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Obesity Epidemic in the Military: Implications for Veterans

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Abstract

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by

Tracy Lewis

MA, Webster University, 1995

BS, West Chester University, 1982

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Care Administration

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Abstract

The purpose of this study was to examine the impact of overweight and obesity on veterans' careers. Obesity, once thought unproblematic for the military, is being recognized as a health concern that has expansive implications for the health and readiness of service men and women, as well as for veterans. There is an abundance of information on obesity within the general population, but research on the impact of obesity on military careers is limited. This quantitative, cross-sectional research study investigated how obesity is a challenge throughout a veteran's career, from enlistment to retirement, using an online survey to gather data related to demographics including rank, age, race/ethnicity, education level, marital status, and years of service. Data were analyzed using descriptive statistics, independent *t* tests, Levene's test, and the Mann-Whitney test. Results of the analyses showed that military veterans' overweight at separation contributes to their likelihood of adverse weight-related experiences while in the service, and that military veterans who are overweight or obese have more adverse weight-related experiences than those who were not obese when they separated from the military. Among respondents who were not overweight at separation, women had more adverse weight-related experiences than men. The findings of this study could change how military leaders and policy makers develop new programs, promoting a focus on the prevention of obesity rather than on causes of obesity. Understanding how overweight and obesity affect service members' careers could lead to increased appreciation of the importance of ensuring military readiness through interventions that address multiple levels of influence.

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Dedication

This dissertation is dedicated to all the Soldiers, Airmen, Sailors, Marines, Coast Guard, and Veterans who give so much of themselves to ensure we can enjoy life and all its liberties this country has to offer. This dissertation is also dedicated to military families, especially my own family, Alfonso, Alyse, and Jazmyne, who incessantly support, encourage, and motivate us to "Be All You Can Be."

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Several key individuals played instrumental roles in the victorious pursuit of my doctoral degree. My sister-in-law, Dr. Evelyn Lewis-Clark, provided indispensable support from the conception to the completion of this research project. I thank you for your wisdom, patience, and ability to ignite my enthusiasm to learn and pursue my academic dream. Mrs. Shirley Bowens, thank you for your prompt reviews and insight, which guided me through the multilevel process. I thank my fellow classmates who provided their feedback, constructive criticism, and encouragement when I wanted to give up. Many thanks to Dr. Montgomery, Dr. Blanson, Dr. Kloos, and Nate Szejniuk for your support and willingness to give up your time to ensure I was on the path to success.

I would like to personally say thank you to my family and friends for keeping me focused and motivated through this entire process. Your prayers, astonishing patience, and unconditional love throughout this journey would not let me quit. A special thanks to my husband, Alfonso L. Lewis, for your unwavering support and love.

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Chapter 1: Introduction to the Study

Introduction

Obesity, as defined by the Centers for Disease Control and Prevention (CDC), occurs when adults 20 years and older have a body mass index (BMI) greater than or equal to 30; adults are considered overweight when they have a BMI between 25 and 29.9 (CDC, 2012). The potential causes of obesity are diverse, but the primary cause is a high-caloric diet adjoined with a lifestyle where physical activity is deficient (Haidar & Cosman, 2011). Obesity is one of the top national health threats and public health challenges facing the United States. The U.S. Surgeon General affirmed that obesity is now of epidemic extent (Crawley & Maclean, 2013). Currently, more than 35% of American adults and 17% of children are categorized as obese (Ogden, Carroll, Kit, & Flegal, 2014). This equates to 78 million adults and 12 million children with obesity (Trogdon, Finkelstein, Feagan, & Cohen, 2012). In 1980, all U.S. states had obesity rates greater than 15%. This rate continued to rise, and, by 1995, there were no states with an obese population smaller than 21.19 % (Gaines, 2015). In 2014, 42 states had obesity rates greater than 25%, and 30 states reported rates greater than 30% (Bornstein et al., 2018, Gaines, 2015). Figures 1 and 2 present the adult obesity rates per state as of 2014 and 2017, respectively.

Figure 1. Adult obesity rates in 2014. From *The State of Obesity 2015: Better Policies for a Healthier America* (p. 9), by Trust for America's Health, 2015 (https://stateofobesity.org/wp-content/uploads/2018/08/stateofobesity2015.pdf). Copyright 2015 by the Robert Wood Johnson Foundation.

Obesity Prevalence 2017

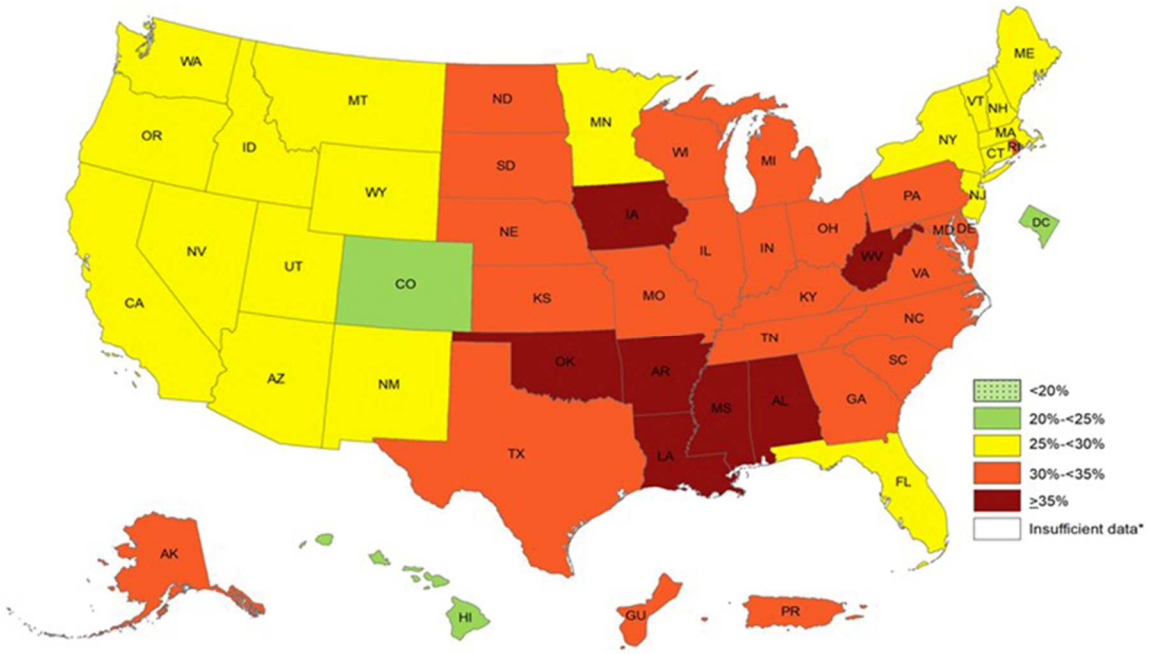

Figure 2. Obesity Prevalence in 2017. From Behavioral Risk Factor Surveillance System. by Centers for Disease Control and Prevention, (2017). (https://www.cdc.gov/obesity/data/prevalence-maps.html). In the public domain.

Changes in the social environment such as reduction of physical fitness and nutrition curricula in schools, larger portion sizes, diets high in fat, and lack of access to playgrounds, parks, or healthy and affordable foods contribute to obesity, as do many hours spent in front of television or computers (Haidar & Cosman, 2011). There are many existing studies on obesity as it relates to the general population; however, few studies have focused on military members or veterans (Adams & White, 2009; Almond, Kahwati, Kinsinger, & Porterfield, 2008; Rush, LeardMann, & Crum-Cianflone, 2016; Sustin, Ferrucci, Zonderman, & Terracciano, 2011; Voss, Pavela, & Stanford, 2018).

Gaines (2015) and Stefanovics, Potenza, and Pietrzak (2018) ascertained that if obesity rates persist on the current path, more than 51% of Americans will be obese by 2030 (Figure 3).

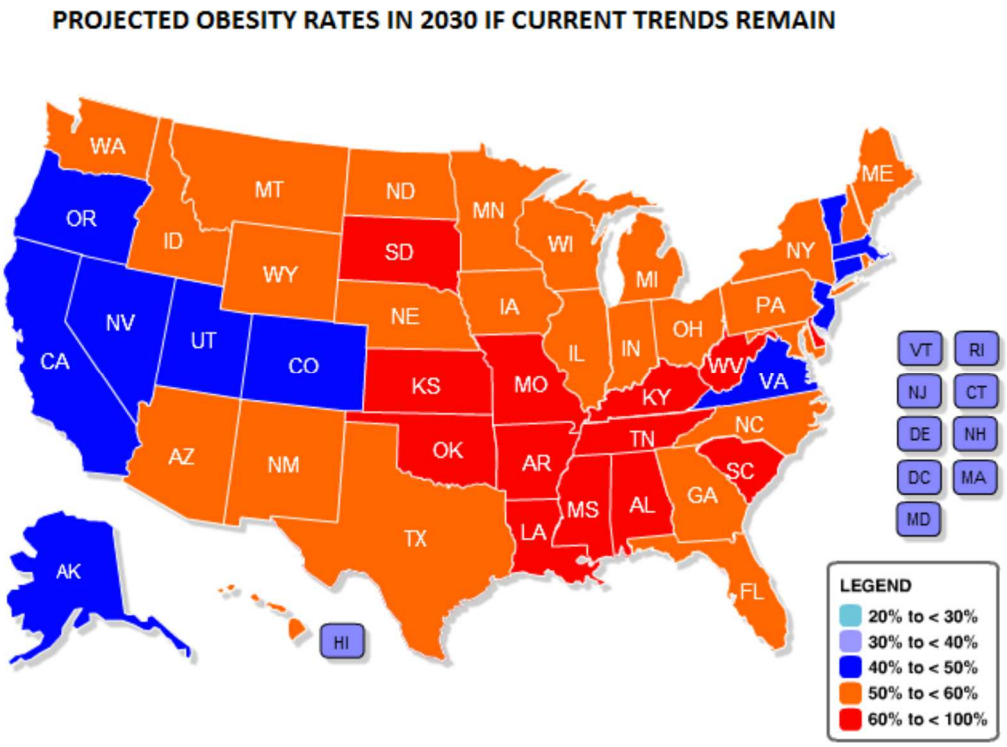

Figure 3. Projected obesity rates by state in 2030. From Trust for America's Health. by Trust for America's Health, 2015 (https://stateofobesity.org/wp-content/uploads/2018/08/stateofobesity2015.pdf). Copyright 2015 by the Robert Wood Johnson Foundation.

Awareness of the effects of obesity among veterans and service members, who make up 13% of the population, may be beneficial to other members of the military community who have limited knowledge of the depth of this crisis (Jay, Mateo, Squires, Kalet, & Sherman, 2015). The high rates of obesity and overweight have repercussions for national security if the Department of Defense is unable to recruit and preserve a fit force (Defense Health Board, 2013).

The U.S. military is not alone in its challenges with obesity. Other nations' military forces, such as the United Kingdom Armed Forces, the Royal Netherlands Army, the Australian Defense Forces, the Belgian Armed Forces, the German Bundeswehr, the Finnish Armed Forces, and the French Armed Forces, have also identified trends toward escalating levels of overweight and obesity (Collee, Clarys, Geeraerts, Dugauquier, & Mullie, 2014; Sanderson, Clemes, & Biddle, 2011). Figure 4 shows the rates of obesity per country as of 2015.

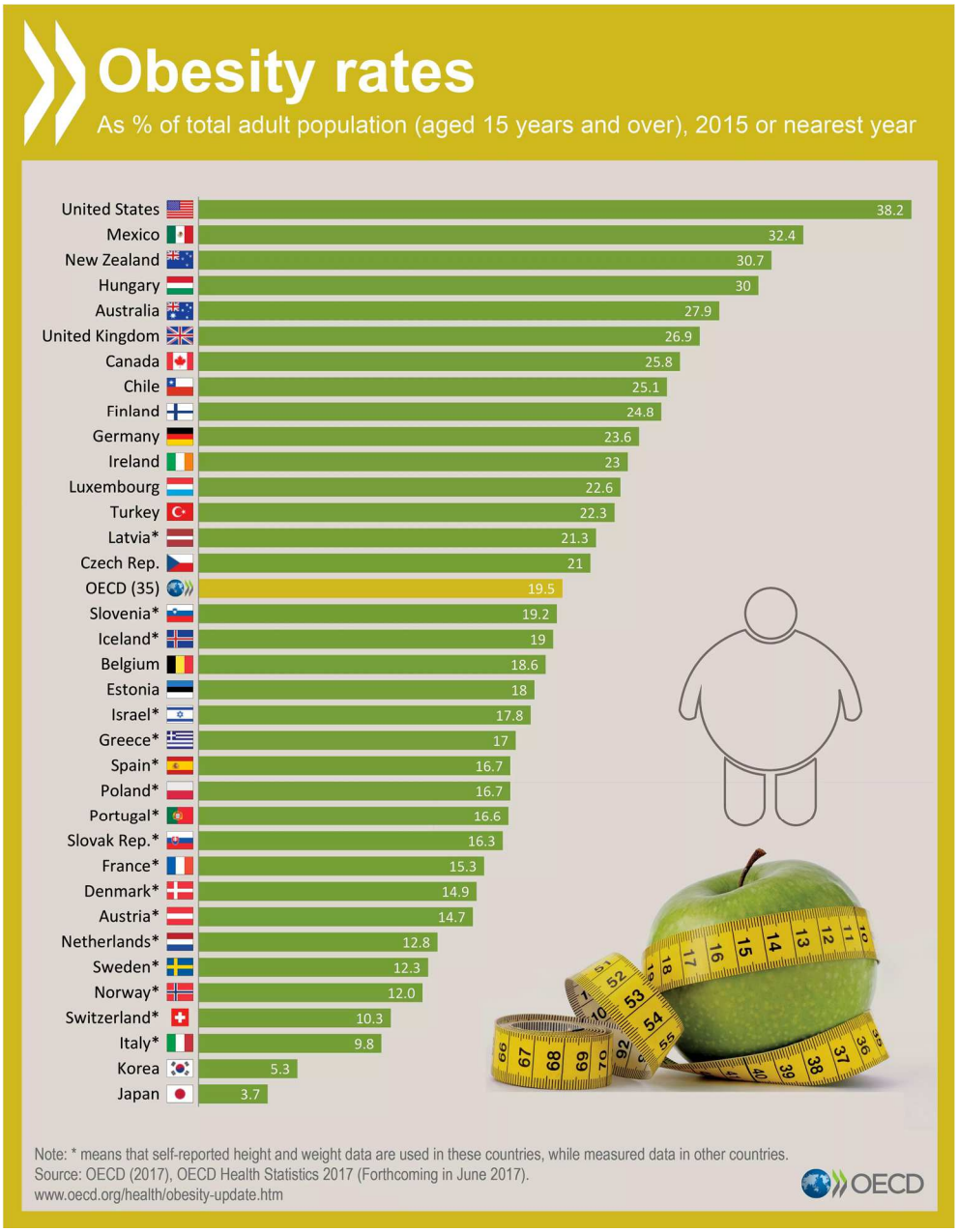

Figure 4. Obesity Rates per Country. From OECD (2017). By Organization for Economic Co-operation and Development (OECD) Health Statistics. https://www.oecd.org/health/obesity-update.htm. Copyright owned by OECD

McLaughlin and Wittert (2009) found the U.S. obesity rate for active military to be 12%. This rate was very similar to the obesity rate of 14% among U.K. military forces.

Research illustrated that the British Army is also experiencing high obesity rates; 56% of the soldiers were overweight, and 12% were obese (Sanderson, 2014).

Military service members are recruited from members of the general U.S. adult population, among whom 78% are obese (Tanofsky-Kraft et al., 2013). Obesity directly affects the health and military readiness of the armed forces, as well as the ability to recruit men and women who are able to meet and maintain the military's weight standards throughout their careers (Cawley & MacLean, 2012; Defense Health Board, 2013; Mission Readiness, 2010; Piche, Stankorb, & Salgueiro, 2014; Reyes-Guzman, Bray, Forman-Hoffman, & Williams, 2015; Voss et al., 2018). Research conducted by the Department of Defense indicated that more than 9 million Americans between the ages of 17-24 are unable to qualify for the armed forces because they cannot meet the weight standards (Tanofsky-Kraft et al., 2013).

In Chapter 1, I present a synopsis of the research conducted in this study. The following sections are inclusive of the background of the study, problem statement, purpose of the study, research questions and hypotheses, theoretical framework, methodology (including the nature of the study, its assumptions, its scope and delimitations, and its limitations), and significance of the study. A summary concludes the chapter.

Background

The military embraces a policy on appearance that is perceived by the public as being healthy and fit (McLaughlin &Wittert, 2009). The concept of weight and height standards for the military began in the 19th century. The first regulation was issued in

1814, allowing “free able-bodied men between the ages of 18 and 35 who were active and free from disease” (Defense Health Board, 2013, p. 22) to join the military. Originally, the standards were proposed to eliminate underweight candidates or those considered malnourished (Friedl, 2012). Minimum and maximum standards for height and weight were established during the Vietnam era. Although the weight standards were indulgent, there was the perception that the post-Vietnam-era military was failing to adhere to physical standards. Weight and height standards were therefore developed to align with a range of BMI and body fat, to avoid misclassification based on muscle mass, and to improve military readiness (Friedl, 2012; Hruby et al., 2015).

