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Prospective Assessment Of Health Disparities And Injury Risk Factors At Basic Combat Training At Ft. Jackson

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PROSPECTIVE ASSESSMENT OF HEALTH DISPARITIES AND INJURY RISK FACTORS
AT BASIC COMBAT TRAINING AT FT.JACKSON

by

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DEDICATION

To all of the men and women that will, are, and have dedicated their lives to defending the United States of America against all enemies foreign and domestic.

ABSTRACT

Numerous recruits for Basic Combat Training (BCT) for the Army fail to complete the course due to injury and time lost. This study was designed to provide a more thorough list of risk factors involved in injury and attrition through real-time data analysis throughout a cycle of BCT. Throughout BCT, a researcher was placed in the Battalion Aid Station (BAS) and recorded the reason for the visit, whether it was a new or existing condition, injury location, medical history, and how long this injury has been an issue. Several risk factors were tested: sex, age, and ethnicity/race. It was found that 39.87% of the Female recruits and 28.34% of the Male recruits visited the BAS. The age that produced the highest percentage of Male recruit visits over 30 years old (37.50%) and the Female recruits was 18-20 years old (46.38%). Non-Hispanic Native Hawaiian and Pacific Islander Males had the highest rate of BAS visits at 40.00% and Non-Hispanic Black Females had the highest rate at 45.42%. The visits to the BAS were higher for Female recruits; older male and younger female recruits.

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LIST OF ABBREVIATIONS

APFT.. Army Physical Fitness Test

BCT.. Basic Combat Training

BAS..Battalion Aid Station

BIA ....Bioelectrical Impedance Assessment

NHA..Non-Hispanic Asian

NHAIAN...Non-Hispanic American Indian and Alaskan Native

NHB ....Non-Hispanic Black

NHM ....Non-Hispanic More than 1 Race

NHNHPI .... Non-Hispanic Native Hawaiian and Pacific Islander

NHW .... Non-Hispanic White

SHPERHD .... Soldier Health Promotion to Examine and Reduce Health Disparities

CHAPTER 1

INTRODUCTION

Basic combat training (BCT) is a 9-week intensive training course designed to indoctrinate civilians into all aspects of the military while exposing them to a myriad of physical, psychological, environmental, and ecological stressors. Despite years of research and scores of improvements in physical training and conditioning practices, numerous Soldiers fail to complete BCT because of injury and lost training time. Approximately 90% of the discharges and recycles can be attributed to injuries and failure to meet minimal training standards.[3,6,15,18,19,25,26,30,36,42,47] A recent epidemiological study at Fort Jackson, South Carolina found that attrition could exceed 7%.[3,26,30,34,36] This falls within the average attrition rate found for the fiscal years 2006-2011 of 6-14% for first BCT service.[1] Therefore, financial burden associated with attrition is substantial considering that the Army trains nearly 100,000 new Soldiers each year. It has been found that among active duty and non-deployed service members a total of 743,547 injuries were experienced in 2006, which produced an injury rate of 628 per 1000 person-years.[17]

The Military already experiences high costs when it comes to training Soldiers for all necessary field encounters. Therefore, strategies to decrease the likelihood of injury are likely to result in substantial cost savings. The United States Army estimates that the cost of training a single Soldier from the time they walk into the recruiting station until their first duty assignment to be approximately $74,800 by fiscal year 2012 figures.[53]

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Even a small reduction in the incidence of recycling and attrition would have a profound financial impact. Injury contributes to an additional financial burden that may not result in attrition, but is reflected in additional treatment costs. Commonly reported training "burdens" have been musculoskeletal injuries (with the majority being to lower the extremities). Injuries pose an enormous burden to both the Soldier and U.S. government, including cost-to-treat, lost work or training time, decreased military readiness and recruit attrition.

