm than good. It didn't fit well ▪ They don't stay on and they hurt ▪ Need more instruction on proper wear and sizing. Difficult to keep knees together without extra effort while wearing braces. Straps are not very durable.
	Neutral	---
Medical/Safety	Positive	<ul style="list-style-type: none"> ▪ I think having or issuing ankle braces would be a good idea because you never know if you sprain your ankle the next time or not. ▪ I think it would be good for people with poor ankles or have had surgery ▪ Would be good for the weak. ▪ Fractured heel, sprained ankle prior to military entrance. Brace helped ▪ Hope to use in future to prevent injury. ▪ It would be good to have so less people would get hurt. ▪ Braces are for the weak. ▪ I think an ankle brace would be a positive addition for the soldier, because this would reduce the injury that would potentially happen. ▪ Could be a safe method ▪ The ankle braces are a good safety measure ▪ They helped to prevent me from re-injuring my ankle ▪ I would wear them just because I haven't injured myself yet. Don't mean I won't in the future I want to be as safe as possible ▪ I wish I would have worn one. Wouldn't be in so much pain now ▪ No room to put in ruck sack. I believe it will prevent ankle injuries.
	Negative	<ul style="list-style-type: none"> ▪ It seems rather pointless if it's only 60% effective and the injuries occur because soldiers land with their feet apart. ▪ As an MP with a V device here as part of SF training I have always trained as I have fought. This ankle brace detracts from the Airborne experience as an improper landing or a mistake is not felt as hard as it should. I busted my knee I made corrections next time to correct the mistake. These things will never be worn in a combat environment and shouldn't be in training ▪ I thought they provided no extra help, but instead might increase injury ▪ Not recommended. I do not have the impression that it increases safety ▪ During practice I was hurt more times with the braces than without ▪ Stupid – train as you are planning to jump. Last minute change=injuries

Table D2. (continued)

Category	Type of Comment	Comment
Medical/Safety	Negative	<ul style="list-style-type: none"> ▪ They do not fit correctly on 90% of students in training unattached straps could cause hazards. ▪ If the soldier land properly no brace is needed. Won't an ankle brace cause legs to be more prone to injury? ▪ No ankle brace. Soldiers will break their legs more injury due to uncomfot than from just doing what is supposed to be done. ▪ Don't need them. Throw this survey away. Won't help you to lobby Congress for the contract. P.S. Didn't the Army try this before, resulting in more broken legs? ▪ NO! How about you doing a proper PLF. A brace will not save you if you slip and land wrong.
	Neutral	<ul style="list-style-type: none"> ▪ Stop wasting my time and the military with this. This is corporate profitizing off soldiers and is a waste of taxpayers' money. Sell them on the internet instead. Notice our company didn't wear them and we had a successful week. No major injuries. ▪ Good idea but I didn't get to wear them. I still didn't get hurt so they are probably not needed.
PLF	Positive	<ul style="list-style-type: none"> ▪ Would help with PLF. Help you relax instead of worry about spreading your feet. ▪ Need more instruction on proper wear and sizing. Difficult to keep knees together without extra effort while wearing braces. Straps are not very durable. ▪ A good idea. I thought they helped maintain proper position in preparation for and during landing. They do not get in the way when worn properly ▪ Braces may be lost, are a nuisance if jumping in combat situation. May help in training for those that cannot keep feet and knees together
	Negative	<ul style="list-style-type: none"> ▪ I landed better on jump week without them than with braces from the tower ▪ I can do better PLFs without them. This week one student got his suspension lines caught in the braces ▪ I have heard only negative comments from those that have worn the brace, such as being harder to move around with and PLF with.
	Neutral	<ul style="list-style-type: none"> ▪ Keep feet, knees together and the brace shouldn't be necessary. ▪ Keep feet and knees together ▪ Correctly performed PLF prevent injuries ▪ Keeping feet & knees together will be fine ▪ If the soldier lands properly no brace is needed. Won't an ankle brace cause legs to be more prone to injury? ▪ By using the techniques taught at airborne school, there is no need for an ankle brace ▪ If you land right you don't need them ▪ I am a master of the PLF. I need no braces. ▪ I did what they taught me and landed safely every time ▪ They are not necessary if you perform a proper PLF ▪ NO! How about you doing a proper PLF. A brace will not save you if you slip and land wrong. ▪ It seems rather pointless if it's only 60% effective and the injuries occur because soldiers land with their feet apart. ▪ As an MP with a V device here as part of SF training I have always trained as I have fought. This ankle brace detracts from the Airborne experience as an improper landing or a mistake is not felt as hard as it should. I busted my knee I made corrections next time to correct the mistake. These things will never be worn in a combat environment and shouldn't be in training ▪ I don't think you need them if you perform a proper landing. ▪ Don't do it. Airborne instructors spent two weeks teaching us how to land properly. ▪ Heard bad things about it. We don't need it. Just keep feet and knees together. ▪ This is not needed. Do a proper PLF and you will be fine. Also how can I be asked to comment on something I have never used? Is this to fill a time block? ▪ Runs risk of making people overconfident and causing them to lose focus on PLF technique.
Tactical	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ How combat effective would it be to wear an ankle brace? Get better chutes ▪ I think they will help, however, they will be difficult to pack in a Alice pack and maybe take up too much room ▪ Braces may be lost, are a nuisance if jumping in combat situation. May help in training for those that cannot keep feet and knees together ▪ I think it is not practical for combat. Advise buying better parachutes not ankle braces. ▪ Not tactically sound ▪ Are these under or over the boot aids? I can tell you that for tactical purposes they don't look like something operators would want to wear under their boots. Decreased mobility, too much time to take on/off. Not ideal. ▪ The ankle brace is a horrible idea. It is untactical, requires time to put on & take off. It is more weight to carry & restricts movement
	Neutral	---