Despite the amount of research being conducted and the countless intervention programs introduced to combat obesity, the prevalence of this disease continues to impact many American service members and follows them into retirement as veterans (Spieker et al., 2015). There is the assumption that military service members are healthy and fit because of rigid physical standards that reflect a military lifestyle (Pasiakos et al., 2012). This assumption may be true when an individual first enters the military; however, research provides evidence that those standards are quickly abandoned (Pasiakos et al., 2012). A key precept of military services is that military members must be ready to answer the call to duty at all times, and service members must be able to readily conduct and perform their responsibilities in any environment or under any circumstances without physical limitations. There is also the supposition that obesity and overweight will be less prevalent among veterans (Koepsell, Littman, & Forsberg, 2011). Regardless of the importance placed upon fitness and weight standards, the United States has seen an

increasing number of veterans who are either obese or overweight (Koepsell et al., 2011; Raffa et al., 2017).

Each branch of the military has its own body composition program, which reflects the body composition deemed appropriate for its specific mission (McLaughlin & Wittert, 2009; Peterson, 2015). Today, Army, Air Force, and Navy applicants are granted permission to enter the service once they have met all medical screening requirements. Applicants have an opportunity to apply for a waiver. The Marine Corps was the first service to assess body composition through circumference measurement; it is also the only service that requires a recruit to demonstrate a minimum level of physical fitness prior to acceptance (Peterson, 2015). With the different measurement protocols, assessing fitness among all of the branches of service can be difficult. Table 1 shows the body fat standards by age and military branch.

Table 1

Body Fat Accession Standards by U.S. Military Branch

Branch of military	Gender	Age	Percentage
Army (accession standards)	Male	17-30	24%
	Male	21-27	26%
	Male	28-39	28%
	Male	40+	30%
	Female	17-30	30%
	Female	21-27	32%
	Female	28-39	34%
	Female	40+	36%
Air Force (accession standards)	Male	17-29	20%
	Male	30+	24%
	Female	17-29	28%
	Female	30+	32%
Navy (accession standards)	Male		23%

	Female	34%
Marine Corps (accession and regular standards)	Male	18%
	Female	26%

All branches of the military conduct body composition assessments and physical readiness/fitness tests, and they have specific guidelines for separation based on these assessments. Physical readiness assessments are generally conducted at the conclusion of training and habitually throughout the military career (Defense Health Board, 2013). Individuals who fail to meet the height and weight standards are enrolled in a weight control program; if the proper weight standards are not maintained, they may eventually be processed for separation from the military. The ultimate decision to separate service members from the military on the basis of physical fitness or any other criterion lies with the member's commanding officer. Commanders are authorized to discharge or deny promotion, schooling, bonuses, transfers, awards, deployments, and leave for those who exceed the weight standards.

Airmen are provided four opportunities to meet weight standards before they are considered for separation from the Air Force. The Air Force uses abdominal circumference (AC) as the main standard determinant. This measurement was implemented due to its straightforward concept; it provides greater capability in ascertaining health risks and allows airmen to monitor their progress. According to a Medical Surveillance Monthly Report (MSMR) published by the Armed Forces Health Surveillance Center (AFHSC, 2011), the annual number of airmen who received an outpatient diagnosis of overweight/obesity between 1998 and 2010 was 7.2%, or 25,667

individuals. In 2008, the Air Force reported that 39,000 airmen were deemed obese (Defense Health Board, 2013).

The Army employs the Army Body Composition Program (ABCP) every 6 months to determine whether soldiers achieve its height-weight standards. If a soldier exceeds the height-weight standards, he or she must be taped or assessed for body composition (Defense Health Board, 2013). If soldiers fail the tape test, they may have their records flagged, which could eventually lead to separation from the military. A soldier could also be barred from re-enlistment if he or she does not achieve satisfactory progress or continuously fails to meet the standards (AR 600-9; U.S. Army, 2013). Between 1998 and 2010, the number of active service members who had received one overweight/obesity diagnosis tripled (1998, n = 25,766, 1.6%; 2010, n = 86,186, 5.3%). The Air Force had the highest prevalence, at 7.2%, followed by the Army, at 6.5%, and the Marines, at 1.7% (AFHSC, 2011).

The Navy's physical readiness program is titled the Body Composition Assessment (BCA). Sailors who fail to meet the appropriate height and weight must be measured for body fat percentage and must participate in the physical readiness program. Service members who fail three tests within a 4-year period are subject to administrative action (U.S. Navy, 2011). They are also not allowed to receive any favorable actions, such as promotions, advanced schooling, transfers, and special assignments.

The Marines' weight program is known as the Body Composition Program. When a Marine is no longer in compliance with the standard weight allowance, he or she is enrolled in the program. Repeat offenders are counseled and made aware of options to

help them overcome their weight issues. If they are continuously unsuccessful in achieving weight standards, they can ultimately be released from the service.

According to Appenzeller (2013), based on general health care expenses, obesity-associated illnesses are responsible for more than 488,000 primary care appointments per year. Obese individuals are 1.9 times more likely to be admitted to military treatment facilities than individuals who meet the standard weight. The combination of high rates of medical utilization and increased injury among military members with rising weight leads to the loss of combat power (Appenzeller, 2013). A study conducted by the AFHSC (2011) among active-duty soldiers found that the percentage of active-duty members who required some type of medical attention due to obesity tripled, from 1.6% in 1998 to 5.3% in 2010. Within the military, weight and obesity are deemed responsible for increased financial burden, decreased operational effectiveness, and reduced eligibility to serve (Bornstein et al., 2018; Shrestha, Combest, Fonday, Alfonso, & Guerrero, 2013).

Injuries and medical conditions associated with obesity increase disability retirement rates. In a study conducted by Roos, Laaksonen, Rahkonen, Lahelma, and Lallukka (2013), disability rates increased by 1.42% among those who were overweight, and 1.98% times among obese military members. In 2010, the Disability Evaluation System noted that 6.8% of enlisted members were overweight or obese at their military entrance physical, an increase from the longtime average of 5.8% (Appenzeller, 2013). Obesity-connected health conditions not only result in disability retirements, but also are evident in nondeployable conditions such as diabetes, obstructive sleep apnea, and nonbattle injuries at base stations and in deployments. In 2001 The Department of

Veterans Administration provided more than $5.5 billion in direct payments to military personnel who suffered musculoskeletal injuries (Bornstein et al., 2018).

Information gathered by the Defense Manpower Data Center showed that 1,808 enlisted soldiers were transferred out of the U.S. Army for failure to meet and maintain height and weight standards after being enrolled in the Army weight control program (Appenzeller, 2013). Research confirmed that enlistment BMI and medical status play a vital role in premature discharge or early separation and may be important for intervention development (Packnett, Niebuhr, Bedno, & Cownan, 2011).

An assembly of retired generals released a report entitled "Too Fat to Fight," voicing their apprehension that the elevation of childhood obesity rates may compromise military readiness and national security (Mission Readiness, 2010). The rising frequency of obesity in the U.S. general population increases the complexity of identifying military recruits who meet weight standards. This is because the general population serves as the military's possible workforce. Civilian obesity and lack of activity have a direct impact on the ability to recruit personnel who meet the set standards (Gubata et al., 2011). The Accession Medical Standards Analysis and Research Activity Group was introduced in 1996 as part of the Division of Preventive Medicine at the Walter Reed Army Institute of Research to aid in the establishment of evidence-based standards for military enlistments. This organization ensures that military recruits are capable of meeting the physical challenges of the military and minimizes morbidity and early discharge from the military (Packnett et al., 2011). The military also strives to ensure that young, healthy, and fit adults have the opportunity to serve, because it is vital to national security that they do

(McDowell & Hubbard, 2013). The Department of Defense stated in 2010 that within a 10-year period, more than 9 million Americans between the ages of 17 and 24 would be unable to qualify for the Armed Forces due to exceeding the weight standards (Eismer, 2009; Mission Readiness, 2010; Tanofsky-Kraft et al., 2013). The CDC also found, through its yearly Behavioral Risk Surveillance System, that 42% of young adults aged 18 to 24 surpassed the military's weight standards (Flegal, Carroll, Ogden, & Curtin, 2010).

Although there is an abundance of research on obesity, there is a limited body of work that addresses the impact of obesity on a service members' careers. The present study has been an attempt to fill this research gap. Findings from the present study may advance the comprehension of the extent to which obesity influences military readiness in the United States, potentially leading to the development of new policies to address obesity in the military. This study examined whether obesity impacts units' readiness and the overall health of service members and veterans as they struggle to battle obesity and have a career in the military. As military budgets continue to diminish, it is imperative that the general population, government officials, and military leaders see clearly how obesity impacts the military population.

Problem Statement

A serious yet preventable health concern is affecting the Department of Defense. Obesity is a complex problem that impacts military members and veterans. An estimated 51% to 61% of active-duty military personnel are considered overweight, and 12% are categorized as obese (Jackson, Cable, Jin, & Robinson, 2013). In 2014, the Veterans

Administration stated that the obesity rate among veterans was 78% (Koepsell, Littman, & Forsberg, 2012; Pronk, 2018, Tanofsky-Kraff et al., 2013; Veterans Administration [VA], 2014). A Millennium Cohort Study conducted from 2001 to 2008 found that the rate of obesity doubled among veterans, from 14% to 32% (Rush et al., 2016). Several studies of the prevalence of obesity targeting the U.S. military veteran population concluded that the prevalence of obesity among military veterans was 25.1% (Raffa et al., 2017).

There are 9 million Americans between the ages of 17 and 24 who want to join the armed forces but who exceed the height and weight standards (Tanofsky-Kraft et al., 2013). Recruiting eligible candidates is steadily becoming a more formidable challenge, as the majority of the labor pool is unable to qualify to serve in the military. In addition, many military members are redirected to remedial training to address their weight loss issues or must defer their induction into the military to a later date because they are unable to meet the height and weight standards (AFHSC, 2009). If obesity rates continue to escalate among young civilian adults, this could impede recruitment, military readiness, and national security (McLaughlin & Wittert, 2009).

Table 2

Overweight and Obesity Rates Among Military and Veterans

Service	Number of members	Overweight %	Obese %
Air Force	325,560	58.0%	13.8%
Army	554,780	61.0%	12.9%
Navy	327,370	62.7%	14.3%

Marines	207,780	55.1%	6.1%
Veterans	21,369,602	75.4%	32.8%

Note. Data from Tanofsky-Kraft et al. (2013).

Overweight and obesity decrease combat readiness by increasing recruits' chances of attrition, early discharge, shorter service lengths, and other health problems (Jackson et al., 2013). The military released 4,500 military service men and women in 2008 for failure to maintain weight standards (Tranofsky-Kraft et al., 2013). Furthermore, the Department of Defense must recruit 184,000 new military personnel each year to replace those who decide to leave before completing their initial contracts (Cawley & Maclean, 2012).

A review of literature emphasized the imperative need for this study. Numerous studies exist on obesity in the civilian population; however, they often exclude the military and veteran populations (Ferrucci, Zonderman, & Terracciano, 2011). There is a gap in literature regarding obesity within the U.S. military population (Ellerman et al., 2014; Lamson, Pratt, Aamar, & Earles, 2015). Therefore, the problem that was examined in this study was the negative effect of obesity on military veterans who separate from the military early, on recruitment, and on national security.

Purpose of the Study

The purpose of this study was to examine whether obesity impacts a veteran's career in the form of more difficult recruitment and more adverse weight-related experiences while in the military. This research focused on veterans who served actively in the Army, Navy, Air Force, and Marine Corps and who separated or retired from the

military. Addressing the effects of obesity on veterans who separate or retire from the military may provide senior military leaders with a better understanding of how obesity impacts their service men and women who are not in weight compliance. This research may help leaders understand the importance of strategies and polices aimed to ensure a fit military force and promote the health of veterans separating from military service. In turn, addressing the issue of obesity could assist in ensuring a healthier military.

The rationale behind this study was that by increasing the comprehension and awareness of the adverse effects of poor health and fitness among the military population, it may be possible to implement effective obesity research and intervention programs that focus on changing individuals' behaviors and attitudes. The potential benefit of this study is that it may be possible, given enhanced awareness and subsequent intervention, to reduce the occurrence of adverse weight-related events (e.g., missed promotions) experienced by service members, in turn improving the readiness and aptitude of the U.S. military. Finally, there is an insufficient amount of research that adequately addresses the effects of obesity on the military population in general (Jay et al., 2015). Therefore, this study's purpose was also to address the gap in the literature.

Research Questions & Hypotheses

Research Question 1: Are military veterans who were overweight or obese upon separation from the military more likely to have experienced adverse weight-related experiences while serving compared with their nonoverweight counterparts?

$H1_0$: Military veterans' overweight at separation does not contribute to their likelihood of adverse weight-related experiences while in the service.

H1A: Military veterans' overweight at separation contributes to their likelihood of adverse weight-related experiences while in the service.

The dependent variable for this research question was adverse weight-related experiences. The independent variable was overweight at separation.

Research Question 2: Are military veterans who were overweight or obese upon separation from the military more likely to have experienced delays in their ability to enter the military or enlist?

$H2_0$: Military veterans' overweight at separation does not affect their likelihood of delays in enlisting.

H2A: Military veterans' overweight at separation affects their likelihood of delays in enlisting.

The dependent variable for this research question was ability to enlist. The independent variable was overweight at separation.

Theoretical Framework

The theoretical framework for my research was built on the socioecological framework. Urie Bonfenbrenner's social ecological systems theory is the most frequently used framework in public health (Glanz, Rimer, & Viswanath, 2008). The socioecological theory facilitates comprehending the effects of overweight and obesity at various levels. The ecological model has also been used to identify targets for health behavior interventions. It is a way to examine the complex relationships between various personal and environmental factors. Because obesity is affected by complex systems, researchers recommend a multisystem approach to address the various factors and levels

(Haung, Drewnowski, & Kumanyika, 2009). The socioecological model provides a foundation to introduce change efforts through multiple approaches (Economos & Irish-Hauser, 2007). Environments that encourage behaviors that cause obesity are major contributors to the current obesity epidemic. For example, the locations of recreational facilities, churches, and parks, as well as features of the physical environment, influence obesity (Blanchard et al., 2005).

The four levels of the socioecological model—individuals, organizations, communities, and policy—are appropriate for health promotion practice (CDC, 2013). Each level of the socioecological model incorporates the previous levels, and it is often difficult to separate the levels. Based on the success that health policy groups experience with major health problems such as tobacco use, many believe the socioecological model can be instrumental in reversing the obesity epidemic. Accordingly, the Institute of Medicine and the World Health Organization have introduced strategies and interventions on obesity that require change at the environmental and policy levels (Glanz et al., 2008).

The socioecological model illustrates the correlation between health behaviors and individual, interpersonal, organizational, community, and environmental characteristics. According to Glanz et al. (2008), the definitive purpose of the socioecological model is to influence the growth of wide-ranging intervention approaches that can methodically focus on mechanisms of change at several levels of influence. While individuals are accountable for determining and making lifestyle changes to eliminate, reduce, or improve their health, their social environments influence those decisions (Glanz et al., 2008).

Although, on one level, obesity can be viewed as a function of genetics, the roles of social and economic factors are becoming more evident. Personal history and biological factors that may increase the likelihood of obesity are found at the individual level (Affenito, Franko, Moore, Thompson, & Blanchard, 2012). Strategies that encourage attitudes, beliefs, and behaviors to prevent obesity are also located at the individual level and are affected by other levels. Working with a dietician or a physician to address weight issues is an action found at this level. When physicians engage in conversations with adult patients concerning their weight, those patients are more apt to initiate a behavior change. This action can also help move patients from one level to the next (Krebs, 2005).

The second level is known as the social environment, or interpersonal level, where one finds family, friends, and peers. At this level, one usually receives support, motivation, and reinforcement from members within the family or group. At this level, individuals can receive support for positive choices and decisions about their weight (Affenito et al., 2012).

The third level is the physical environment level, which incorporates home, work sites, schools, neighborhoods, organizations, and communities. This level is also referred to as the community level, and it deals with relationships that increase the risk of becoming overweight. At the organizational level, individuals can increase their knowledge and make informed health decisions. Macrolevel environments include societal and cultural norms and values, healthcare systems, and government and political structures (Story et al., 2008).

The socioecological framework describes behavioral influences that intermingle across various levels of an individual's behavior. This model provides an explanation of how health and wellbeing of a person are established by several influences and their interactions. The framework also examines a wide range of political and environmental factors that shape individual and interpersonal characteristics (Langille & Rogers, 2010). The socioecological model provides a framework for assessing factors associated with obesity.

Four suggested principles of the social ecological model are as follows:

1. Multiple levels of factors influence health behaviors; influence does not just come solely from one level but is inclusive of all the levels of the socioecological model.
2. Influences interact across levels; variables work together to increase their influence.
3. Multilevel interventions should be most effective in changing behavior; incorporating individual and environmental elements has more impact on changing behavioral skills.
4. Socioecological models are most powerful when they are behavior specific; incorporating individual and environmental elements has more impact on changing behavioral skills. The model is most effective when it is tailored for specific health behaviors.

The cross-sectional approach used in this study emphasized the social ecological theory proposed by Bronfenbrenner (1979). The theory assimilates communitywide

preventive strategies of public health and therapeutic and curative strategies of medicine. It also focuses on the active roles taken on by people in changing their health behavior. The general thesis of the social ecological model is that environments and certain social factors allow or constrict the range of behavior by advancing certain actions and by discouraging other behaviors (Blanchard et al., 2005). "Healthy behaviors are thought to be maximized when environments and policies support healthful choices, and individuals are motivated and educated to make those choices" (Glanz et al., 2008, p. 467). Chapter 2 includes additional details expounding on the socioecological model.