It was found that approximately 25% of male and 50% of female recruits for the Department of the Army experience one or more musculoskeletal injuries during BCT.[24,34,39] Knapik et al has further delineated that not only do these injuries occur at a high rate; but also, the majority of these injuries are at or below the knee (59% and 69% of all-cause injury, men and women, respectively).[27,34] Known risk factors that predispose one to injury have been extensively examined and include, but are not limited to: age, sex, smoking, and physical fitness (aerobic endurance, muscular endurance, muscular strength, etc). For example, stress fractures have been reported to be 1.5 – 2.0 times higher in females.[23,25,26] However, little information is available with regard to racial, ethnic, and/or socioeconomic disparities. In addition to time lost due to injuries, cost-to-treat musculoskeletal injuries are estimated to be $16.5 million during initial entry training.[4] According to Knapik et al, reducing injuries via changing formal physical fitness training during BCT could save ~ $14 million annually.[29]

A sedentary lifestyle prior to arriving at BCT is a known risk factor for attrition, being recycled, and overuse injury.[19,21,24-26,29,30,32,43,47,49] Recently, Knapik et al reported average step counts during BCT to be 16,311 +/- 5,826 per day, or nearly three times

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the expected step count (approximately 5,000) of sedentary individuals.[31,50] In 2009, Knapik et al found that male and female recruits have been failing the Army's 1-1-1 physical fitness assessment at a declining rate, from 4% in 2003 to 34% in 2009 and 10% in 2003 to 47% in 2009 respectively.[38] This indicates that there has been a steady increase in sedentary activity prior to BCT in recruits. The activity levels and step-counts during BCT increase drastically compared to pre-service levels, thus providing little time for the musculoskeletal structure of sedentary individuals to adjust to the increase in activity levels. In addition to step counts and activity level, the time Soldiers spend on their feet (in a load bearing state) is likely to contribute to injury risk. Most musculoskeletal injuries in particular present in the first 3-weeks of BCT.[33] Therefore, the stress reaction process almost certainly occurs early in training.[44] However, besides the single study documenting step counts, little is known about load progression during BCT. The Soldier Health Promotion to Examine and Reduce Health Disparities (SHPERHD) project was designed as a gateway to study problems related to various health aspects effected during recruitment, BCT, and post-deployment. As part of the SHPERHD project, the purpose of this particular study was to provide a more thorough list of risk factors involved in injury and attrition in real time throughout a cycle of BCT. This study was unique in that the injury data was collected in real time comprehensively over the three phases of BCT.

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CHAPTER 2

METHODS

The Human Use Review Committee at the University of South Carolina (USC) and the Medical Research and Material Command approved this study that was conducted at Fort Jackson, South Carolina (2009 – 2011). All participants in the current investigation provided their informed voluntary consent after being briefed by study personnel about the study rationale and their role as research participants. Investigators adhered to U.S. Army Regulation 70–25, U.S. Army Medical Research and Materiel Command Regulation 70–25 and policies regarding the protection of human subjects as prescribed by Code of Federal Regulations (CFR) Title 45, Volume 1, Part 46; Title 32, Chapter 1, Part 219; and Title 21, Chapter 1, Part 50 (Protection of Human Subjects). A consent form was utilized that was consistent with University of South Carolina, Fort Jackson and USAMRMC ORP HRPO policies. This form was for the consent to participate in the Injury/Surveillance Component of the study. The demographics questionnaire collected baseline risk factors and information related to health disparate populations (race, ethnicity, date of birth, smoking behavior, sex, last zip code).

A research assistant at the Battalion Aid Stations (BAS) conducted daily injury surveillance during operational hours Monday through Saturday. The research assistant determined if a Soldier was part of the study, then documented the reason for the Soldiers' visits (illness and or injury), if it was a new or existing condition, the location of injury or symptoms, previous history of condition, and how long the symptoms have

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persisted. As each company/class graduated BCT, the Company Commander or their designate was asked to provide a list of all Soldiers who graduated and those who were separated along with the reason for their separation.

Data analyses included both descriptive and inferential. Descriptive statistics included frequencies, proportions affect sizes and means and standard deviations for the baseline and measured variables as warranted. Inferential analyses included rates with 95% confidence intervals that were calculated for both injuries per 100 days of training. Relative risk and relative risk ratios were calculated with 95% confidence intervals to compare risk for injury, referral and attrition. Missing data was handled by using the methods of Royson et al., in employing a MICE model (i.e., multiple imputation of chained equations).[48]

CHAPTER 3

RESULTS

During cycle one there were 502 Soldiers in the battalion that was monitored; however, only 467 Soldiers chose to participate in the study. There were 314 men and of those men, 89 of them visited the BAS and accounted for 53.85% of the total number of visits. There were 153 women that chose to participate, 61 of them visited the BAS and accounted for 46.15% of the total number of visits. Out of the 299 total visits to the BAS, 106 of them were referrals and 43 of those visits were by men and 63 were by women. Females were 1.7 times more likely to be referred to the BAS than males. Physical injuries accounted for 61.1% of the visits and the other 38.9% of the visits were non-physical reasons (i.e. colds, infections, general pains, pick-up medication, etc) (Table 3.1).