Table D2. (continued)

Category	Type of Comment	Comment
Handling	Positive	<ul style="list-style-type: none"> ▪ A good idea. I thought they helped maintain proper position in preparation for and during landing. They do not get in the way when worn properly
	Negative	<ul style="list-style-type: none"> ▪ Would be hard to run off the drop zone with an ankle brace on. ▪ Got in the way when I was training ▪ Seem like a good idea, but found they hinder your ability to run if needed. ▪ I don't like the idea. I would not feel comfortable with it. I feel it would interfere with exiting the aircraft.
	Neutral	---
Choose for Army	Positive	<ul style="list-style-type: none"> ▪ I feel everyone should use them ▪ Everyone should wear them always. ▪ I think having or issuing ankle braces would be a good idea because you never know if you sprain your ankle the next time or not. ▪ It would be good to have so less people would get hurt.
	Negative	<ul style="list-style-type: none"> ▪ It's just 1 more thing we have to wear, not really necessary. ▪ No ankle brace. Soldiers will break their legs more injury due to uncomfot than from just doing what is supposed to be done. ▪ I don't think you need them if you perform a proper landing. ▪ Don't do it. Airborne instructors spent two weeks teaching us how to land properly. ▪ Heard bad things about it. We don't need it. Just keep feet and knees together. ▪ It is not necessary. 1% injuries for a class of 300 is acceptable. ▪ I didn't have a problem with my legs or ankles at all. If properly trained the braces are not needed ▪ Don't need them. ▪ Don't use ▪ Not necessary. Design parachute that slows descent to 5 ft./sec. ▪ This is not needed. Do a proper PLF and you will be fine. Also how can I be asked to comment on something I have never used? Is this to fill a time block? ▪ Don't need them. Throw this survey away. Won't help you to lobby Congress for the contract. P.S. Didn't the Army try this before, resulting in more broken legs? ▪ The ankle brace should not be used for airborne training. ▪ They are not needed if you pay attention to training ▪ I really don't think they are needed, but a different (safer) parachute would help. ▪ They are pointless to wear and very unnecessary ▪ Don't wear them ▪ Seem unnecessary ▪ Did not see the need for them. ▪ Not needed ▪ They do not offer adequate and should not be used ▪ I think it's a good idea but should not be mandatory ▪ Positive. Does not need to be an issued item. Wear your own if necessary. ▪ Think they are awkward and are unnecessary new piece of equipment. ▪ Keep feet, knees together and the brace shouldn't be necessary. ▪ By using the techniques taught at airborne school, there is no need for an ankle brace ▪ It's just another piece of gear that we don't need taking up space in our ruck. Let those that want to wear, but don't force it on people. HOORAH government contractors ▪ I think that ankle braces would be a negative/positive; and should be optional not mandatory ▪ Good idea but I didn't get to wear them. I still didn't get hurt so they are probably not needed.
	Neutral	---
Choose for Self	Positive	<ul style="list-style-type: none"> ▪ They are good I thought they helped a lot I would wear them if I jumped again ▪ I believe the ankle supports gave me the support I needed. I am glad I was the one wearing them ▪ Good they really are bad to walk in but to land I really do want to wear them.
	Negative	<ul style="list-style-type: none"> ▪ Better off without them ▪ Don't need them ▪ I would have liked to have jumped without them, because the ankle braces do not allow you to keep your feet together. ▪ The ankle braces are not very good. I would rather not have worn them ▪ The ankle braces did not fit me properly and were more of an inconvenience than an aid. I would rather jump without them. ▪ I would prefer to jump w/o the braces because I think I could keep my feet and knees together better.
	Neutral	---