The declining health status of America's military is a concern for all. The increasing rates of obesity present a significant threat to the military's ability to recruit and retain service members and sustain military readiness. There is a crucial need to ensure that military leaders comprehend that reducing obesity can facilitate the recruitment process and help bring to an end premature separation from the military based on weight. To evoke change in behavior, it will take a combination of individual, institutional, and environmental levels of intervention. The socioecological model was thus appropriate to the present study, which examined how individual overweight affects veterans' careers at the organizational and community levels.

Nature of the Study

This study employed a quantitative, cross-sectional, survey-based research design. According to Campbell and Stanley (1963), cross-sectional research is customary in development research; it is used to contrast variables and comprehend the frequency of various conditions and factors related to the outcomes of interest (Carlson & Morrison,

2009). The purpose of cross-sectional research is to discover the prevalence of the outcome of interest (Levin, 2006). Survey-based cross-sectional designs provide participants with sets of questions whose answers can express the relations among variables (Frankfort-Nachmias & Nachmias, 2008). This research used a web-based, modified Related Behaviors Survey of Active Duty Personnel Health (HRB) questionnaire to collect quantitative data.

An advantage of cross-sectional research is that one can gather data on individual characteristics while simultaneously collecting information about results. This particular design was well suited for my study on the effects of overweight and obesity on the military, because the sample could be drawn from the whole population (Levin, 2006). Cross-sectional research is an efficient way to evaluate a large sample of service members labeled overweight or obese. Similarly, cross-sectional research can be used to estimate the association between obesity and military readiness (Carlson & Morrison, 2009).

Cross-sectional research involves the collection of data at one time only. This characteristic is a limitation, because it provides no information on the order in which events occur. The cross-sectional design provides only a snapshot of a situation. However, a cross-sectional design is ideal when there are time constraints and fewer resources available to conduct research (Levin, 2006). By contrast, longitudinal studies involve the collection of data over extended periods of time and permit researchers to measure change in variables but require more time and resources to conduct. Conducting a study over long periods can also result in loss of samples (Ployhart & Vandenberg,

2010). Further, longitudinal research emphasizes explaining why changes occur (Ployhart & Vandenberg, 2010). Because this present study did not focus on any changes over time, longitudinal research was not appropriate to answer the research question.

Case study design was not appropriate for the present study because case studies compare cases with similar attributes, are time consuming, require experienced interviewers, and limit generalizability of conclusions (Voss, Tsikriktsis, & Frohlich, 2002). Furthermore, case study is best conducted in a natural setting (Voss et al., 2002), which was unavailable in the present study. Additional details on the methodology are included in Chapter 3.

Definitions

Accession: The number of people the military recruits, approves, and qualifies to advance to basic training within a given year (Defense Health Board, 2013).

Adverse weight-related experiences: Any formal sanction or activity imposed upon a military service member as a result of his or her failure to meet weight requirements. Examples include being passed over for promotion, being denied earned awards, and being denied advanced schooling.

Applicant: An individual who presents to a military entrance processing station for evaluation for acceptance into military service (AMSARA, 2016).

Army Body Composition Program (ABCP): Soldiers are subject to many demands and challenges that may impact individual readiness. The ABCP provides commanders with a systematic approach to enforce military standards across the unit while supporting soldiers with the resources they need to return to an optimum level of individual

readiness (AR 600-9; U.S. Army, 2013).

Body mass index (BMI): The most universally accepted measure of obesity. A person's weight in kilograms divided by the square of height in meters; it is an inexpensive screening tool used to identify overweight and obesity (CDC, 2015; Federal Defense Board, 2013).

Enlisted personnel: A member of the armed forces who is in a rank below a commissioned officer or warrant officer (Department of VA, 2012).

Fitness: The capability of service members to satisfy the physical demands of their jobs for prolonged durations and to meet physical emergencies they may face during combat (Department of Defense, 2005).

Military branch of service: A subdivision of the U.S. Department of Defense. The military branches are the Air Force, Army, Coast Guard, Marine Corps, and Navy. Each branch has distinct responsibilities in relation to the security of the United States.

Military readiness: Readiness is a primary mission of military forces, defined as the ability to answer the call for duty or action at any time and not be restricted by physical constraints. It is also the overall capacity to perform the physical duties of military service and combat, consisting of the components of physical fitness, health, and motivation (DODD 1308.1, 2004). For the purpose of this research, military readiness is defined as the capability of a unit to perform its mission with well-trained, physically fit, and medically cleared service men and women (Harrison, 2014).

Obesity: For the purpose of this study, obesity is a body mass index greater than 30. However, the Army defines obesity by a body mass index greater than 25 (AR 600-

63; U.S. Army, 2015).

Overweight: Exceeding the maximum limit according to the service's height and weight screening table. The Army determines overweight based on a soldier's height, weight, age, and gender. The Air Force, Navy, and Marines determine overweight based on height, weight, and gender (AR 600-63; U.S. Army, 2015; Department of Defense, 2005).

Veteran: A person who served in the armed forces and received a discharge under honorable conditions (38 U.S.C. §101(2); 38 C.F.R. §3.1(d).

Assumptions

There is the general assumption that the military is exempt from having members who are overweight or obese. Research illustrates that not only are obesity and overweight in existence within the armed forces, but they affected nearly 12.4% of service members in 2011. The assumption underlying this study was that obesity impacts military end strength through recruiting, readiness, and retirement. Obesity affects whether recruits will be permitted the right of entry into the military and whether veterans will be involuntary separated from the military. If rates of overweight and obesity continue to increase, they could have detrimental repercussions for U.S. national security (Defense Health Board, 2013). There is also the assumption that the Department of Defense will not be capable of sustaining a fit fighting force into the future given swelling rates of obesity and overweight (Gagnon & Stephens, 2015). The Department of Defense defines fit fighting force as having the competence to execute the physical duties of military service and combat (DoD Directives, 2004)

A further assumption is that recruitment goals are being met; therefore, there is no requirement to ease existing accession standards regarding members who are overweight or obese (Defense Health Board, 2013). With DoD's dependence on the general population to fulfill its allocations, there is the assumption that the DoD makes an effort to ascertain that children maintain a healthy weight to help support force readiness in the future. As obesity rates in the general population increase, civilian applicants will be characterized as medically unfit for military service (MSMR, 2011). There is also the assumption about the level of fitness required to maintain the height and weight standards. There are specific guidelines developed by the DoD that address the level of fitness for the desired service.

Scope and Delimitations

The scope of the study encompassed testing for an association between overweight at military separation and adverse weight-related experiences, and an association between overweight at military separation and delay in recruitment. Military standards for enlistment and recruitment are reflected in AR 600-9 (U.S. Army, 2013). The study concentrated on enlisted active duty, Army, Navy, Marine Corps, and Air Force personnel who served within the last 20 years. Members of other forces and those who served outside the designated years were outside the scope of the study. The study also excluded Reserve Forces and National Guard units.

Limitations

One of the limitations considered in the study was the self-reporting of height and weight data to calculate BMI. According to Reyes-Guzman et al. (2015), there is a

correlation between self-reported height and weight and measured height and weight, but obesity may be underreported when relying on self-reports. Therefore, the study may not accurately reflect the number of participants who were overweight at separation from the military. An additional limitation of the study was that military service members might be less prone to divulge sensitive information due to a fear of consequences and a strict military code of conduct (Barlas, Higgins, Pflieger, & Diecker, 2013). Further, the use of cross-sectional data was a limitation because it may have been biased by the specific characteristics of each sample (Reyes-Guzman et al., 2015).

A challenge in the study was that there is no one standard definition of obesity or overweight. Each branch of the military has different definitions, methods, and standards to identify overweight and obese service members (Cawley & Maclean, 2013; Defense Health Board, 2011). For example, in the Air Force, height fractions are rounded to the nearest 0.25 inch and weight fractions to the nearest 0.25 pounds. For the Army, when height fractions are less than 0.25 inch, height is rounded down to the nearest whole number; if the height fraction is greater than 0.25 inches, height is rounded up to the next whole number. The Marine Corps chooses to round to the nearest whole inch for heights, and weight fractions ≤ 0.5 are rounded down; otherwise, they are rounded up. The height measurement is rounded to the nearest whole inch, and the weight measurement is rounded down to the nearest pound (AR 600-9; U.S. Army, 2013; Yamane, 2007). This posed a problem to the present research because members of different services may have received or not received weight-related sanctions based on their respective branch's

rounding practices. A more methodical technique for all of the branches within the military would have improved the research.

Significance

Many people are of the belief that obesity is not a problem in the military. This study examined how military personnel who are affected by obesity may be subject to sanctions because they exceed or fail to maintain weight-height standards. This study could increase awareness of the impact of overweight and obesity on service members' careers. The study could also help to demonstrate the need for more military leaders and healthcare personnel to receive training on effective counseling and support approaches to managing weight issues. Increasing senior leader awareness and knowledge on the impact of obesity on service members' careers may help leaders better address the issues.

Service members labeled obese and overweight are often subject to weight stigma. This not only threatens to weaken them as individuals, but also affects units and family members (Defense Health Board, 2013; Puhl & Heuer, 2010). Obese individuals are often the target of unfair treatment regarding employment, health, and daily encounters. Unfair treatment, according to Carr and Freeman (2005), is the actions of individuals and agents of social institutions who denigrate and exclude, as well as the reactions of persons in the devalued social category. This unfair treatment can contribute to low self-esteem (Carr & Friedman, 2005). With all the pressure on service members to "make weight" and a culture that focuses on fitness and values thinness, service members may be particularly vulnerable to weight and obesity stigmatization. Weight and obesity stigma in the armed services is often related to increased calorie intake, disinclination to

diet, binge eating, fad diets, avoidance of physical activity, and detrimental weight control measures (Schvey et al., 2016). Unfortunately, neither the struggle of obesity nor the stigmatization of obesity ends when one is discharged from military service. According to Littman et al. (2012), overweight or obese military service members become overweight and obese veterans.

This research may contribute to positive social change by offering service members and military leaders a better understanding of the impact that overweight and obesity can have on a veteran's career through recruitment and adverse weight-related experiences. Instead of turning service members away when they are not qualified, or separating them when they fail to meet the weight standards, there is a need for better programs and tested interventions to educate service members on how to overcome weight challenges with counseling and support from within their communities. There is the possibility that this study could assist in developing new policies, or changes to existing policies, regarding sanctions and separation from the military based on weight requirements, as well as new or changed weight management policies. It could serve to foster a change in the military culture regarding how those in key leadership positions view obesity and how best to address this enemy. Such social change could alter military environments where remedial physical training, or not "making weight," goes hand in hand with shame or stigma. It could help to change the mindset within the military, such that overweight service members are no longer viewed as solely responsible for the management and control of this medical problem.

Summary

Obesity is a complex, multi-faceted issue, and obesity rates continue to rise throughout the United States. The U.S. military is not impervious to this epidemic. Obesity in the military is a serious issue presently affecting service members' health, fitness, quality of life, and readiness. Despite the fact that there is a plethora of literature on obesity, when it comes to obesity and being overweight within the military community, the literature is often lacking and exiguous (Smith et al., 2012). In Chapter 1, I elucidated the study's background (including obesity rates among various military branches), problem statement, purpose, research questions, theoretical framework, nature, pivotal terms, assumptions, scope, limitations, and significance. The purpose of the study was to take a retrospective review of the impact of obesity on separated and retired service members' careers.

In the past, obesity has been thought to merely be correlated to an imbalance between energy expenditure and intake. However, current research recognizes the influence of relationships between individuals and their environments (Williams, Kabukurum, Mayo, & Griffin, 2011). The socioecological model explicitly incorporates individual and external influences, but also more peripheral factors, such as environments. Scrutinizing the various levels of influence can increase the understanding of factors that may influence health risk associated with obesity (Linke, Robinson, & Pekmezi, 2013).

In Chapter 2, I present a review of existing literature on the effects of obesity and overweight on military service members, as well as the challenges of being overweight or

obese while trying to maintain a military career. The literature review includes articles examining behavioral, environmental, individual, and organizational factors. The literature helps one to gain a better understanding of obesity in the military and the impact of obesity on veterans' careers. Further, the chapter includes a discussion of obesity among active-duty personnel from the veteran's perspective, as well as its effects on recruitment and adverse weight-related experiences, helping to provide validation for the study. Finally, the literature review contains a comparison of obesity trends among active-duty military personnel within the various armed forces.

Chapter 2: Literature Review

Introduction

The prevalence of obesity in the United States has continued to rise over the last two decades. In harmony with national trends, rates of overweight and obesity have escalated in the United States military population. Accordingly, the Department of Defense decided to adhere to Healthy People objectives in 2010 in order to engage in efforts to increase the proportion of adults with healthy weight (BMI $\geq$ 18.5 and $<$ 25) by at least 60% (Smith et al., 2012). The Department of Defense is putting a great deal of effort behind the Healthy People objectives. In this quantitative study, a Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel was selected for data collection. The data from the survey were used to ascertain the impact that obesity had on the military careers of separated or retired veterans. Within the general population, attention on obesity research has expanded, increasing the momentum of this inquiry; however, obesity research within the military is less common (Smith et al., 2012). This chapter presents a review of existing research and theoretical literature related to the research topic, with the aim of situating the present research within the body of knowledge and illuminating the challenges that service members face when they are considered overweight or obese. The literature review covers factors that are known or believed to contribute to obesity within the military, as well as the study's theoretical framework. The chapter concludes with a summary.

There is an immense amount of research on obesity addressing the general population. However, there is limited literature on obesity among active-duty military

members. Research routinely concentrates on health promotion and disease prevention among service members, but the high prevalence of both overweight and obese service members warrants more attention. In this quantitative study, collected data from a survey facilitated the investigation of the impact that overweight and obesity have on service members' careers.

Literature Search Strategy

In this chapter, I introduce findings from the review of literature, which was conducted to assess existing knowledge on this subject. The resources for this literature review were retrieved from the Stephen B. Thacker CDC Library, Walden University Library, and online databases. Key search terms included *obesity, overweight, armed forces,* and *military*. Results were narrowed and specified using the following additional search terms: *physical fitness, fitness test, Air Force, Army, Navy, Marines, enlisted, service members, military personnel, recruitment standards, physical activity, body mass index (BMI), accessions, veterans,* and *soldiers.* Databases searched included MEDLINE, ProQuest, Health & Medical Complete, PubMed, CINAHL, Laureate International Universities, Scopus, Ovid, Science, Direct, Sage Premier, SocINDEX, PsycINFO, Military and Government, Academic Search Complete, and Taylor and Francis Online. The search included information from obesity studies related to the U.S. military and English-language articles published between 2011 and 2018. Extension of publication dates beyond the most recent 5 years was used as needed to explore highly relevant and seminal articles identified within the reference lists of the initial search results.

Obesity in the U.S. Military

Several researchers have illustrated that obesity rates are rising not only for the general population, but also within the military population (Gagnon & Stephens, 2015; Reyes-Guzman et al., 2015; Sanderson, Clemes, & Biddle, 2014; Sparks & Bollinger, 2011). Vogel (1992) conducted a study examining the enforcement of military standards and claimed that such standards had "virtually eliminated" military obesity and, moreover, increased military operational readiness. By 2008, however, this statement was no longer true. Instead, 70,000 military service men and women were identified as overweight (Davis, 2011). The military is losing a large number of high-quality service men and women who are qualified and trained in their field of specialty because of the simple fact that they are overweight. Reyes-Guzman (2015) found that obesity rates (BMI $\geq$ 25) increased from 50.6% in 1995 to 60.88% in 2008. The Department of Defense found that 61% of men and 39% of women on active duty are overweight, and 12% are obese (Sanderson et al., 2011).

Over the past several years, the Department of Defense has provided more guidance and directives centering on the topics of weight and obesity. To remain in the military service, members are required to maintain a certain standard of physical fitness and body composition. Each service department instituted its own BMI table and required body fat percentage based on guidance from the Department of Defense. The principle behind the body composition guidelines is to encourage physical training and good nutritional habits in order to make certain that a high state of readiness is maintained (Friedl, 2012).

There is an assumption that military service members are healthy because of the strict requirements in this profession to maintain a certain level of physical fitness. Although the military has specific standards for weight, as well as physical fitness and medical standards upon entering the service, these standards are not always followed once an individual enters into the military (Pasiakos, 2012). If service members do not achieve weight in accordance with military standards (AR 600-9; U.S. Army, 2013), they are subject to separation from the military. According to the Military Service Fitness Database, 2,400 soldiers were discharged between 1999 and 2000 for exceeding weight standards or for their inability to maintain weight standards consistently according to regulations (Bacon, 2010).

Body Mass Index and Weight Requirements

In 1976, the Army Physical Fitness and Weight Control Program (AR 600-9; U.S. Army, 2013) introduced the BMI calculation (Kumankika et al., 2014). The other service branches were soon to follow. Today, the military still uses BMI, and physical fitness is a job requirement while in the service. BMI is used to define the weight status of an individual. There are two sets of standards used in the military. The first set is for the accession of recruits initially entering the military, and the second set is the basic standard that military members must meet for retention in the service (Kumankika et al., 2014). BMI is calculated based on height and weight. Tables 3–7 present the height and weight requirements for the Army, Air Force, Marine Corps, and Navy.