The ages of the 313 male Soldiers that visited the BAS ranged from 18 to over 30. The youngest age group of the male Soldiers was 18 to 20 years old and there were a total of 147 that participated in the study. This was the age range that contained the highest number of visits to the BAS (81 visits). This number of visits corresponds to 50.31% of overall male soldier visits to the BAS. The subsequent age rage was 21 to 25 years old and this range contained 122 male Soldiers. There were 60 visits to the BAS in this age range and that accounted for 37.27% of total visits to the BAS for male Soldiers. There were 28 male Soldiers within the 26 to 30 year old age range, that represented 9 total visits and 5.59% of the visits to the BAS during cycle one. The final age range was over

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30 years old and there were 16 Soldiers and 11 total visits by this group, which counted for 6.83% of the total number of visits (Table 3.2).

There were 152 Female Soldiers that visited the BAS and their ages ranged from 18 to over 30 years old. Within the first age range, 18 to 20 years old, there were 69 Soldiers and 66 total visits to the BAS, which accounted for 46.81% of total visits. This was the age group that had the highest percentage of visits to the BAS. A total of 60 Soldiers represented the next age group, 21 to 25 years old, and they visited the BAS 52 times within cycle one. Their total percentage of visits was 36.88%. The 16 Female Soldiers ages 26 to 30 years old visited the BAS 15 times and accounted for 10.64% of total visits. There were 7 Female Soldiers over 30 years old and they visited the BAS 8 times overall, which accounted for 5.67% of the total visits to the BAS (Table 3.3).

The demographics for the Male Soldiers were further broken down into their race and ethnicity. There were 199 Non-Hispanic White (NHW) Male Soldiers that participated in the study and this group had 107 total visits to the BAS. This accounted for 66.88% of the total visits, the highest of all of the groups. The Non-Hispanic Black (NHB) Male Soldiers were 51 in total and visited the BAS a total of 28 times, which accounted for 17.5% of total visits. A total of 43 Hispanic Male Soldiers participated and had a total of 17 visits to the BAS. Their cumulative percentage of visits was 10.63% of the total. The Non-Hispanic Asian (NHA) Male Soldiers totaled 8 and the Non-Hispanic Native Hawaiian and Pacific Islander (NHNHPI) Male Soldiers totaled 5. Both of these groups visited the BAS 3 times and their total percentage of visits was 1.88% overall. The Non-Hispanic More than 1 race (NHM) were represented by 7 Male Solders and

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accumulated 2 visited overall. They accounted for 1.25% of total visits to the BAS (Table 3.4).

There were 71 NHW Female Soldiers that participated in the cycle one study. They visited the BAS 64 times and had the highest percentage of visits, 45.39%. The NHB Female Soldiers were 42 in all and had 40 total visits to the BAS. They had the second highest percentage of visits, 28.37%. The 22 Hispanic Female Soldiers visited the BAS 21 times and accounted for 14.89% of the total number of visits. The NHA Female Soldiers were 7 in all, visited the BAS 4 times, and accounted for 2.84% of cumulative visits. There were 5 NHNHPI Female Soldiers and they visited the BAS 3 times and they accounted for 2.13% of the total number of visits. The 6 NHM Female Soldiers visited the BAS on 9 separate occasions and represented 6.38% of the total (Table 3.5). The group that was not represented in either the Male or Female Soldier subcategory was the Non-Hispanic American Indian and Alaskan Native (NHAIAN) Soldiers (Table 3.4 and Table 3.5)