Table D2. (continued)

Category	Type of Comment	Comment
Confidence/Security	Positive	<ul style="list-style-type: none"> ▪ They made me feel confident. ▪ Didn't hinder movement at all and I felt safer in the brace ▪ Would help with PLF. Help you relax instead of worry about spreading your feet.
	Negative	<ul style="list-style-type: none"> ▪ Runs risk of making people overconfident and causing them to lose focus on PLF technique. ▪ I don't like the idea. I would not feel comfortable with it. I feel it would interfere with exiting the aircraft. ▪ I didn't wear the ankle brace during jump week and feel it gives the jumper a feeling of false security ▪ I did not care for them and was incredibly relieved to not have to wear them on the jumps.
	Neutral	---
Transport	Positive	---
	Negative	<ul style="list-style-type: none"> ▪ It is a large item and might not be worth the benefits. Just continue to train properly and execute ▪ I think it is a horrible idea. It's another item to lose; it's too large and awkward. Think about the guy who has to wear it then carry it. Airborne Ops have been conducted since WW II without them. ▪ It's just another piece of gear that we don't need taking up space in our ruck. Let those that want to wear, but don't force it on people. HOORAH government contractors ▪ It's extra gear to carry ▪ I think ankle braces is just too much junk to carry ▪ No room to put in ruck sack. I believe it will prevent ankle injuries. ▪ The ankle brace is a horrible idea. It is untactical, requires time to put on & take off. It is more weight to carry & restricts movement
	Neutral	---
General	Positive	<ul style="list-style-type: none"> ▪ I think it's a good idea but should not be mandatory ▪ It seems like a good project, just needs to be more compatible. ▪ I think the brace is a good idea, but I don't think I would wear it. ▪ I think it is a great idea. I would use it. ▪ Sounds like a good idea. ▪ Seem like a good idea, but found they hinder your ability to run if needed. ▪ I think they would be good. I would wear them. ▪ Positive. Does not need to be an issued item. Wear your own if necessary. ▪ It will help some people. ▪ I think it is a good idea. But I don't think I will ever wear one. ▪ I think that it is a good idea. ▪ Good Idea ▪ I strongly support the use of ankle braces ▪ It's a good idea but it will not help your shins or knees ▪ Would be great ▪ A brace during training may form habits that are good. ▪ It worked great for the other students ▪ They worked OK when I was on the tower ▪ Good idea but I didn't get to wear them. I still didn't get hurt so they are probably not needed. ▪ Thought they are good ▪ Good ▪ I liked their use during training. I wish I wore them during jump week. ▪ Didn't hinder movement at all and I felt safer in the brace ▪ They are good ▪ They seemed OK in training. I did not jump with them ▪ Good for you ▪ They helped during ground and tower week, but I never used them to jump. ▪ They help ▪ Very helpful ▪ I think that ankle braces would be a negative/positive; and should be optional not mandatory ▪ I didn't wear them, but I would. I think they are a good idea.
	Negative	<ul style="list-style-type: none"> ▪ Might cause more problems than good ▪ I have heard only negative comments from those that have worn the brace, such as being harder to move around with and PLF with. ▪ NO! How about you doing a proper PLF. A brace will not save you if you slip and land wrong. ▪ I disagree with it. No robot legs. ▪ The ankle brace is a horrible idea. It is untactical, requires time to put on & take off. It is more weight to carry & restricts movement ▪ More equipment bad deal. ▪ Waste of time and money. ▪ Stop wasting my time and the military with this. This is corporate profitizing off soldiers and is a waste of taxpayers' money. Sell them on the internet instead. Notice our company didn't wear them and we had a successful week. No major injuries.