Table 3

U.S. Army Height and Weight Requirements for Males

Height in inches	Minimum weight	Max. weight (age 17-20)	Max. weight (age 21-27)	Max. weight (age 28-39)	Max. weight (age 40+)
58	91				
59	94				
60	97	132	136	139	141
64	110	150	154	158	160
65	114	155	159	163	165
66	117	160	163	168	170
67	121	165	169	174	178
68	125	170	174	179	181
69	128	175	179	184	186
70	132	180	185	189	192
71	136	185	189	194	197
72	140	190	195	200	203
73	144	195	200	205	208
74	148	201	206	211	214
75	152	206	212	217	220
76	156	212	217	223	226
77	160	218	223	229	232
78	164	223	229	235	238
79	168	229	235	241	244
80	173	234	240	247	250
Maximum % body fat standards		20%	22%	24%	26%

Note. From *The Army Body Composition Program (AR 600-9);* p. (75) by U.S. Army, (2013), Washington, DC: Department of the Army. In public domain.

Table 4

U.S. Army Height and Weight Requirements for Females

Height in inches	Minimum weight	Max. weight (age 17-20)	Max. weight (age 21-27)	Max. weight (age 28-39)	Max. weight (age 40+)
58	91	119	121	122	123
59	94	124	125	126	128
60	97	128	129	131	133
61	100	132	134	135	137
62	104	136	138	140	142
63	107	141	143	144	146
64	110	145	147	149	151
65	114	150	152	154	156
66	117	155	156	158	161
67	121	159	161	163	166
68	125	164	166	168	171
69	128	169	171	173	176
70	132	174	176	178	181
71	136	179	181	183	186
72	140	184	186	188	191
73	144	189	191	194	197
74	148	194	197	199	202
75	152	200	202	204	208
76	156	205	207	210	213
77	160	210	213	215	219
78	164	216	218	221	225
79	168	221	224	227	230
80	173	227	230	233	236
Maximum % body fat standards		30%	32%	34%	36%

Note. From *The Army Body Composition Program (AR 600-9);* p. (74) by U.S. Army, (2013), Washington, DC: Department of the Army. In public domain.

Table 5

U.S. Air Force Height and Weight Requirements

Height in inches	Max. weight—Males	Max. weight—Females
58	132	120
59	136	124
60	141	128
61	146	132
62	150	137
63	155	141
64	160	146
65	165	150
66	170	155
67	176	160
68	181	164
69	186	169
70	192	174
71	197	179
72	203	184
73	208	189
74	214	195
75	20	200
76	226	205
77	232	211
78	238	216
79	244	222
80	250	228
Body fat %	18% max	26% max

Note. From Air Force Fitness Program (AFI36-2905) p. (98), by U.S. Air Force, 2013, Washington, DC: Department of the U.S. Air Force. In public domain.

Table 6

U.S. Marine Corps Weight Allowances

	Males			Females	
Height (inches)	Minimum standard (pounds)	Maximum standard (pounds)	Height (inches)	Minimum standard (pounds)	Maximum standard (pounds)
58	91	132	58	91	120
59	94	136	59	94	124
60	97	141	60	97	128
61	100	146	61	100	132
62	104	150	62	104	137
63	107	155	63	107	141
64	110	160	64	110	146
65	114	165	65	114	150
66	117	170	66	117	155
67	121	176	67	121	160
68	125	181	68	125	164
69	128	186	69	128	169
70	132	192	70	132	174
71	136	197	71	136	179
72	140	203	72	140	184
73	144	208	73	144	189
74	148	214	74	148	195
75	152	220	75	152	200
76	156	226	76	156	205
77	160	232	77	160	211
78	164	238	78	164	216
79	168	244	79	168	222
80	173	250	80	173	228

Note. From *Marine Corps body composition and military appearance program (MCO 6110.3),* by Marine Corps, 2016.Washington, DC: Marine Corps. In public domain.

Table 7

U.S. Navy Height and Weight Requirements

Height in inches	Max. weight—Males	Max. weight—Females
62	150	149
63	155	152
64	160	156
65	165	160
66	170	163
67	175	167
68	181	170
69	186	119
70	191	122
71	196	125
72	201	129
73	206	132
74	211	136
75	216	140
76	221	144
77	226	147
78	231	216
79	236	241
80	241	227
Age	**Body fat %—Males**	**Body fat %—Females**
18-21	22%	33%
22-29	23%	34%
30-39	24%	35%
40+	26%	36%

Note. From *Physical Readiness Program* (OPNAVINST 6110.1J; p. (6), by U.S. Navy, 2011, Washington, DC: Department of the Navy. In the public domain.

According to the CDC (2012), an individual with a BMI of 30 or more is considered obese, and an individual who is overweight has a BMI of 25–29.9. Research has shown that individuals who are overweight or obese are subject to increased risk for many related diseases. Flegal, Kit, Orpana, and Graubard (2013) conducted a study analyzing the BMI categories of approximately 2.88 million individuals. The results showed that mortality was much lower among those who were overweight but not obese ($25 \leq BMI < 30$) when compared with normal weight ($BMI < 25$) individuals. The meta-analysis did not show an excess mortality correlating with grade 1 obesity ($30 \leq BMI < 35$), and the findings were consistent with results from two other studies (McGee, 2005; Janssen & Mark, 2007). These results cast into question the utility of BMI as an indicator of overall health status.

Although BMI is considered a good instrument for screening, it is deficient in predicting health risk for individuals because it does not directly measure body fat. For example, a weight lifter might not meet height and weight standards due to greater levels of muscle mass (Hruby et al., 2015; Smith et al., 2012). BMI does not recognize the difference between excess fat and muscle. According to CDC, because no individual body fat measurement tool is capable of clearly distinguishing health from disease, BMI should be employed as an initial screening tool. BMI should be used as a gauge to track weight status and recognize potential weight problems in individuals. Military members with high BMI often have lower Army Physical Fitness Test (APFT) scores than those with lower BMI. It was also found that recruits with a high BMI in basic training used the outpatient clinics more often (Bedno et al., 2010; Cowan, Bedno, Urban, Yi, & Niebur,

2011). The approximate risk for illness in men with high body fat while in basic training was 70%, which correlated with exceeding the body fat standards (Bedno et al., 2010; Cowan et al., 2011; Defense Health Board, 2013). Each branch of service screens for overweight/obesity utilizing a combination of BMI and waist circumference as a gauge of body fat percentage (Reyes-Guzman et al., 2015). This screening is conducted at least every 12 months.

The Navy employs the body composition assessment (BCA) score in an effort to maintain BMI. Both serve as stand-ins for determining body fat percentage. The BCA is assessed twice annually, and the inability to receive a passing score could be detrimental to one's career. (Lennon, Oberhofer, & McQuade, 2015). In 2012, Lennon, et al. (2012) conducted a study of active duty service members in the Navy, including men and women. The study illustrated the body composition failure rates for 313,513 sailors. The results demonstrated that the BCA failure rate was 2.2% overall, 2.0% for men and 3.4% for women. The prevalence of obesity in men was 15.4% and 4.6% in women. This was the first time that Navy-wide body composition failure rates were published. The research also revealed that weight is singlehandedly an independent risk factor for BCA failure.

An analysis was conducted in 2005 on weight and obesity among active duty staff members at a large Navy medical center. The study focused on specific inadequacies of the U.S. Navy's weight management program. The Navy utilizes the physical fitness assessment (PFA), which uses terms such as "within standards" and "out of standards," which are based on the body composition analyses (BCA), to evaluate body weight (Gantt et al., 2008; Lennon et al., 2015). Although BMI is the most commonly used

surrogate for body fat measure, the Navy does not use BMI to conduct the identification of the overweight/obese service members. The results of the BCA are not recorded consistently during clinical visits or collected as part of the physical fitness assessment. In the study, 53% of the active duty staff members were considered either overweight or obese according to BMI. In terms of weight measurements, based on the Navy's system, only 149 personnel were identified as being "out of standards," and 2,805 personnel were "within standards." Incorporated in the "within standards group" were 241 staff members with obese BMIs and 1,365 personnel with overweight BMIs (Gantt et al., 2008). The system of measurement employed by the Navy to characterize personnel failed to identify or provide staff members with early intervention and treatment of high-weight personnel at risk for enhanced morbidity and loss of productivity (Gantt et al., 2008).

Research concluded that elevated BMI is associated, not only with a decline in fitness, but also with an increase in pain, injury, disability, and early separation or retirement in military personnel (Niebuhr et al., 2011; Roos, Laaksonen, Rahkonen, Lahelma, & Lallukka, 2013). Packnett et al. (2011) researched BMI and its effect on early discharge from the U.S. Army among a large cohort of first-term, active duty soldiers. In the article, early discharge was defined as a discharge date of fewer than 365 days after the date of entry into the military. Soldiers who displayed a higher BMI (BMI $\geq$ 30) incurred higher discharges, at the rate of 3.5% during the first year of service (Packnett et al., 2011). The study was conducted from 2001-2011 and involved 620,310 men and women. The results showed that obese males had an attrition rate of 27.8% and females had one of 45.9% (Defense Health Board, 2013).

A high BMI has also been recognized as a barrier to physical activity participation (Caperchione et al., 2008). When individuals fail to acknowledge that they are overweight or obese, getting them to participate in physical activity is a much larger challenge. Despite the established benefits of physical activity, fewer than 50% of adults were classified as active within the minimum levels (Caperchione et al., 2008; Kruger, Bowles, Jones, Ainsworth, & Kohl, 2007). The IOM found that, when recruits exceeded the BMI or designated height-weight standards, but later passed the standards, 80% abandoned the military before carrying out their contracts (Crawley & Maclean, 2012).

Costs of Overweight and Obesity to the Military

Based on the research of AMSARA (2010), the most common disqualifying condition among potential recruits was exceeding the weight/body fat standards. In 2012, a review of Army enlisted soldiers conducted by AMSARA and found that, from 2001-2011, 35.2 % of men were overweight ($25 \leq BMI < 30$) and 14.6 % were obese ($BMI > 30$; AMSARA, 2012). Among women, it found that 32.8 % were overweight and 2.3% were obese. The Naval Recruiting Command reported that approximately 1 in 8 potential applicants that visited Navy recruiting were unfit for processing due to their inability to meet BMI standards. According to the U.S. Medical Surveillance Monthly Report (2009), 16% of service members diagnosed with being overweight and obese had at least one medical encounter for a joint and back pain condition. These conditions were the leading causes of lost duty time (Sanderson et al., 2011).

The cost of obesity associated with the military is approximately $1.1 billion each year. In 2012, based on data from the Defense Manpower Data Center, 1,808 soldiers

were separated from the Army for failing to meet the height and weight standards. Research shows that service members who labor to meet the weight standards for entry into the military may have a greater likelihood of failing weight standards later in their careers (Tanofsky-Kraft et al., 2013). The loss of personnel produces a significant financial loss and incurs substantial financial burdens. To recruit and train an enlistee, the approximate cost is $75,000 (Accession Medical Standard, 2012; Piche et al., 2014). Several studies (Dall et al., 2009; U.S. Medical Surveillance Monthly Report, 2010) have reported that it takes $1.1 billion to treat obesity-related conditions and keep active-duty members within their respective weight standards. It costs another $106 billion to cover the expenses of lost work productivity (Reyes-Guzman et al., 2015; Hruby et al., 2015).

Reyes-Guzman et al. (2015) also reviewed how obesity increased within the ranks of the military. Reyes-Guzman et al., found that the highest increase in obesity was among military women, with an increase of 14%. The ranks with the largest gains were warrant officers, and senior enlisted personnel followed closely behind. Those ranks had the oldest personnel, as well. Excessive weight and body fat among the Active Duty, National Guard, and Reserve populations reduces overall force fitness and readiness (Defense Health Board, 2013). Excessive weight and body fat have also correlated with the decline in military operational effectiveness (Defense Health Board, 2013). Obesity may also result in acute and chronic health issues.

Many researchers suggest that obesity may affect national security (Cawley & MacLean, 2012; Defense Health Board, 2013; Mission: Readiness, 2010; Piche et al., 2014; Reyes-Guzman et al., 2015). Mission: Readiness, an organization of retired

military leaders, has reported that 27% of today's young adults are too overweight to serve in the military, which causes concern about the strength of the nation's future military (Cawley & MacLean, 2012; Defense Health Board, 2013; McDowell & Hubbard, 2013).

In 2011, the MSMR recapitulated that from 1998 to 2010, the percent of active military members with overweight/obese related diagnoses increased significantly. The study documented that 382,448 active military members were still in active service after initial overweight/obese related diagnoses (MSMR, 2011). The report revealed that, between 2006 and 2010, the average length of time service members remained on active duty after overweight/obese a diagnosis was 3.54 years (MSMR, 2011). The largest duration for active service after overweight diagnoses was among 25-29 year-olds. Among racial-ethnic groups, Hispanics had the shortest amount of time remaining in the service after diagnoses (MSMR, 2011). The study also demonstrated that these service members are not at any greater likelihood to experience career-threatening physical or medical conditions often associated with being overweight or obese, suggesting that the costs of separating overweight individuals from the military may be greater than is warranted by their health-related outcomes.

Obesity Intervention

Researchers used the socioecological framework in a study to develop intervention programs for reducing obesity. The study took place among elementary school students in North Carolina, with plans to expand to older students and ultimately parents and older adults in nearby communities (Corsion et al., 2013). The project was

titled Achieving Health for a Lifetime (AHL) and uses the socioecological framework to promote behavioral changes in nutritional habits and physical activity (Corsion et al., 2013; Langille & Rogers, 2010).

The AHL includes all levels of the socioecological framework. At the individual level is the school-aged child, and the school moderates the interactions (Corsion et al., 2013). The individual level was the major focus of the study and included the student's personal history, beliefs, and attitudes. The purpose of the study was to create a partnership between the community and academic institutions based on a common interest: decreasing the obesity epidemic. The AHL used community meetings, interviews, focus groups, and advisor councils to evaluate community services or the lack thereof (Corsion et al., 2013). By utilizing the socioecological approach, the researchers were able to gain valuable information on the community's perception of the obesity problem in Durham, NC. This enabled them to identify how difficult it can be for impoverished children to follow basic weight-management guidance given in obesity prevention programs (Corsion et al., 2013).

Recruitment

The goal for recruitment within the U.S. Department of Defense is 190,000 per year (Crawley & Maclean, 2012). This is the number of new recruits necessary to replace military personnel who are either retiring or leaving the military service for other reasons. The cost to recruit and train a replacement is, on average, $75,000 per person, and $60 million is spent on replacing first-term recruits (Crawley & Maclean, 2012; Piche et al., 2014; Wang et al., 2011). Recent studies indicate that only 26% of today's youth between

the ages of 17-24 are qualified to enlist without acquiring a waiver, and, as of June, 2011, a quarter of all youth could meet weight standards (Poling, 2012; Guba, 2012). The Center for Naval Analyses estimates that approximately 30% of U.S. adolescents are likely to be ineligible due to excess body fat (Nobrega, 2012). According to the Navy Recruiting Command, recruiters estimate that nearly 1 in 8 (12.5%) future applicants that come into the recruiting stations do not meet accession height-weight standards (Nobrega, 2012).

The reason for one-quarter of the applicants' separation from the military is the inability to maintain weight standards (Crawley & Maclean, 2012). With data from the National Center for Health Statistics, researchers Crawley and MacLean also estimated in 2007-2008 that 12% of eligible males between 18 and 42, along with 35% of eligible women, surpassed the military's height and weight standards. The percentage of ineligibility has doubled for men and tripled for women (Crawley & Maclean, 2012; Sanderson et al., 2014). Between 2007-2012, 15.9%-21.6% of applicants were disqualified for being overweight or obese, and the major cause of medical disqualifications of applicants screened at military recruiting stations is being overweight or obese (Hruby et al., 2015). In 2016, according to the AMSAEA Annual Report, obesity continued to be the leading medical disqualification for those entering active duty military service.

The elevated obesity rates in the United States have drastically reduced military applicants over the past decades. If obesity rates continue to climb, it is possible the United States will reach a point where there are inadequate numbers of recruits who can

meet the physical standards of the armed forces (Gagnon & Stephens, 2015). According to Gagnon and Stephens, in their study of active duty military, the trends in national obesity data and military accessions records show that there would be more people who failed for weight than were needed to access the requisite percentage of applicants. Their findings also illustrated that retirements and attrition rates would remain constant, obesity rates in the United States would continue to climb, and the demographics of those wanting to serve would continue to emulate the general population (Gagnon & Stephens, 2015).

Obesity is the focus of concentrated public health efforts in the United States. With childhood obesity rates increasing in children aged 12-19 (5% in 1980 to 30% in 2012), the Department of Defense is disheartened about the state of their future labor pool (Ogden, Carroll, & Kit, 2014). Young children who have parents that serve in the military have a greater likelihood of contemplating service in the military than those with no record of service. Childhood obesity can have serious ramifications and can affect the child throughout his or her life (CDC, 2015). There is a 70% chance that overweight adolescents will grow to be overweight or obese adults, and this percent raises to 80% if at least one of the parents is obese. Some of the health issues that normally affect adults are now manifest in children (Kral & Faith, 2009; Lifshitz, 2008; Williamson et al., 2008). Because health issues such as heart disease can begin early in childhood obesity, the tolls of such a disease result in a lifestyle of health issues and drive up healthcare costs (CDC, 2015). With the implications that childhood obesity has on the health of adults and the probability that the future service members will be supplied from military

families, obesity is critical to the future of the United States national security and military readiness (National Defense Board, 2013).

The military accession standards for BMI and body fat percentage were developed to maximize readiness and protect the health of military members. The Defense Health Board identified that one purpose of the physical fitness standards for military service is to enhance recruitment of service members who are capable of meeting the standards (Defense Health Board, 2013). According to Department of Defense Directive 1308.3, service members must meet and maintain the accession height-weight and body fat standards for the service for which they are seeking admittance. The U.S. Military Entrance Processing Command Regulation 40-1 stipulates that, if a recruit does not meet the height-weight and body fat standards, he or she will be temporarily disqualified.