TABLE 3.1 BATTALION AID STATION DATA BY SEX CYCLE ONE

Metric		N	% of total N	Number of Unique Visits	% of Unique Visits	% of Soldiers who Visited BAS	Total Number Visits	% of Total Visits	Number Referred	% Referred	Relative Risk	95% CI
Sex	Male	314	67.24%	89	59.33%	28.34%	161	53.85%	43	26.71%	referent	
	Female	153	32.76%	61	40.67%	39.87%	138	46.15%	63	45.65%	1.71	1.25, 2.34
	Total	**467**		**150**		32.12%	**299**		**106**	35.45%		

Representative of the number of visits to the BAS by Male and Female Soldiers throughout a cycle of BCT. The second column labeled N represents the number of soldiers per sex. Unique visits correspond to the number of soldiers that visited the BAS one or more times. Referred visits correspond to the soldiers that were requested to go to the BAS.

TABLE 3.2 NUMBER OF VISITS AND REFERRALS BY AGE FOR MALE SOLDIERS

Metric		N	% of total N	Number of Unique Visits	% of Unique Visits	% of Soldiers who Visited BAS	Total Number Visits	% of Total Visits	Number Referred	% Referred	Relative Risk	95% CI
Male/ Age	18-20	147	46.96%	40	44.94%	12.78%	81	50.31%	22	27.16%	referent	
	21-25	122	38.98%	36	40.45%	11.50%	60	37.27%	17	28.33%	1.04	.61-1.79
	26-30	28	8.95%	7	7.87%	2.24%	9	5.59%	3	33.33%		
	30>	16	5.11%	6	6.74%	1.92%	11	6.83%	1	9.09%	0.74	0.29-1.90
	Total	313		89		28.43%	161		43	26.71%		

Representative of the number of visits to the BAS by Male Soldiers, sorted by age, throughout a cycle of BCT. The second column labeled N represents the number of Male soldiers per age range. Unique visits correspond to the number of soldiers that visited the BAS one or more times. Referred visits correspond to the soldiers that were requested to go to the BAS.

TABLE 3.3 NUMBER OF VISITS AND REFERRALS BY AGE FOR FEMALE SOLDIERS

Metric		N	% of total N	Number of Unique Visits	% of Unique Visits	% of Soldiers who Visited BAS	Total Number Visits	% of Total Visits	Number Referred	% Referred	Relative Risk	95% CI
Females/ Age	18-20	69	45.39%	32	52.46%	21.05%	66	46.81%	35	53.03%	referent	
	21-25	60	39.47%	22	36.07%	14.47%	52	36.88%	19	36.54%	0.69	0.45-1.05
	26-30	16	10.53%	5	8.20%	3.29%	15	10.64%	6	40.00%		
	30>	7	4.61%	2	3.28%	1.32%	8	5.67%	3	37.50%	0.74	0.42-1.29
	Total	152		61		40.13%	141		63	44.68%		

Representative of the number of visits to the BAS by Female Soldiers, sorted by age, throughout a cycle of BCT. The second column labeled N represents the number of Female soldiers per age range. Unique visits correspond to the number of soldiers that visited the BAS one or more times. Referred visits correspond to the soldiers that were requested to go to the BAS.

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TABLE 3.4 NUMBER OF VISITS AND REFERRALS BY RACE/ETHNICITY FOR MALE SOLDIERS

Metric		N	% of total N	Number of Unique Visits	% of Unique Visits	% of Soldiers who Visited BAS	Total Number Visits	% of Total Visits	Number Referred	% Referred	Relative Risk	95% CI
Male Race & Ethnicity	NHW	199	63.58%	56	63.64%	28.14%	107	66.88%	25	23.36%	referent	
	NHB	51	16.29%	15	17.05%	29.41%	28	17.50%	10	35.71%	1.53	.84-2.80
	Hispanic	43	13.74%	10	11.36%	23.26%	17	10.63%	5	29.41%	1.26	.56-2.84
	NHA	8	2.56%	3	3.41%	37.50%	3	1.88%	1	33.33%		
	NHAIAN	0	0.00%	0	0.00%		0	0.00%	0			
	NHNHPI	5	1.60%	2	2.27%	40.00%	3	1.88%	0	0.00%		
	NHM	7	2.24%	2	2.27%	28.57%	2	1.25%	1	50.00%	1.07	.31-3.73
	Total	**313**		**88**		28.12%	**160**		**42**	26.25%		

Representative of the number of visits to the BAS by Male Soldiers, sorted by race/ethnicity, throughout a cycle of BCT. The second column labeled N represents the number of Male soldiers per race/ethnic group. Unique visits correspond to the number of soldiers that visited the BAS one or more times. Referred visits correspond to the soldiers that were requested to go to the BAS.