Table D2. (continued)

Category	Type of Comment	Comment
General	Negative	<ul style="list-style-type: none"> ▪ I think that ankle braces would be a negative/positive; and should be optional not mandatory ▪ Please no more equipment that helps me 1 out of 1000 situations. ▪ I did not like the ankle brace ▪ I did fine. I had no ankle brace and had no problems. If it was mandatory it's just another thing to worry about. ▪ Don't need them if you do what you're told ▪ The brace would just that much more to deal with. I was fine without them. ▪ Stupid – train as you are planning to jump. Last minute change=injuries ▪ They are stupid ▪ Thankfully I didn't have to use it. It seems like it would do more harm than good. It didn't fit well ▪ Don't like them ▪ Not a good idea especially if you jump with them but not train with them ▪ I tried them and feel that they are for pussies ▪ They do not offer adequate and should not be used ▪ They are more harmful than helpful and an unrealistic training tool. We won't have them in combat so we should not train with them ▪ They suck. Waste of money ▪ It was useless ▪ I did not care for them and was incredibly relieved to not have to wear them on the jumps. ▪ They are pointless ▪ I don't like them ▪ Useless ▪ I find them bulky and had no need for them. ▪ I don't need it and it is a bad idea ▪ Need more instruction on proper wear and sizing. Difficult to keep knees together without extra effort while wearing braces. Straps are not very durable.
	Neutral	<ul style="list-style-type: none"> ▪ Don't know. Haven't made enough jumps to know. ▪ Unsure – Not enough experience within the “community” ▪ Did not have brace ▪ Did not use ▪ Was not given opportunity to wear one ▪ Never wore it ▪ Never got to try them out ▪ Ankle warmers will not be worn at the unit. Why should they be worn here? ▪ I could not see any difference ▪ Made no difference to me ▪ Did not seem to make much of a difference ▪ I felt my landings did not differ with or without the ankle braces. I actually felt less stress to my legs without the braces during jump week than I did during ground and tower week with them
Not Relevant		<ul style="list-style-type: none"> ▪ A little more padding for the glutious maximus would help ▪ PLEASE Stop soliciting this poor Army branch. It is wrong! ▪ Need knee braces ▪ Thanks for telling us about this AFTER we jumped! Way to be on top of that one guys. ▪ Do they come in assorted colors/sizes? ▪ If you are here to sell items to the Soldiers...you are thieves preying on U.S troops. Please go away forever ▪ Good luck with the test. ▪ These are not worth \$100.00. Made in China @ \$25 a pair. ▪ I never received one, but I was perfectly fine in my confidence and abilities to perform a PLF. ▪ I have no problems without an ankle brace ▪ Didn't use brace, but good training is better than plastic ▪ I want better parachute ▪ I had no personal problems with my ankles ▪ We were never instructed on how to use the equipment

APPENDIX E
Acknowledgements

We would like to thank the Airborne students who completed the survey reported here.