In 2005, the Assessment of Recruit Motivation and Strength (ARMS) Study focused on Army applicants who were unable to meet the height-weight and body fat standards, but had, however, passed the ARMS test. In this study, the Army and Navy had six Military Entrance Processing Stations where the weight standards were relaxed and where they permitted recruits who were unable to satisfy the height-weight and body fat standards to be granted weight waivers. The results from the study revealed that the applicants who failed to meet the standards did not have a higher prevalence of separating 18 months after joining the military than those who did meet the standards. The outcome also demonstrated that height-weight standards were less predictive of attrition than fitness (Niebuhr et al., 2013; NRC, 2006).

Packnett et al. (2011) measured the effect of BMI on premature discharge from the U.S. Army in a large cohort of first-time enlisted and active duty soldiers. The results indicated that soldiers with a higher BMI had an elevated rate of discharge. Soldiers who received a medical waiver to enter the service had a higher rate of medical discharge than soldiers who needed a medical reexamination (Packnett et al., 2011).

The escalating obesity rates in the United States impact the potential labor force of military applicants. This raises the question of whether the United States will be able to maintain a fit fighting force in the forthcoming years. Since the Department of Defense is dependent upon an all-volunteer force, it looks to the U.S. general population to meet recruitment requirements (Crawley & Maclean, 2012). The all-volunteer military that supplies the recruiting efforts may soon become compromised as the pool of eligible candidates continues to shrink. Gagnon and Stephens (2015) suggested that, if obesity continues to increase, there would be a shortage in the number of qualified applicants to staff the armed forces. Hruby et al. (2015) concluded that, since the armed forces obtain the majority of their recruits from the general population, the obesity rate threatens the pool of applicants. Approximately 20% of men and women who tried unsuccessfully to enter into the Army failed to qualify due to being overweight or obese (Hruby et al., 2015). More than 35% of young men and 60% of young women would fail the weight standards of at least one military service (O'Conner, 2013).

The applicants who do meet the weight standards continue to struggle to maintain those requirements. Men between the ages of 17 and 20 are permitted to enlist with 24% body fat, but must drop to 20% in order to remain. The body fat percentage for women

between the ages of 17 to 20 to enter into the armed forces is 30% (Crawley & Maclean, 2013). In 2010, researchers at the Uniformed Services University of the Health Sciences reported that 86,186 service members had at least one obesity-related diagnosis, and 15% of men and 20% of women reported having trouble meeting weight standards (MSMR, 2011; Tanofsky-Kraft. et al., 2013). Researchers have also found that heavier individuals are more likely to fail basic training than those who meet the weight standards (Jones et al., 1988; Knapik et al., 2001; Poston et al., 2002).

In 2010, the Disability Evaluation System (DES) had 6.8% of enlisted members with a diagnosis of being overweight or obese at their military entrance physical, an increase from the longtime average of 5.8% (Appenzeller, 2013). Research also illustrated that 9.3% of enlisted military members were found to have either high weight or body fat percentage irregularities during their physical examination at the military entrance processing station. Those who were classified as overweight had a 30% higher probability of receiving disability retirement, and those considered obese had a 40% chance (Appenzeller, 2013; Niebuhr et al, 2011). In 2010, 40% of the health issues assessed for disability were associated with or aggravated by overweight and obesity (Appenzeller, 2013).

According to Hruby et al. (2015), the likelihood of overweight women entering in the Army increased in the 1990s, and again after the body fat standards were relaxed in the 2000s. Additionally, the results showed that women enlisting and remaining on active duty are less likely to be considered overweight or obese than men (Hruby et al., 2015).

According to Tanofsky-Kraft et al., (2013), 80% of applicants who superseded the

weight standards but were later able to meet the standards or receive a waiver, were later separated from the military before completing their initial enlistment. These data illustrate that, not only is it becoming increasingly difficult to recruit eligible applicants, but it is also difficult to retain recruits once they are members of the military (Tanofsky-Kraft et al., 2013). Further, as compared with historic data, military recruits are now less physically fit and heavier, with higher body fat, highlighting the necessity for effective primary prevention strategies (Pasiakos et al., 2012). The percentage of recruits who were obese (14%) was much lower than U.S. population estimates (34%) for adults 20–39 years of age (Pasiakos et al., 2012). Although obesity rates appear different in recruits, it is important to recognize that new recruits must meet body weight standards in order to enter military service (Pasiakos et al., 2012).

AMSARA (2011) conducted a study of active duty Army enlisted personnel to examine the association between BMI measured at accession and premature separation within the first three years of military service. The results concluded that 27.8% of the 514,257 obese males and 45.9% of the 106,053 obese females experienced attrition. The study also illustrated that obese recruits had a 9% greater risk of attrition, and overweight recruits had a 3% decreased risk of attrition (Defense Health Board, 2013). As greater demands for efficiency arise in the Department of Defense, early attrition may no longer be acceptable.

National Security

An important factor that must not be overlooked is the impact obesity can have on operational readiness, which can affect national security. A physically fit force is a

fundamental tenet of the Army's mission. A study conducted by Crawley and Maclean (2013) indicated trends that threatened to lower the academies' attendance numbers and could result in derogation from military readiness, as well as a smaller number of top-quality leaders. In the NHANES Continuous Survey 2009-2010, results demonstrated that the percentage of men between the ages of 17-22 years exceeded the U.S. Military Academy weight standards. The percentages of those exceeding the standards increased from 3.0% during 1959-1962 to 8.4% in 2009-2010. For women in the same age category, the percent exceeding the standards increased from 4.1% from 1959-1962 to 18.0% during 2009-2010 (Crawley & Maclean, 2013).

The Institute of Medicine (2004) reported that obesity is correlated to poor job performance in military professions. When it is determined that service members exceed the height and weight standards, their military careers are put in jeopardy. Military members can be prevented from receiving promotions, advanced schooling, bonuses, transfers, awards, and leaves. In some cases, obesity affects the individual's ability to deploy to real-world missions or to re-enlist (Purvis et al., 2013; Tanofsky-Kraft et al., 2013). Obesity can obstruct entrance into the military, and service members who are allowed to join the military even though they exceed body fat standards are placed into the Army's Weight Control Program. If one does not make reasonable progress within six months, one can be processed for elimination from the service (Hruby et al., 2015).

Research by AMSARA (2012; Krukowski et al., 2014), showed that decreases in military operational effectiveness and fitness, as well as increases in the risk of pain, injury, disability, and early retirement or discharge in military personnel are linked to

obesity. There may also be an increased risk of receiving administrative actions, including discharge from the service (AMSARA, 2012). When a member of a team or section is released, it affects members of the unit, especially when considering the time spent training together as one unit. Physical fitness and body weight are notably significant to military duties. Militaries throughout the world use a fit appearance as a sign of strength, discipline, and professionalism. According to Friedl (2012), obesity and reduced physical fitness are discordant with military operation. Military personnel are often put through training and operational exercises that consist of a multitude of stressors such as caloric deficiency, sleep deprivation, and extended periods of physical strain. These variables affect both the physical and cognitive performance of soldiers and can decrease operational effectiveness (Friedl, 2012; Purvis et al., 2013). Military members are often subject to the additional stressors of frequent deployments and relocations. Stressors such as combat, exposure to causalities, war zones, deployments, and re-assignment can affect the psychological and physical health of service members. Research shows that stress is also related to obesity and excess body weight (Tanofsky-Kraft et al., 2013). Studies show that the average weight gain within the Air Force is 0.6-1.4 lbs for men, and 0.8 lbs for women per year, accumulating over the path of their military careers (Tanofsky-Kraft et al., 2013).

Obesity has also been determined to be unfavorable to individuals and to the collective military capability due to the correlation with depressive symptoms (McLaughlin & Wittert, 2009). Research shows that obesity is related to long-term health issues, and places obese personnel at higher risk of acute events and injury, and can

compromise the unit and the mission (Defense Health Board, 2013). Similar studies also suggest that applicants and veterans identified as obese are more likely to utilize sick-leave for longer durations, and obesity is associated with high productivity losses, producing a high cost (Neovius, Rasmussen, Rehnberg, & Neovius, 2012).

Obesity continues to have indirect costs, such as loss of productivity. A study conducted by Robbins et al. (2002) aimed to determine the increase in medical care and lost workdays among active duty Air Force personnel with excess body weight. The evidence illustrated that overweight and obesity were responsible over $19 million in costs per year and contributed an estimated 28,521 lost days per year (Robbins et al., 2002). A study of active duty military conducted by Reyes-Guzman et al. (2015) found that lost productivity from being overweight or obese costs the military $106 million per year. To treat obesity-related conditions, it costs a total of $1.1 billion (Reyes-Guzman et al., 2015).

Poston (2002) conducted a study of obese airmen that examined whether weight or obesity predicted chance of discharge from basic training. The results of the study indicated that being underweight was a predictor of medical discharge during basic training. The overweight status was associated with a small increase in the probability of medical discharge. Overall, overweight and obese Airmen were not more likely to be discharged within the first year of military service than individuals who had an average BMI.

According to a report by a group of 300 retired Generals and Admirals, it was determined that there were three major reasons that young men and women pose a

challenge to the military: they were too heavy to join, became too heavy once admitted in the military, or had weak muscles and bones and suffered from excessive sprains and stress fractures (Mission: Readiness, 2012). The study also disclosed that, during the Iraq war, recruiting commands had several recruiters who were unsuccessful in attaining their recruitment goals. The Army made a decision to temporarily allow physically fit overweight recruits who had high body fat to enlist in the service. The study demonstrated that the overweight recruits had a 47% higher chance of encountering musculoskeletal injuries and fractures and to have to recycle through boot camp (Cowan, 2011; Mission: Readiness, 2012). In most cases, service members who are injured do not deploy with their units. Overweight service members experience injuries at a higher rate. This can impact the service member, the unit, and national security (Mission: Readiness, 2012; AFHSC, 2011). In the U.S. military, stress fractures are substantial complications to military operational effectiveness and have a higher incidence among recruits with elevated BMIs (AFHSC, 2011). The study also demonstrated among basic trainees that stress fractures were responsible for more lost duty days and training recycles than any other training-related injury.

The literature review makes it evident that the high prevalence of obesity within the armed forces needs attention. Regardless of the strict physical performance standards, members of the military are not impervious to this epidemic. Weight and obesity within the military affect service members' health, fitness, and quality of life. The implication of the literature review on obesity in military populations is that military service members have access to customized and appropriate guidance regarding weight, healthy eating,

and support approaches to weight management, yet obesity is still on the incline (National Defense Board, 2013; Reyes-Guzman et al., 2015).

Veterans

Research shows that obesity is affecting United States veterans in mounting numbers (Jay, Mateo, Squires, Kalet, & Sherman, 2015; Kahwati et al. , 2011). According to the Department of Veterans Affairs, in 2014 there were 21.8 million veterans in the U.S., and 78% of those Veterans were either overweight or obese (Koepsell et al., 2012; Veterans Affairs, 2014). According to a report by the Veterans Health Administration, 37.4% of female veterans and 32.9% of male veterans receiving outpatient care at Veterans Affairs-operated medical facilities are classified as obese, compared with 26.1% of adults in the civilian population (Mendez, 2012). Additionally, over 165,000 veterans were reported to have a BMI of 40 or above, classifying them as "very severely obese," at which point weight gain begins to interfere with basic physical functions, and risks of chronic illnesses related to weight become much higher (Locatelli et al., 2013).

In a 2013 study conducted by Maguen et al., of 500,000 Iraq and Afghanistan veterans, 75% were found to be either overweight or obese. The three-year study concluded that veterans were at much higher risk of being obese and were more likely to continue gaining weight as time went on, rather than staying stable or losing weight (Maguen et al., 2013). Evidence shows that veterans have a higher prevalence for weight gain during the first few years of separating from the service, as the assimilation back into civilian life occurs (Littman, Jacobson, Powell, & Smith, 2013; Maguen et al., 2013;

Noel et al., 2013; Yaffe, Hoang, Byers, Barnes, & Friedl, 2014). Regardless of the amount of attention focused on fitness and healthy weight maintenance throughout a veteran's career, it is often not enough to motivate healthy weight when the weight standards are no longer enforced.

A study conducted by Masheb et al. in 2014 identified several consistent patterns that contribute to this higher rate of obesity among veterans. The study examined reports by veterans of eating behaviors learned during military service, which involved learning the ability to eat very quickly during basic training. Over time, they became conditioned to eat excessive calories in response to stressful situations or during times of conflict (Masheb et al., 2014). Many veterans felt that the high-carbohydrate, high-fat diets they were introduced to during military service led them to make unhealthy eating choices after they left active duty and were no longer as physically active. In virtually all cases, veterans exercised less after leaving the service, but did not reduce the amount of food they ate in an average meal compared to when they were on active duty. The study also identified higher incidence of food cravings, binge eating, nighttime eating, food hoarding, and a preference for sweets among veterans compared to the civilian population (Masheb et al., 2014).

A study team in 2018 conducted a survey utilizing the data from A National Health and Resilience In Veterans Study (NHRVS). The survey was a nationally representative survey of 3,122 U.S. veterans conducted in December of 2011. The objective was to provide an updated estimate of the prevalence of obesity in the U.S. military veterans and evaluating a broad range of sociodemographic. The results

concluded that that 32.7% of the U.S. veterans are obese. This is higher than previously reported for U.S. military veterans nationally using the VHA healthcare system. The study proposes a continuing increase of obesity in the U.S. veteran population in younger, non-white veterans and those using the VHA as their principal source of care. The study also found that obesity in veterans was strongly correlated with multiple medical conditions, sedentary lifestyles, and reduced quality of life (Stefanovics et al, 2018).

The environment veterans once knew, where exercise regimes and structure took up a great portion of their day, changes upon separation or retirement. They now grapple with incorporating physical activity, limiting their calorie intake, and maintaining their weight. While the increasing obesity rate among veterans has been an acknowledged issue for several years, current efforts to prevent it have had only marginal effects and have not been able to stop the percentage of veterans classified as overweight or obese from continuing to increase year to year. Awareness of how weight gain occurs among veterans and service members may serve to foster a better understanding of the impact obesity has on the veterans and service members (Jay et al., 2015).

Theoretical Framework for the Study

Regardless of the plethora of research and information on obesity and weight, there has been no compelling movement in the prevalence of obesity, and it continues to be one of the most significant health concerns for the U.S. military (Alber & Hamilton, 2013; Crawley, Maclean, 2011; Defense Health Board, 2013; Gattis, 2011; Hurby et al, 2015; Ogden, Carroll, Kit, & Flegal, 2014; Sanderson et al., 2011). Since the socioecological framework is encapsulated within the ecological framework, a

comprehensive understanding of ecology theory is needed. Researchers suggest that human behavior cannot be understood without contemplating the context in which it takes place (Davison, Jurkowski, & Lawson, 2012).

There were many prominent researchers involved in the development of the ecological theory; however, Urie Bonfenbrenner's Ecological Systems Theory is the most common theory associated with public health (Glanz et al., 2008; McLearn & Hawe, 2005). Bonfenbrenner's System Theory introduces three levels of influence: microsystem, mesosystem, and the exosystem (Callahan-Myric, 2014; Swick & Williams, 2006). Today, these levels are identified as the socioecological model. The model suggests that the various levels influence behaviors such as physical activity and eating. The basic concept of the ecological theory includes various levels that can influence behavior, such as intrapersonal, interpersonal, organizational, community, physical environment, and policy (Blanchard et al., 2005; CDC, 2012; Glanz et al., 2008; Eisenman et al., 2008; Zurawik, 2014).

In 1988, Kenneth McLeroy and his partners introduced an ecological model of health behavior consisting of five levels of influence: intrapersonal, interpersonal, institutional (organizational), community, and public policy (McLeroy, 1988). This model was taken even further when Stokols described four fundamental assumptions that must be present when implementing statistical models to develop health interventions. The assumptions are as follows: (1) health behavior is influenced by physical environments, social environments, and personal attributes; (2) environments are multidimensional, such as social or physical, actual or perceived, spatial arrangements or

social climate; (3) human-environment interactions occur at varying levels of aggregation (individuals, families, cultural groups, whole populations); and (4) people influence their settings, and the changed settings then influence health behaviors (Warner, 2012).

What distinguishes the ecological theory from behavioral theories are the environmental levels of influence and the incorporation of broader community, organizational, and policy influences on health behavior (Glanz et al., 2008). The cynosure of the ecological models involved in public health is on the individual's transactions with their physical and social environments (Glanz et al. 2008). Support for the ecological models as applied to health behaviors is increasingly evident in the following documents: Healthy People 2012; Institute of Medicine, Report on Health Behaviors, 2001; Child Obesity Prevention 2005; The World Health Organization's Strategy for Diet, Physical Activity and Obesity, 2004; and the World Health Organization Framework Convention on Tobacco Control (Glanz et al. 2008).

According to the Institute of Medicine Report on Health and Behavior and Healthy People 2010 National Objectives, ecological models are becoming more popular when addressing public health concerns (Economos & Irish-Hauser, 2007; Sallis et al., 2006). If the goal is to motivate individuals to change their behavior, strategies should incorporate environments and policies (Glanz et al. 2008). Researchers propose that based on the success of reversing the tobacco epidemic, there is the probability that the obesity epidemic can experience the same success by enhancing environments and policies that drive physical activity and nutritional behaviors (Institute of Medicine, 2001; Koplan, Liverman, & Kraak, 2005; World Health Organization 2004).