TABLE 3.5 NUMBER OF VISITS AND REFERRALS BY RACE/ETHNICITY FOR FEMALE SOLDIERS

Metric		N	% of total N	Number of Unique Visits	% of Unique Visits	% of Soldiers who Visited BAS	Total Number Visits	% of Total Visits	Number Referred	% Referred	Relative Risk	95% CI
Female Race & Ethnicity	NHW	71	46.41%	28	45.90%	39.44%	64	45.39%	26	40.63%	referent	
	NHB	42	27.45%	19	31.15%	45.24%	40	28.37%	19	47.50%	1.67	.75-1.82
	Hispanic	22	14.38%	7	11.48%	31.82%	21	14.89%	10	47.62%	1.17	.68-2.00
	NHA	7	4.58%	3	4.92%	42.86%	4	2.84%	3	75.00%		
	NHAIAN	0	0.00%	0	0.00%		0	0.00%	0			
	NHNHPI	5	3.27%	2	3.28%	40.00%	3	2.13%	2	66.67%		
	NHM	6	3.92%	2	3.28%	33.33%	9	6.38%	3	33.33%	1.23	.69-2.18
	Total	**153**		**61**		39.87%	**141**		**63**	44.68%		

Representative of the number of visits to the BAS by Female Soldiers, sorted by race/ethnicity, throughout a cycle of BCT. The second column labeled N represents the number of Female soldiers per race/ethnic group. Unique visits correspond to the number of soldiers that visited the BAS one or more times. Referred visits correspond to the soldiers that were requested to go to the BAS.

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CHAPTER 4

DISCUSSION

The overall aim of the SHPERHD project at Fort Jackson, SC was to examine a myriad

of issues related to the 9-week BCT that Soldiers undergo. This project combined both a

prospective and retrospective analyses of different aspects of BCT, specifically as it

related to the physical and mental demands placed on Soldiers over the 9 weeks of

training. In addition, a clear objective was established to examine specific background

variables on Soldiers, including race/ethnicity, age, and sex, as it pertained to different

physical variables, especially injuries, for Soldiers in training. It was reported in 2011

that approximately 25% of male and 50% of female recruits sustain more than one injury

throughout BCT[52] and these injuries are the reason for more than 80% of the discharges

within the first year recruiting class.[2,41] Understanding the risk factors and being able to

see in a real-time manner the types of injuries that occur throughout BCT could help

determine predisposition to certain types of injuries obtained during BCT, thus helping

the Army save 2 billion dollars worth of medical costs yearly due to injuries.[10] The three

categories that were used to differentiate between the soldiers that visited the BAS

throughout cycle one of BCT were sex, age, and race/ethnicity.

There have been mixed reviews when it comes to comparing Male Soldiers to

Female Soldiers with regards to differences in injury rates. In this study, the ratio of Male

Soldiers to Female Soldiers was roughly 2 Males per 1 Female. There were 89 Male

Soldiers that visited the BAS throughout BCT and they accounted for 59.33% of unique

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visits. The Female Soldiers had 61 unique visits that accounted for 40.67% of the total number of unique visits. Even though the percentage of unique visits was greater for the Male Soldiers than the Female Soldiers, there was a higher percentage of total Female Soldiers (39.87%) that visited the BAS than total Male Soldiers (28.34%). In a previous study, Bell et al looked at Male and Female recruits, specifically, and attributed the difference in injury rate mainly to their fitness level throughout training.[7] In a literature review by Bulzacchelli et al, they concluded that the evidence presented in several studies is not strong enough to help support a theory that Female Soldiers are at a higher risk of obtaining an injury during BCT when compared to Male Soldiers.[8] However, in several previous BCT and military studies by Knapik et al., Male Soldier injury rates range between 14-42% and Women's rates ranged between 41-67%.[36] The percentage of Male Soldiers that visited the BAS in this study falls within the range that was found by Knapik et al; however, the percentage for Female Soldiers does not fall within the range. Knapik's study involved 840 Males and 571 Females producing a ratio of roughly 1 Male per 0.75 Females.[36] The disparity in size between this study and Knapik's could explain why the Female range does not fall within their range. Knapik et al also conducted a study during a 19-week military police training course where they found that women were more likely to be discharged and recycled, 3.13 and 2.75 times respectively, when compared to the males. The injury incidence for Women was found to be 51.2% for training-related injury index and 17.8% for Males.[28] These values fall within the previously reported values from Knapik's earlier findings and help to support the findings in this study. Even though the percentages where much greater than the ones in this study, it still supports the trend that the percentage of Female injuries are higher than

Male injuries. In 2006, the National Research Council questioned if any sort of fitness-based intervention or injury preventative program could account for anatomical and physiological differences women have compared to men that predispose them to injury.[40] These anatomical and physiological differences could be an explanation as to why it is more likely for a Female Soldier to sustain an injury compared to a Male Soldier.

The age of a soldier with regards to injury rates has been previously studied, but not in a real time data collection manner. In this study there were 40 Male and 32 Female Soldiers aged 18-20 that visited the BAS and those soldiers accounted for 27.21% and 46.38% of the total number of Soldiers within their age range. The following age range of 21-25 had 36 Male and 22 Female Soldiers sustain an injury corresponding to 29.51% and 36.67% of the number of Soldiers within the mentioned age range. The subsequent age range of 26-30 had 7 Male and 5 Female Soldiers visit the BAS and they accounted for 25% and 31.25% of their population. The final age group of 30 and older had 6 Male and 2 Female Soldiers sustain injuries and they represented 37.50% and 28.57% of the Soldiers in their age range. The trend for Male Soldiers was the older in age a Soldier was the more visits to the BAS, however it was the opposite for the Female Soldiers. There have been several studies performed that have stated that trainees between the ages of 20-24 are 1.2-1.3 times more likely to sustain an injury and those that are 25 or older are 1.5-4.3 times more likely to sustain an injury than the younger trainees regardless of sex.[8] Also, Knapik et al found that in general men and women have an increased chance of acquiring an injury at an older age during One-Station Unit Training (OSUT).[28] Their findings are consistent with several other authors that concluded that during BCT both men and women of an older age are more likely to experience an injury.[20,25,34,35,37] Older

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age should coincide with an increased risk of injury due to several changes that occur within the body as a human begins to age. Stem cells begin to lose their ability to initiate and conduct tissue repair, increased susceptibility to microtraumas, and loss of muscle mass, strength, endurance, flexibility, and aerobic capacity are a large fraction of factors that change throughout the body with age.[11,12,35] The Male Soldier's positive correlation with the increase in age and visits to the BAS could be explained by the aging process described above; however, the Female Soldier's negative correlation between age and visits to the BAS does not follow the trend seen in other studies. This could be due to the fact that these studies had more Female recruits in the older age groups or they separated their age groups differently than done in this study. It could also be explained by the smaller conglomerate of older Female recruits in this study arriving to BCT physically fit and prepared for the training.

Ethnicity as a risk factor has been observed in several studies and no clear conclusions have been drawn. In this study, there were 56 Male and 28 Female NHW Soldiers that visited the BAS throughout BCT. They accounted for 28.14% of the Males and 39.44% of the Female Soldiers in their ethnic group. The NHB Male and Female Soldiers had 15 Male and 19 Female Soldiers visit the BAS. The Soldiers that visited the BAS represented 29.41% of the Males and 45.42% of the Female NHB Soldiers. There were 10 Male and 7 Females visited the BAS and this accounted for 23.26% and 31.82% of the total number of Males and Female Hispanic Soldiers, respectively. There were 3 Male and 3 Female NHA Soldiers that visited the BAS and they accounted for 37.50% of the Males and 42.86% of the Females. The Male and Female NHNHPI and NHM Soldiers both had 2 Soldiers visit the BAS. Both Male and Female NHNHPI Soldiers that