The Socioecological Model and Obesity

Obesity is often said to be a function of biology and genetics. However, the roles of social, environmental, and economic factors in the obesity epidemic are evident (CDC, 2013f). Obesity is influenced by the social environment, which involves societal norms for eating, physical activity, body image, marketing activities, and cultural forces. Obesity can also be facilitated or impeded by the environment. A built environment consists of (1) the availability and accessibility of food and drink, and (2) the safety, accessibility, and existence of space for physical activity (CDC, 2013f; Whittemore, Melkus, & Grey, 2004). This framework provides a composition for examining and understanding the issues surrounding obesity and weight, and could be instrumental in identifying strategies to decrease obesity rates.

The socioecological theory illustrates the correlation between health behaviors and individual, interpersonal, organization, community, and environment. According to several scholars (CDC, 2013; Glanz et al., 2008; Linke, Robinson, & Pekmezi, 2013), the definitive purpose of the socioecological model is to influence the growth of wide-ranging intervention approaches that can methodically focus on mechanisms of change at several levels of influence. By encompassing the socioecological approach, obesity can be addressed at multiple levels, to include individual and family characteristics, along with characteristics of the community and surrounding area (Hawkins, Cole, & Law, 2009). The complex, multifaceted study of weight and obesity demands comprehensive approaches encompassing individual behavior and individual environments successful interventions are to be viable (Economos & Irish-Hauser, 2007). The socioecological

approach offers a theoretical framework for recognizing the interchange between persons, groups, and their sociophysical settings (Stokols, 1996; Whittemore et al., 2004). The socioecological perspectives highlights that behaviors and health are often influenced by several levels, including the individual, families, groups, and populations (Glantz et al., 2013; Ockene et al., 2007). Statistical research has assimilated person-focused efforts to transform individual health behavior with environment-centered interventions in order to improve physical and social surroundings and decrease dominant health issues (Stokols, 1996; Whittemore et al., 2004; Zurawik, 2014).

The use of socioecological models has become more popular as a shift has occurred from person-focused to environmentally based and community-oriented health promotion (Economos & Irish-Hauser, 2007; Linke et al., 2013; Stokols, 1995). When utilizing a socioecological strategy to promote health behavior, the focus is not on the persons who are making or not making healthy choices. Instead, the strategy is to engage the social process and those that have influence on the choices (Breslow, 1996; Linke et al., 2013; Stokols, 1995). According to Stokols (1996), the nucleus of socioecological theory is that health is influenced by multiple factors, such as personal attributes, genetic heritage, psychological dispositions, and behavioral blueprints (Stokols, 1996). These attributes can influence health directly or in combination with diverse environmental circumstances. A vital predictor of wellbeing in social ecological research is the level of compatibility between people and their environment (Stokols, 1996).

Research suggests that environments that support obesity-causing behaviors may be contributing to the obesity epidemic. Today's technology, which nurtures sedentary

behavior, overindulgence in fast foods, and unhealthy diet choices have contributed to the obesity epidemic (Whittemore et al., 2004). As a result, focus on the social and environmental context becomes vital in intervention programs aiming to promote health. Based on this concept, a socioecological approach is justifiable for examining the obesity epidemic (Alber & Hamilton-Hancock, 2013; Blanchard et al., 2005; Economos & Irish-Hauser, 2007; Sallis, 2006; Stokols, 1996). The foundation of the socioecological approach is that environments and certain social factors allow or restrict a variety of behaviors by advancing or discouraging particular actions and behaviors (Blanchard, et al., 2005). The CDC recommended that the prevention and treatment of obesity can be accomplished by approaching the issue at the various levels of the socioecological model (Callahan-Myrick, 2014; Emmons, 2000; Hamre et al., 2006). According to Pronk, 2018, when studying obesity it should be researched as a whole simultaneously involving multiple scales such as individual (micro), families (meso), and the society (macro). This approach will lead to inform decisions regarding resource investment and policy development (Pronk, 2018).

Obesity at Each Level of the Socioecological Model

Even though the levels of the socio-ecological model vary, each level is incorporated within the succeeding level. Interventions to battle obesity can take place at any of the levels. The first level is the individual or intrapersonal level. Obesity can be viewed on this level as a function of genetics. Personal history and biological factors that may increase the likelihood of obesity are found at the individual level (Affenito et al., 2012; Sarrafzadegen et al., 2013). Strategies that encourage attitudes, beliefs, and

behaviors that prevent obesity are also located within the individual level and are affected by other levels (Whittemore et al., 2004). Working with a dietician or a physician to address weight issues are actions found at this level. Adult patients who are obese and engage in conversations with their physicians concerning their weight are more apt to initiate behavior change. This action can also help move individuals from one level to the next (Krebs, 2005). Of all the levels, the interpersonal level is the most personal and related to an individual's behavior and health beliefs (Callahan-Myrick, 2014; CDC, 2012).

The interpersonal level is where one finds family, friends, and peers. Personal physicians, as well as key opinion leaders, are also contained at this level. At this level, one usually receives support, motivation and reinforcement from within the family or group. At this level, an individual can receive support for positive choices and decisions about his or her weight (Affenito et al., 2012; Whittemore et al., 2004). There are no rules or guidelines that govern how group members will provide emotional support, information, and help in fulfilling social responsibilities and health-related change (Zurawik, 2014). Social norms and identity roles, which are developed and operated at this level, can also influence lifestyle and healthy choices. Interventions that are designed to impact the interpersonal level set out to reinforce the social networks and support systems in order to enable individuals to make confident decisions about their health (Whittemore et al., 2004).

The third tier is the physical environment or institutions and organization level, and it incorporates home, work sites, schools, neighborhoods, organizations, and

communities (Alder et al., 2013; Fitzgerald & Spaccarptella, 2009; Glanz et al., 2008; Whittemore et al., 2004). This level has a considerable amount of influence on physical activity behavior. Strategies at the physical environment level may include community education, support groups, peer programs, and incentives. The organizational level takes into consideration the rules and policies that endorse healthy behavior. A strength of interventions aimed at institutional organizations is the ability to focus on several influences on the individual (Whittemore et al., 2004).

The next level is the community level. Individuals who increase their knowledge and make informed health decisions define this level. This level is where relationships may increase the risk of becoming overweight, so social norms must change (Brown, 2011). At this level, members can be educated about how to make healthy choices as well as how to incorporate physical activity and nutrition at different groups (Brown, 2011; Gentile, 2012; Golden & Earp, 2012). The goal at this level is to enhance health services and empower disadvantaged groups. Community promotions have shown the potential of multiple-level interventions through outcomes and reach. One disadvantage of intervention and research at this level is that they can be expensive and difficult (Whittemore et al., 2004).

The final level is the policy level. The policy level is defined as the local, state, or federal government that influences all the other levels through laws, ordinances, and regulation (Story et al., 2008). To avoid lethargy in the process of implementing a policy, there must be a coordinated and sustained plan of action to address the obesity epidemic. Several policy and environmental changes must be put in place to build healthier

environments that promote energy balance. No one level has precedence over another, and interventions work best when targeting multiple levels of influence and providing links between services (Whittemore et al., 2004). An example of a program that focuses on social and environmental elements of the community is the Healthy Cities Project. This program's objective is to increase health as a priority within local government and address obesity and other health issues with a variety of collaborative strategies, all while targeting several levels of influence (Kegler, 2002).

The CDC utilizes the socioecological model in their Toolkit to address the obesity epidemic. This model illustrates the correlation between health behaviors and the levels within the socioecological model (CDC, 2013f). The Toolkit focuses on policy, systems, and environmental interventions that have a greater impact on large populations. The three outer levels have a larger impact on obesity than the two inner levels (Callahan-Myrick, 2014; CDC, 2013f).

Points of Difference Between the Socioecological Model and Other Models

The socioecological framework describes behavioral influences that intermingle across various levels of an individual's behavior. It presents a framework for understanding the factors that create and maintain health and health-related issues, highlighting points of intervention and comprehending how social problems are created and maintained within subsystems (Wendel et al., 2015). This model provides an explanation of how health and wellbeing of a person is established by several influences and their interactions. The framework also examines a wide range of political and environmental factors that shape individual and interpersonal characteristics (Langille &

Rogers, 2010). The socioecological model provides a framework for assessing factors associated with obesity. The principles of socioecological models are consistent with social cognitive theory concepts, which suggest "creating an environment conducive to change is important to making it easier to adopt healthy behaviors" (Glantz, 2013, p. 14; Warner, 2012). One manner in which the socioecological model differs from the social cognitive theory is that the stress in on the function of the environment, and not solely on the social environment (Warner, 2012).

It has been documented that environments unreliably affect health (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2003). According to Glantz (2013), the basic principle of socioecological models conforms to social cognitive theory concepts and emphasizes developing an environment beneficial to change, which makes it easier to implement healthy habits. Developing a resolution to the obesity epidemic must be a shared responsibility. Forming coalitions that consist of the various levels will enable a greater number of organizations to develop obesity-prevention policies and programs.

The socioecological approach assimilates person-focused efforts to modify health behavior with environment-focused interventions to augment their physical and social surroundings. This socioecological approach offers a theoretical framework for recognizing the interchange between persons, groups and their sociophysical settings (Breslow, 1996; Stokols, 1996; Stokols, Allen, & Bellingham, 1996). In health promotion, the nucleus of social ecological theory is that health is influenced by a multiple of factors such as personal attributes, genetic heritage, psychological dispositions, and behavioral blueprints (Stokols, 1996). The attributes can influence

health directly or in combination with diverse environmental circumstances. A vital predictor of wellbeing in socioecological research is the level of compatibility between people and their environments (Stokols, 1996).

Researchers Pronk and Boucher suggested orienting obesity prevention approaches toward the identification and integration of relationships between and among individuals, environments, and resources (Economos & Irish-Hauser, 2007). They advocated for a systems approach that would build strategies across a multitude of individual and institutional stakeholders.

Similarly, researchers Corsion et al. (2013) have stated that, unlike other models, the socioecological framework acknowledges collective and cultural viewpoints of people with diverse ethnicities and socioeconomic backgrounds. It also examines how distinct perspectives collectively influence individual behavior and provides avenues to create a consumer intervention guide that meets the community's needs. This approach helped to build partnerships between healthcare organizations and the community and encouraged all to have a voice in the decision process.

Real-World Applications of the Socioecological Model

The socioecological model has been applied to obesity problems in several groups, such as children, African American women, and veterans (Fleury & Kew, 2006; Corsin et al., 2013). It has also been applied to policymaking approaches across the United States and abroad. This section reviews some of the program and policy implementations of the socioecological model to the problem of obesity.

Nutrition and Physical Activity Program to Prevent Obesity and Other

Chronic Diseases. The CDC established the Nutrition and Physical Activity Program to Prevent Obesity and Other Chronic Diseases (Hamre, Renaud, Franco, & Williams-Piehota, 2016). This program partnered with state health departments because they felt the health departments had a clearly defined avenue of approach to propagate scientific evidence in communities. One of the aims of the states is to develop private partners to help identify resources, whether human or financial, which will aid in building healthy communities. The concept is that governmental success will necessitate the capability to sustain and coordinate actions that result in change within our organizations, environments, and behavioral and health outcomes (Hamre et al., 2016). The health departments collaborate with stakeholders at each level to construct health-promotion and intervention programs to decelerate the obesity epidemic. Using the socioecological model, each state develops obesity prevention plans through public and private partnerships (Hamre et al., 2016).

As part of the CDC program, states were asked to focus on two of the five levels of the socioecological model when developing the new programs, in order to support a society that affords people the opportunity to live healthy lives (Hamre et al., 2016). The study revealed that the individual level was most commonly addressed, at 85%, trailed by the organizational level, at 67%. The interpersonal and community levels were both roughly addressed at 53%, with the society level in the rear with 40%. Since its inception, the partnership has implemented programs that target changing the obesity environment through the enactment of bills related to obesity, nutrition, and physical activity, including policy changes provisions (Hamre et al., 2016).

The socioecological model allows state health departments to consider individual behaviors that are modeled by social, political, and economic influences initiated where people live. Throughout the program, states are emboldened to employ strategies and multilevel approaches. As a result of this program, 96% of the funded states reported that 166 nutrition and physical activity policies were introduced, altered, or adapted for the prevention and control of obesity (Hamre et al., 2016). Evidence shows that state programs were able to initiate policies and environmental changes to build an atmosphere conducive to behavior change. Communities are being constructed where people can attain a healthy weight and where healthy choices are easy choices.

Ottawa Charter for Health Promotion. The socioecological approach was introduced in the Ottawa Charter for Health Promotion (Townsend & Foster, 2011; Zurawik, 2014). The Charter acknowledged the influence of individual, social, and environmental factors in physical activity, obesity, health, and wellbeing. It also explored the various opportunities for interventions at both the individual and community levels (Zurawik, 2014). The fundamentals of the approach are that (a) behavior affects multiple levels of influence; (b) individual behavior is molded by the social environment (Townsend & Foster, 2011). Instead of viewing individuals from an isolated view, they should be viewed form their larger social circles where they live. Gentile et al. (2009) advised utilizing socioecological models that focus on multiple levels of influence to examine the obesity epidemic. Educational institutions are commonly selected for prevention and intervention programs because of their ability to reach the majority of the youth population. Many of the school-based interventions fail to include families or

communities, and because of this, the overall effectiveness is constricted (Gentile et al., 2009).

Switch Program. Socioecological models that target multiple levels of influence have been recommended to address the obesity epidemic (Katz et al., 2005; Koplan, Liverman, & Kraak, 2005; Sacks, Swinburn, & Lawrence, 2008). Although socioecological models that consist of multilevel interventions have been recommended to address the obesity epidemic, there are few, if any, examples of studies that have implemented a multilevel intervention aimed at changing behavioral risk factors for obesity (Gentile et al., 2009; Whitemore et al., 2004). The few such studies that do exist have had mixed results. For example, a study conducted by Gentile et al. (2009) examined Switch, a community-based intervention for 1,323 elementary students aimed at changing key behaviors related to childhood obesity. The socioecological framework was utilized as a guide in the development of the program. The Switch program focused on families as the major influence point. It was hypothesized that providing programming at all levels (community, school, and family) would produce a greater effect than focusing on one level only. The Switch program supported healthy lifestyles and healthy choices by encouraging students to "Switch what you Do, Chew, and View" (Gentille et al., 2009, p. 2). Both behavioral and environmental strategies were introduced at several ecological levels. The evidence indicated that the Switch Program had little to no effect on promoting an increase in physical activity or making healthier food choices.

MOVE intervention. A conference held in Washington, DC, in 2007 focused on the operational framework for bridging factors that influence obesity-related behaviors at

the various socioecological levels for the United States Military (Levine et al., 2014). This included polices that govern food; physical, social, and economic environments; and factors related to service members and their surroundings. The National Institutes of Health, the Canadian Institutes of Health Research, and the CDC supported the conference. The central theme throughout the conference was that the military weight program was aligned with the assimilation of biological, social, and environmental influences on behavior (Levine el al., 2014).

Research shows that the socioecological approach is being utilized today in the implementation of the military MOVE intervention program (Jay et al., 2016). The MOVE program is a weight management health promotion program originally designed in 2006 to help increase quality of life among veterans. The acronym MOVE represents Managing Overweight/Obesity in Veterans Everywhere (Warner, 2012). According to research, using a multi-level approach, such as the socioecological approach to weight loss, when dealing with military members is import because of the complexity of factors involved in their weight struggles (Rosenburg, Ruser, & Kashaf, 2011; Warner, 2012). This program is now being offered as a pilot program to active duty service members stationed at Fort Lewis, Washington, and to veterans who receive their healthcare from VA facilities (Piche et al., 2014; Warner, 2012).

According to Jay et al. (2016), the MOVE program aligns with Bronfenbrenner's socioecological model in that it speaks to several levels of influence, but targets interpersonal and organizational factors as a method to change behavior patterns. The program illustrates how organizations can interact with behavior to advance and sustain

healthy behaviors (Jay et al., 2016; Warner, 2012). The results of the study indicated that, between 2008 and 2009, after roughly six months, 18.6% of the 31,853 participants had lost 5% of their body weight (Warner, 2012).

Public health policy. Researchers acknowledge that a more comprehensive policy approach is warranted in trying to reduce the obesity epidemic (Alder & Hamilton-Hancock, 2013; Leroux, Moore, & Dube, 2013; Sacks et al., 2008). Many current obesity policies use the socioecological approach, where the concept is the impact health policies have on health status through their effect on health determinants such as patterns of eating and physical activity (Alder et al., 2013; Sacks, et al, 2008). Based on the increasing severity of the obesity epidemic, however, government policies for obesity fail to adequately address the underlying determinants of health.

Alder and Hamilton-Hancock (2013) conducted a study to describe the current obesity policies in the United States and their association with the socioecological factors that affect obesity. A major objective of the study was to determine whether there was a relationship between levels of policy and obesity rates by state. The results illustrated that 58% of polices used the socioecological model at the interpersonal level, 16% at the community and societal levels, and 10% at the intrapersonal level (Alder et al., 2013). There was a positive relationship between the number of societal level policies and the number of community-level policies. There was a relationship between obesity rates and the number of community-level policies. Notwithstanding the recommendations to employ the socioecological model to confront obesity, numerous states are deficient in a comprehensive approach to obesity policies (Alder et al., 2013). Drafting policies at all

socioecological levels may be arduous, but it may be necessary to impede the obesity epidemic.

The approach used in this dissertation study assimilates the socioecological theory proposed by Bronfenbrenner (1979). The socioecological model incorporates the community-wide, preventive strategies of public health and the therapeutic and restorative strategies of medicine. It also focuses on the active roles that people take on in changing their health behavior. "Healthy behaviors are thought to be maximized when environments and policies support healthful choices, and individuals are motivated and educated to make those choices" (Glanz et al., 2008, p. 467).

This study serves to offer information on how the social ecological model is utilized to identify the gaps in research referencing the impact of obesity on a veteran's career. Despite the consensus that the social ecological model could be instrumental in the obesity epidemic, there is still an inadequate amount of studies where a multilevel intervention is introduced to target obesity and a need for further research (Gentile, 2009; Katz et al., 2005; Koplan et al., 2005; Sacks et al., 2008). According to Golden & Earp (2012), research shows that a majority of articles on ecological levels that target obesity intervention programs are more inclined to target individual and interpersonal characteristics, instead of institutional, community or policy elements.

Research Studies Using the Socioecological Model to Address Obesity

The socioecological model provided a framework for evaluating factors associated with obesity in a study conducted by Bois and Goodman (1989). The study was conducted among 153 Navy sailors, of whom 59% were categorized as obese. One of

the purposes of the study was to assess personal, environmental, and psychosocial factors related to obesity. In the study, the environment was recognized, acted upon, and modified to invoke a psychosocial response that resulted in variable levels of adaption (Bois & Goodman, 1989). Such modification to personal or environmental factors can lead to discrepant health conclusions.

Bois and Goodman (1989) studied the effects of demographic characteristics related to obesity such as age, sex, education, pay grade, rank, psychosocial factors, medical history, and diagnosis of family obesity. They also looked at interactions to test the effects of family obesity and age on body fat percentage, and to determine if the influence of family obesity continued to be a factor with older age. The results illustrated that sex, age, navy ranking, food obsession, and family obesity accounted for 56% of the discrepancy in percentage of body fat. The socioecological approach in this study aided in defining the conceptual structures often related to obesity. The results demonstrated that the Navy has a robust relationship to obesity-prone food behaviors, family obesity, and lower socioeconomic levels (Bois & Goodman, 1989).

According to Dietz (2016), the only explanation for the quickness with which obesity has expanded across the United States lies in changes in the environment, which have increased calorie intake and reduced energy expenditure.

Applying the socioecological model to the obesity in the military will assist in moving past intrapersonal factors such as attainment of knowledge, attitudes, and skills that are the common focus of health education programs. There are many existing studies on obesity (Brisbois, Framer, & McCargar, 2012; Finkelstein et al., 2012; Ogden et al.,

2014; Stevens et al., 2012; Sutin, Ferrucci, & Zonderman, 2011). However, there is a tremendous gap in research focusing on individuals who serve in the military. One of the advantages of the socioecological model is that, instead of advocating for individuals or introducing segregated approaches, stakeholders (such as community leaders, unit and base commanders, family support groups, healthcare professionals, public officials, and government and industry pillars) can envision their responsibilities and roles in addressing obesity (Ney, 2004).

Levels of Socioecological Obesity Intervention in the Military

The intrapersonal level of the socioecological model focuses on individual soldiers, airmen, sailors, and marines. The goal is to augment service members' knowledge, influence their attitudes and beliefs regarding their perception of themselves as obese or overweight, and increase their knowledge about serving size, portion control, or daily allowances. At this level, military members are screened for exceeding the height and weight standards, or diagnosed as obese. They may also be enrolled in weight control programs. The socioecological model can be used to develop comprehensive intervention approaches that systematically target mechanisms of change at each level of influence. When environments and policies reinforce choices that are beneficial, and soldiers, airmen, sailors, and marines begin to make educated choices, behavior change can occur (Warner 2012).

The interpersonal level may consist of platoon or squad leaders, family members, or others within their inner circle. This level might consist of those from whom service members seek advice or in whom they confide to help make tough decisions. This close

circle of family and friends can have a major influence on one's lifestyle. In basic training, trainees are matched with a buddy, and the two proceed to train together. That buddy makes sure his or her teammate does not oversleep or pushes the trainee to complete a road march. This is an example of interpersonal intervention. The interpersonal level is about relationships with so-called navigators. Navigators are people who act as supports to the service member (CDC, 2013). Interventions appropriate for this level include:

- platoon sergeant referral of service member to nutritional counseling,
- reminders to service members about weigh-ins and their importance, and
- assistance provided from service member navigators to eliminate barriers that exist in attending physical training or nutritional counseling.

The third level of the model focuses on the activities and programs implemented at the organizational level. The activities facilitate individual transformation of behavior by impinging on societal and cultural norms and eliminating individual level barriers (CDC, 2013). At the organizational level, one can receive education about nutritional classes, physical activity, and how to make healthy choices. Some of the following activities may be appropriate at this level:

- furnishing an evaluation of progress,
- providing education on the advantages of exercise and good nutrition, and
- adopting the rules and policies of weight control programs.

The next level includes the community or neighborhood. Most military bases provide the necessities of a sound physical environment for the promotion of physical

activity, but military environments may also promote obesity. For example, the civilian communities' military bases offer fast food or convenience stores, which promote poor nutritional choices. According to Fitzgerald and Spaccarotella (2009), the makeup of a neighborhood can influence eating behaviors.

Another issue the military faces is that service members may deploy to locations where physical activity is not only a challenge, but a safety risk as well. During those deployments, military members eat high caloric foods, and the opportunity to exercise may not present itself. When deployed or training, numerous service members seek to live, shop, and frequent restaurants outside military bases. Fast food restaurants and video games are ubiquitous in military and residential communities (Armed Forces Health Surveillance Center, 2011; Tanofsky-Kraft et al., 2013). Exploring how communities are arranged and how they operate can enhance the capability to take an integrated or multisystem approach and apply it to the blueprint for programs that address food, activity, and weight (Krukowski 2007). The interventions appropriate within the socioecological model for this level include:

- developing partnerships and coalitions within the community to enhance parks, sidewalks, recreational facilities, and the distribution of inexpensive fruits and vegetables;
- conducting public awareness and educational campaigns to get the community involved; and

- creating programs focusing on economical ways to prepare quick and healthy meals and selecting healthier foods when eating out or when deployed (Fitzgerald & Spaccarptella, 2009).

Soliciting community input can be beneficial in shaping and implementing program activity. Research suggests that building a sense of camaraderie and belonging in a program, regardless of its theoretical frameowrk, amplifies the potential for positive change in immediate behaviors and interpersonal patterns of influence (Economos & Irish- Hauser, 2007).

The fifth level of the socioecological model is the policy level. Policy-level factors include local, state, and federal policies that endorse healthy behavior through interventions that may include:

- pooling resources together to communicate new weight rules and regulations to platoons, companies, and family support groups;
- explaining new policies to the community about utilizing military facilities; and
- a proclamation by the base commander highlighting a military healthy challenge month.

Summary

The literature review accentuates how important it is to the Department of Defense to not only prevent obesity but to address the impact obesity it is having on veterans' careers and the men and women who serve our nation. More than 70% of the adults in the United States exceed the weight standards and are not qualified to join the

military (Armed Forces Health Surveillance Center, 2011Crawley & Maclean, 2012; Jackson, Cable, Jin, & Robinson, 2013; Ogden et al., 2014; Tanofsky-Kraft et al., 2013; Trust for America's Health, 2015). Obese service members and military applicants are at increased risk for health related diseases, suffer from excessive sprains and stress fractures, and are more likely to experience separation from the military (Crawley & Maclean, 2012; Niebuhr et al., 2011; Trust for America's Health, 2015). The literature review also shows impacts of obesity on readiness, manpower, and resource allocation that will become more pressing as the Department of Defense faces budget constraints. Soldiers, airmen, sailors, and marines who continually struggle to make weight for admittance into the military have a greater likelihood of failing weight or physical fitness assessment as their career progresses (Hurby et al., 2015; Packnett et al., 2011; Tanofsky-Kraft et al., 2013).

According to research, using multi-level approaches like the socioecological approach to weight loss when dealing with military members is important because of the complex factors that service members face (Rosenburg et al., 2011; Tanofsky-Kraft et al., 2013; Warner, 2012). Soldiers and veterans experience a unique environment where being overweight or obese can affect their career, which is not a common occurrence in the civilian population. Therefore, military overweight must be addressed by interventions to change physical activity behaviors. In this chapter, I presented information on what gaps are present in this area of research. There is a lack of research that addresses the military population and its struggle with obesity (Niebuhr et al., 2011; Packnett et al., 2011; Tanofsky-Kraft et al., 2013). The research gaps are found in the

maintenance of weight standards and interventions that assist military members and veterans to achieve and maintain healthy nutritional habits and fitness. There is also a lack of literature that addresses obesity once military members begin to transition to veteran status.

There are limited studies that focus on the relationship between excess weight and physical fitness in active duty military populations (Collee et al., 2014). Regardless of the necessity for research stressed in the literature, and calls for such efforts from the Department of Defense and other governmental agencies, there is still an inadequacy of research focusing on the military population. There is a need for additional research to help determine which of the socioecological model's multiple components are critical in the behavior change process, and to investigate challenges the military could make to stem the rates of obesity in this culture (Linke et al., 2013; Tanofsky-Kraft et al., 2013). To help turn the tides in the fight against obesity, military leaders must be open to receive training on current evidence-based intervention programs, and greater funding for programs and research will be needed (Economos & Irish-Hauser, 2007). Further research will help to determine how best help service members prevent obesity and continue to serve their country.

For this research, a survey will be conducted of military veterans to investigate the relationship between overweight and obesity at separation from the military and veterans' careers, including their adverse weight-related experiences and delays in recruitment. With access to a dependable established tool (Survey of Health Related Behaviors Among Active Duty Military Personnel) to collect the data, this approach will

aid in the evaluation of the association between obesity in service members' recruitment and career advancement. Chapter 3 offers a detailed description of the research design and methodology employed to conduct this study.

Chapter 3: Methodology

Introduction

Creswell (2009) suggested, "Quantitative research is a means for testing objective theories by examining the relationships amongst variables" (p. 4). Through this quantitative study, I sought to examine whether obesity impacts veterans' careers in the form of more difficult or delayed recruitment and more adverse weight-related experiences while in the military. This chapter presents the methodology for the study, including a description of the the design, participants, sample size, and instruments used. The chapter proceeds with a description of the procedures for data collection and analysis, followed by threats to validity and ethical considerations. A summary concludes the chapter.

Research Design

This study used a cross-sectional, quantitative, correlational survey design. Cross-sectional research studies are based on observations that take place in different groups at one time. This means that there is no experimental procedure, so the researcher manipulates no variables. Instead of performing an experiment, the researcher relies on existing differences and simply records the information observed in the groups being examined. Therefore, cross-sectional research describes the characteristics that exist in a group but does not determine any cause-and-effect relationship that may exist. Although the groups used to collect data are not geographically bound and may not be randomly selected, the data generated can be used to estimate the prevalence of an outcome (Zamboagna, Rodriguez, & Horton, 2008).

Cross-sectional designs often use survey research to ask participants questions designed to reveal the patterns of relations between variables (Frankfort-Nachmias & Nachmias, 2008). The objective of a correlational study design like that used in the present study is to examine the correlations among multiple characteristics of a population (Szklo & Nieto, 2014). In 2004, Granello and Wheaton argued that the use of a web-based survey design presents the researcher with various advantages, such as rapid data collection and economy of design. Additionally, the Internet can simplify the manner in which quantitative, survey-based studies are conducted. Furthermore, using a web-based survey allows respondents anonymity and freedom from pressure to complete the survey (Daley, McDermott, Brown, & Kittleson, 2003).

The cross-sectional design employs numeric descriptions of an attitude of a specific group and is the most common design used in the social sciences (Jones, 2015). A cross-sectional approach is customary in development research and is used to contrast variables and comprehend the frequency of outcomes and possible factors related to the outcomes (Carlson & Morrison, 2009; Levin, 2006). The cross-sectional design is recommended for research that involves the collection of data on relevant variables at one time only from different people, subjects, or phenomena. Nevertheless, this characteristic is viewed as a limitation because it provides no order in which events occur (Levin, 2006).

The cross-sectional design provides only a snapshot of the actual situation at any given time (Levin, 2006; Mann, 2003). A cross-sectional design is ideal when there are time constraints and smaller amounts of resources (Levin, 2006). Cross-sectional research

designs are also known to have lower attrition rates. In addition, if random sampling is used, the results may be more likely to allow for generalization to a larger population (Jones, 2015).

With cross-sectional studies, one of the advantages is that researchers can gather data on individual characteristics while simultaneously collecting information about results. This particular design was well suited for my study on obesity and its effects on the military because the study was drawn from the whole population (Levin, 2006). The cross-sectional design is an efficient way to evaluate a large sample of service members labeled overweight and obese. Similarly, cross-sectional designs can be used to estimate the association between obesity and military career events (Carlson & Morrison, 2009). Noted disadvantages of cross-sectional survey designs are difficulty in establishing the time sequence of events and causal inference (Mann, 2016). Cross-sectional research is relatively easy and cost effective to conduct and was thus appropriate for my research study.

According to Levin (2006), cross-sectional surveys are also beneficial in gauging the practices, attitudes, knowledge, and beliefs of a population in relation to certain health events. The survey provides an indication of the extent of the problem in a particular population at a certain point in time. It also offers a foundation for developing appropriate public health measures. Cross-sectional studies are relatively inexpensive and quick, and data are collected from individuals, which allows for more complete control of the data collection process. Such studies are beneficial for generating and expounding hypotheses, piloting technology, and building foundations for decisions about upcoming

follow-up studies (Mann, 2003). Additionally, cross-sectional studies are conducive to assessing several outcomes concurrently (Thiese, 2014). This study design was particularly suited to my research because it was useful in establishing the prevalence of obesity. Using a web-based survey also provided an efficient and effective way to reach the target population because it was not restricted by distance. I concluded that the most suitable option based on the sampling frame, research purpose, and examination of previous research was a cross-sectional, quantitative, correlational survey design.

Research Questions

In this study, the cross-sectional research design was used to address the following research questions:

Research Question 1. Are military veterans who were overweight or obese upon separation from the military more likely to have experienced adverse weight-related experiences while serving compared with their nonoverweight counterparts?

$H1_0$: Military veterans' overweight at separation does not contribute to their likelihood of adverse weight-related experiences while in the service.

H1A: Military veterans' overweight at separation contributes to their likelihood of adverse weight-related experiences while in the service.

The dependent variable for this research question was adverse weight-related experiences. The independent variable was overweight at separation.

Research Question 2. Are military veterans who were overweight or obese upon separation from the military more likely to have experienced delays in their ability to enter the military or enlist?

$H2_0$: Military veterans' overweight at separation does not affect their likelihood of delays in enlisting.

H2A: Military veterans' overweight at separation affects their likelihood of delays in enlisting.

The dependent variable for this research question was ability to enlist. The independent variable was overweight at separation.

Population

The target populations from which the sample was drawn consisted of military veterans who seved in the U.S. Army, Air Force, Navy, or Marines from 1997-2017. The following inclusion criteria were set: retired or separated under honorable conditions, retired within the last 30 years, and 19 years and older. Participants needed to have access to the Internet, either at home or in a public location, to complete the web-based survey. The exclusion criteria excluded veterans who were incarcerated at the time of data collection or had received a dishonorable discharge.

Sampling and Sampling Procedures

Convenience sampling is a type of nonprobability or nonrandom sampling technique. The focus of non-probability sampling is sampling techniques that are based on the judgement of the researcher. In nonprobability sampling , there is no reassurance that everyone has a chance of being incorporated. Convenience sampling is also known as *haphazard* or *accidental sampling* (Ilkeret al., 2016). Convenience sampling technique was selected because it was not possible to use the entire population and participants were easily accessible. Some of the reasons for selecting convenience sampling are that it

is (a) cost effective, (b) conducted in a short period of time, (c) useful in a pilot study, and (d) availability of data. Convenience sampling may be used in conjunction with most study designs (Sedgwick, 2013). Convenience sampling can assist in gathering useful data and information that could not be gathered using probability sampling techniques (Ilkeret et al., 2016).

The sample may not be truly representative of the population. Generalization is not possible when using convenience sampling; however, a survey can still be useful to test certain questions and explore the the types of responses received, and the results can be used as a catalyst to create additional questionnaires. When a sample does not represent the entire population, the researcher should be aware of the characteristics of the sample obtained through convenience sampling (Sedgwick, 2013). This will assist the researcher in knowing how well the population is represented. Convenience sampling may be used in concurrence with most study designs.

Sample size is a crucial element in research because it can affect the quality of results. In quantitative studies, a desirable sample size is determined by the expected variation in the data. The more wide ranging the data, the larger the sample size required to achieve the same level of accuracy (World Health Organization & University of Amsterdam, 2004). One way to determine a sample size is through power analysis.

The goal of a power analysis is to provide accurate information that addresses the research question. The power of statistical significance is defined as the probability that the sample will reject a hypothesis (Trochim, 2006). A power analysis can help determine the number of subjects needed. To reject the null hypothesis, power should be

at least .80. To compute the sample size, a power analysis was conducted using G*Power. G*Power is a software program for computing statistical power analyses for various statistical tests, such as the *t* test, *F* test, and chi-square (Faul, Erdfelder, Lang, & Buchner, 2009). According to Faul et al. (2009), G*Power has a long history of flexibility and accuracy. It was also noted that sample size is calculated by considering three factors, identified as power, significance level, and effect size. The effect size is also referred to as the *magnitude of the difference*. If a higher sample size is used, the chances of experiencing Type-I and Type-II errors are diminished. Small samples are also known to harm the internal and external validity of a study, whereas very large studies may magnify the findings of dissimilarity, thus emphasizing statistical differences that may not be pertinent (Faber & Fonseca, 2014). I calculated the sample size for this study with the following parameters: 80% statistical power for a two-sided significance level, effect size of .25, and alpha level of .05. I calculated the sample size for this study using a two-way ANOVA with six groups and three *df* in the numerator and with the following parameters: 80% statistical power for a two-sided significance level, effect size of .25, and alpha level of .05. The calculation resulted in a required sample size of 158 veterans.