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visited the BAS accounted for 40% of the total and the NHM Male Soldiers accounted for 28.57% and 33.33% of the Females. The NHNHPI Male Soldiers and the NHB Female Soldiers had the highest percentage of Soldiers visit the BAS throughout BCT. In a study comparing Infantry (I), Artillery (CA), Construction Engineers (CE), and Special Forces (SF) Soldiers by Reynolds et al., it was found that Caucasian/NHW CA and CE Soldiers are more likely to experience low back and lower extremity musculoskeletal injuries.[46] It was also found in several other studies that Caucasian/NHW Soldier trainees have a higher susceptibility to blisters and stress fractures compared to African Americans/NHB.[5,16,47] Hruby et al found a semi-positive correlation between BMI and injuries in US Army Soldiers and they saw that those that identified as Hispanic were more overweight and obese than those that identified as NHW and NHB.[22] Therefore from this data, it can be extrapolated that Hispanic Soldiers are more likely to experience an injury than NHW and NHB Soldiers. In a study on discharge from Marine Corp Basic Training by Reis et al, it was found that Non-Hispanic Caucasians/NHW were 2.28 times more likely to be discharged than those that identified as Hispanic.[45] This finding was congruent with several other findings, although there is not a clear explanation as to why this ethnicity is more likely to be discharged.[9,13,14,30,45,51] Most of the studies find that NHW are more susceptible to injury and thus discharge; however, the findings in this study do not correlate. It is most likely the case that NHW have been found to have the highest rates of injury and discharge because they make up more of the population of recruits and Soldiers in each branch; thus, the probability of NHW experiencing an injury or being discharged is much higher. This study has an advantage over all of the other studies because it is real-time data, not data taken from previous medical charts and

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surveys. The findings that NHNHPI Male and NHB Female Soldiers having the highest incidence of visiting the BAS does not have any support in the literature mainly because there has not been a clear conclusion on what ethnicity predisposes an soldier to injury or discharge which can be related to visits to the BAS.

While our findings add significantly to the current literature on injury rates in BCT, there are a number of limitations that should be noted. This study was limited to only the data for the personnel that went through BCT in Ft.Jackson during one cycle. The normal size of a class of BCT soldiers should range between 1000-1200 soldiers; however, this class that was observed was just over 500 Soldiers. This study also did not represent all recruits in BCT because all of the ethnicities (e.g. NHAIAN) were not represented; this could be due to the geographic location of the BCT that was observed. Further, the data that was obtained during this cycle was extensive and could not all be included. This comparison may be skewed because the data values were not separated between injury and non-injury visits. It was found that 61.1% of the visits were for physical injuries (sprains, strains, fractures, etc.); however, the data for the separation between physical injuries, other injuries, and non-injuries was unavailable and could not be used to help accurately assess sex, age, and ethnicity/race as risk factors.

There are several factors that can lead to injury in Soldiers that are going through BCT. Sex, age, and ethnicity are not the only risk factors, but they are the factors that a Soldier has no control over and thus knowledge of the probability of injury would allow for strategies that may prevent injury in individuals at risk. It was shown that Female Soldiers overall visit the BAS at a greater rate than Male Soldiers. Based off the rate of visits it can be inferred that Female Soldiers are more likely to sustain an injury than

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Males. Older Male Soldiers had the highest percentage of visits to the BAS and follow the previous literature trends that state that the older the Soldier the more likely they are to become injured. Older Female Soldiers did not follow the trend; however, their numbers were small cumulatively so that could explain why they did not do so. More research needs to be performed on the race/ethnicity of Soldiers to find a trend that can be applied to injury rates. From this data it can be inferred that Female and older Soldiers sustain injuries at a higher percentage than Male and younger Soldiers participating in BCT.

Future steps in the SHPHERD project would be to present the data on the BAS visits with the total separated into categories of non-injuries, physical injuries, and other injuries. Since the data was collected in real-time, there should be a time stamp on the visits, which can be used to find out during what phase and activity the recruit sustained an injury. This can be very helpful because based off of the number of BAS visits alone it is recommended to establish a workout regiment each recruit should perform prior to entering BCT. There should be several different programs designed, some more tailored towards those recruits that have a rather sedentary lifestyle and one for those that have a more active lifestyle. This design should allow for the recruits to enter physically fit, having performed some of the tasks that they will encounter throughout BCT, and with a lower probability of sustaining an injury because their bodies will be more prepared for the specific training activities during each phase.

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