Recruitment

The goal of the recruitment strategy was to augment the benefits and reduce the disadvantages of web-based recruitment. Research confirmed that when there is higher incentive or recompense for participation, there are greater numbers of participants (Singer & Cong, 2013). However, this study did not use any recruitment strategies where

monetary incentives for participation were offered. Participation was strictly voluntary. Participants were made aware of the secure online survey administered through SurveyMonkey through e-mail and offered an opportunity to participate.

Participation

I contacted veterans through Mr. Ronald Steptoe, the CEO of Warrior Centric Health Organization. Mr. Steptoe passed the survey link to his members, who were veterans. Before data collection commenced, the study protocol was approved by Walden University's Institutional Review Board (IRB). A consent form accompanied the e-mail inviting veterans to participate in the research project, along with the instructions. The invitation contained the research purpose, time needed for completing the online survey, and link to a secure online survey. Potential participants were also made aware that their participation was strictly voluntary. The online survey was open for 6 weeks, and thereafter the survey site closed. An e-mail was sent to the participants to thank them for their participation in the survey. My e-mail address and phone number were made available to all participants in an effort to give everyone the opportunity to make contact. To ensure security and privacy, the returned surveys were housed in a secured location (an encrypted site for a short duration of time). After the retention period expires, the documents will be destroyed according to Department of Defense regulations.

Data Collection

Data were collected using an online, self-administered questionnaire developed by the Department of Defense in 2008. The data were collected with minimum to no risk to participants. The online survey company, Survey Monkey, allows users to create their

own web-based surveys. Its features allow for data to be accumulated in percentages, frequencies, and cross tabulations. Once the data were collected, they were extracted from Survey Monkey and imported into an Excel spreadsheet. The data were then transferred to Statistical Package for Social Sciences (SPSS) version 24.

To ensure potential respondents' confidentiality and anonymity, the web-based survey tool uses Secure Sockets Layer (SSL), a data encryption program that encodes the respondents' answers. Survey Monkey provides firewall technology to further enhance protection of data from unauthorized access. It also uses a filter that prevents the recording of participants' IP addresses. The web-based online surveys were assigned a Uniform Resource Locator (URL) that was e-mailed to potential respondents. All participants had the opportunity to choose not to participate at any point during the survey by deleting the e-mail. Following protocol, I ensured that this study received IRB approval from Walden University before collecting any data or contacting any participants.

Instrumentation

The primary instrument for this study was the 2008 Department of Defense Health Related Behaviors Survey of Active Duty Military Personnel (HRB) developed by the Department of Defense (Appendix B). The 2008 HRB Survey is the 10th in the series administered by Research Triangle Institute (RTI) International under the sponsorship of the Office of the Assistant Secretary of Defense (Health Affairs), the TRICARE Management Activity (Health Program Analysis and Evaluation Directorate), and the Coast Guard (Barlas, Higgins, Pflieger, & Diecker, 2013). The HRB survey has been

instrumental since its inception in 1980 in providing military leadership within all branches of the service with insight into the welfare of service members and information to facilitate policy and programmatic changes. It is one of the largest surveys that anonymously gathers data on behavioral health issues affecting the U.S. military (Barlas et al., 2013).

The 2008 HRB is in the public domain, and therefore no permission was required to use it. Dr. Robert Bray, senior author of the survey, was contacted via e-mail to inquire about using the survey. He confirmed that the questionnaire was considered in the public domain.

In 2008, the HRB was administered through a web-based format, which allowed the survey to expand its geographic reach and not be restricted to specific military bases (Barlas et al., 2013). The survey was designed to explore program effectiveness and determine the level of emphasis to be placed on programs in the future. The objective of the survey is to continue to assess trends in various health behaviors within the military. The results of the survey help leadership to evaluate the current state of readiness and policies that are associated with health behaviors, as well as to monitor service members' needs (Military Health Systems, 2009).

The target population for the 2008 HRB consisted of Army, Navy, Marine Corps, and Air Force members who were nondeployed and on active duty. Data have been collected over the last 30 years from a representative sample of active-duty members from each branch of the Armed Forces for the HRB survey. Exempted from the study were service academy students, personnel absent without official leave (AWOL), and

personnel who were incarcerated at the time of data collection. The reliability and the validity of the self-report data have been tested (Akhtar-Danesh, Dehghan, Merchant, & Rainey, 2008; Senier, Bell, Strowman, Schempp, & Amoroso, 2003).

Potential threats to reliability and validity in this survey stem from the possibility that survey respondents might not answer honestly, but instead provide socially desirable answers. There was also the concern that service members would not divulge information about behaviors that could put their military careers at risk. However, research suggests that, although self-reporting may underestimate the prevalense of sensitive behaviors, the method generally provides valuable data (Barlas et al., 2013).

Operationalization of Variables

Weight-related experiences. For the first research question, the dependent variable was *weight-related experiences*. The value for this variable was computed by summing items #14, 17, 18, 19, 20, and 21 (Appendix B). The items were actions that negatively affected veterans due to obesity or overweight such as denial of promotion no advance schooling, not eligible for awards, failure of a physical fitness test and returned early from school due to not meeting weight standards. The scores could range from 0 to 6, with a midpoint of 3.5. A higher score indicated that the respondent had more weight related experiences while in the service. I designed this computation.

Ability to enlist. The dependent variable for the second research question was *ability to enlist*. The value for this variable was computed by summing items #2, 15, and 16 (Appendix B). The scores could range from 0 to 3.0 with a midpoint of 2.0. A higher score indicated the respondent had more unsuccessful recruitment efforts due to weight. I

designed this computation.

Overweight at separation. The independent variable for both research questions was overweight at separation. The variable was defined by participants' responses to item #23: "Were you overweight when you retired or separated from the military?" This item was coded 0 = no, and 1 = yes.

Data Analysis

The results of the survey are presented in narrative form in Chapter 4. The data analysis plan for this study began with the receipt of the data from Survey Monkey. SPSS 24.0 was utilized to organize the extracted data for analysis. According to Field (2009), an analysis method for quantitative data includes examination of frequency distribution and evaluation of data completeness and consistency. Field (2009), also explained that the suitability of statistical tools for research studies is reliant on the types of variables, level of measurement, and research question. Statistical analysis was utilized to determine associations that exist in the data.

Frequency statistics were calculated for all variables. Skewness and kurtosis statistics were used to test the assumption of normality. Any skewness or kurtosis statistic above an absolute value of 2.0 denotes a non-normal distribution. Levene's test of Equality of Variances tested for the assumption of homogeneity of variance.

Independent *t*-tests, frequency distributions, and a one-way analysis of variance (ANOVA) were used to compare the independent variable (overweight at separation) to the dependent variables (ability to enlist, adverse weight-related experiences); thus, an ANOVA was appropriate for comparing independent variables. When testing between-

groups differences for two groups, an independent samples *t* test was used. For the comparison of three groups or more groups, a one-way ANOVA was employed. Where a significant main effect was found for an ANOVA, then post hoc testing was conducted to test pairwise differences between groups using Tukey's test.

To address violations in any of the aforementioned statistical assumptions when conducting between-subjects comparisons, the Mann-Whitney U test for comparing two groups and the Kruskal-Wallis test was utilized for comparing three or more groups. When significant main effects were found for Kruskal-Wallis tests, subsequent Mann-Whitney U tests were used in a post hoc fashion to explain pairwise differences.

Means and standard deviations were interpreted for between-subjects statistics like independent samples *t* tests and ANOVA. Medians and interquartile ranges were analyzed for between-subjects comparisons using Mann-Whitney U and Kruskal-Wallis tests. A *p* value of .05 was taken to indicate statistical significance, and all analyses were conducted using SPSS Version 24.0.

Threats to Validity

A common definition of validity is from Hammersley: "An account is valid or true if it represents accurately those features of the phenomena, that is intended to describe, explain or theorize" (Winter, 2000, p 1). Validity places emphasis on the accuracy and candor of the research study. External validity is required for assurance in declaring whether the study's results are relevant to other groups. It is the degree to which generalizations can be made to individuals, settings, and times based on the results of an investigation. A reactive effect of experimental arrangements is one example of a

threat to external validity that may be applicable to this study. This is also known as the Hawthorne affect (Wright & Lake, 1963).

Information bias is the result of systematic measurement errors correlating operationalized constructs with data collection methods (Szklo & Nieto, 2014). The use of self-reported data in this study might introduce bias associated and has significant consequences for the accuracy of screening and measurement. Subjects may provide responses that are not accurate, preferring to provide socially acceptable responses. Participants may use estimation of their weight rather than actual measurements. Use of self-report or inaccurate measurements can result in misclassification.

Experimenter bias is also a concern in this study. Researchers may be biased toward the results they desire. This can affect objectivity and potentially result in research errors that skew the study in one direction or the other. When internal validity is enhanced by research and experiments that are well designed, carefully controlled, and meticulously measured, alternative explanations for the phenomena under consideration can be excluded.

Ethical Considerations

Authorization to access to veterans' e-mail addresses was received before any contact was made. The authorization detailed how the researcher was provided with the e-mail addresses of all potential participants in order to conduct the survey. The participants were fully informed of the content of the study and provided a copy of the consent form through a link to the survey. By clicking on the link, participants indicated that they had read the instructions related to the risks and benefits of the research study.

The consent form fully disclosed the participants' rights to abandon the survey at any time during the research process. All data were collected in accordance with American Psychological Association guidelines. Completing the online survey served as consent to participate in the research study. A waiver of documented consent for the research study was utilized to ensure anonymity and to avoid jeopardizing participants' identities. Completing the informed consent process was a requirement to participate in the survey and cannot be waived.

Anonymity is of great concern. Precautions were taken to guard the respondents' anonymity. The secure online survey was completed anonymously and administered through the Survey Monkey website. A link to connect to the survey went directly from Survey Monkey's established open web link. At no time was personally identifiable information, such as participant's names, e-mails, organizations, or IP addresses, requested. I used every opportunity to adhere to stringent ethical guidelines in order to preserve participants' privacy, confidentiality, dignity, rights, and anonymity.

Summary

Chapter 3 has outlined the research methodologies, strategies, and design used in the study. Additionally, the chapter includes procedures and details for identifying participants, data collection tools, analysis methods, validity of the instrument, and ethical concerns. Chapter 4 provides a detailed presentation of the findings of the statistical analyses conducted to examine whether obesity impacts a veteran's career in the form of more difficult recruitment and more adverse weight-related experiences while in the military.

Chapter 4: Results

Introduction

Obesity is an important health issue in the United States and globally. The focus of this quantitative study was illustrating how obesity affects the military's ability to recruit and retain men and women in a high state of readiness and the impact that obesity has on veterans' careers. This study also explored whether obesity impacts a veteran's career in the form of more difficult recruitment and more adverse weight-related experiences while in the military. Prior research has demonstrated that obesity is a key factor in premature discharges or early separation from the military (Packnett et al., 2011).

Chapter 4 is organized around the research questions of interest and the hypotheses associated with each question. In this chapter, I report on data collection and then present the results of the study, including a description of the sample demographics and the variable frequencies, along with a discussion of missing data and assumption testing for statistical analysis. Next, I address the research questions by presenting the results of the statistical analysis, followed by a conclusion of the research study's findings. The research questions and hypotheses that guided data analysis were as follows:

Research Question 1: Are military veterans who were overweight or obese upon separation from the military more likely to have experienced adverse weight-related experiences while serving compared with their nonoverweight counterparts?

$H1_0$: Military veterans' overweight at separation does not contribute to their

likelihood of adverse weight-related experiences while in the service.

H1A: Military veterans' overweight at separation contributes to their likelihood of adverse weight-related experiences while in the service.

Research Question 2: Are military veterans who were overweight or obese upon separation from the military more likely to have experienced delays their ability to enter the military or enlist?

$H2_0$: Military veterans' overweight at separation does not affect their likelihood of delays in enlisting.

H2A: Military veterans' overweight at separation affects their likelihood of delays in enlisting.

Data Collection

Data were collected electronically from participants using the online survey program Survey Monkey. Survey Monkey is a well-established and frequently used service that affords users the ability to collect data confidentially and anonymously, establish specific data collection protocols, custom design survey questions, create unique URLs for linking to surveys, and store data securely for an indefinite period of time.

Once IRB approval was given, the survey questions for the study were uploaded to Survey Monkey, and a direct link to the online survey was created. The link initially led participants to the informed consent section of the study, and if participants chose to continue, they could click another link to proceed to the survey. The CEO of the Warrior Centric Health Organization agreed to release the survey link to the organization's network of veteran contacts. The timeframe for data collection was 6 weeks. This

allowed respondents ample time to complete the survey. The survey was open from September 18, 2017, to October 31, 2017. A reminder e-mail was sent to participants on October 6, 2017. Of the 450 surveys sent to veterans, 158 were completed. This resulted in a response rate of 35%. The objective for the sample size was calculated at 158.

Results

Demographic Characteristics

All participants in this study met the following criteria: served honorably in the Army, Navy, Marine Corps, or Air Force; were 19 years or older; and were enlisted, officers, retired, separated under honorable conditions, or retired within the last 30 years. The exclusion criteria for this study applied to veterans who were incarcerated at the time of data collection or had received a dishonorable discharge. Descriptive statistics were computed with SPSS (version 24.0) to explore the characteristics and distribution of data. Table 8 illustrates that 61% of participants were retired military veterans and 39% were veterans who separated from the military but did not retire. A nonretired veteran is one who served actively in the military and who was discharged or released under conditions other than dishonorable. A nonretired veteran separated from the service prior to completing 20 years of military service and does not receive retirement compensation.

Table 8

Demographics—U.S. Veterans

	Numbers	Percentage
Retired veterans	96	61.1%
Nonretired veterans	61	38.9%

Note. $n = 157$.

Gender, age, and race/ethnicity. The variables gender, age, and race/ethnicity had the following distribution, summarized in Table 9. For gender, of those who completed the survey, men comprised 64% (*n* = 100), women 36% (*n* = 56). The majority of participants were 51 years and older (*n* = 96, 61%), followed by veterans between the ages of 34 and 49 (*n* = 49, 31%). The racial/ethnic distribution was as follows: Black, 66% (*n* = 104); White, 28% (*n* = 44); and Native American, 2.5% (*n* = 4). Of those who responded to the survey, none identified themselves as Hispanic or Asian. Three percent of participants (*n* = 5) failed to register their race.

Table 9

Demographics—Gender, Age, and Race/Ethnicity

		Number	Percentage
Gender	Male	100	63.7
	Female	56	35.7
	Missing	1	0.6
Age	25-29	5	3.2
	30-34	7	4.5
	35-50	49	31.2
	51 and older	96	61.1
Race/ethnicity	White	44	28.0
	Black	104	66.2
	Native American	4	2.6
	Missing	5	3.2

Note. *n* = 157.

Branch of service, rank, transition, length of service, serve on active duty, and combat zone. Four military branches were represented in this study, as seen in Table 10.

Table 10

Demographics—Branch of Service, Rank, Length of Service, Active Duty Period, and Combat Zone

		Number	Percentage
Branch of service	Air Force	33	21.0
	Army	100	63.7
	Marine Corps	11	7.1
	Navy	12	7.6
	Missing	1	0.6
Rank	04 and above	38	24.2
	01-03	26	16.6
	E7-E9	45	28.7
	E4-E6	43	27.4
	E1-E3	4	2.5
	Missing	1	0.6
Length of service	1-12 months	1	0.6
	1-3 years	3	1.9
	3-5 years	18	11.5
	6-10 years	27	17.2
	10-20 years	40	25.5
	More than 20 years	68	43.3
Years of active duty	Vietnam era	7	4.5
	May 1975-July 1990	34	21.7
	Aug 1990-Aug 2001	62	39.5
	Sep 2001 or later	46	29.3
	Mark all that apply	7	4.4
	Missing	1	0.6
Combat zone	No	55	35
	Yes	102	65

Note. $n = 157$.

The preponderance of the participants came from the Army (*n* = 100, 64%), followed by the Air Force (*n* = 33, 21%), Navy (*n* = 12, 7.7%), and Marines (*n* = 11, 7%). A plurality of participants held the ranks of E7 through E9 (*n* = 45, 29%), closely followed by the ranks of E4 through E6 (*n* = 43, 28%). The E-grade least represented was E1 through E3 (*n* = 4, 2.6%). Commissioned officers in this study made up a total of 41% of the sample (*n* = 64). The preponderance of participants served in the military for greater than 20 years (*n* = 68, 43%) during the period of 1990-2001 (*n* = 62, 40%); the most common length of service was between 10 and 19 years (*n* = 72, 45%). More than half of the veterans had been deployed to a combat zone during their time on active duty (*n* = 102; 65%).

Education, marital status, veteran's spouse, day of physical activity, general health. Most of the veterans participating in this study were married (*n* = 106, 68%) or had been married (*n* = 25, 15%). The data illustrate that most veterans' spouses were not in the military (*n* = 103, 66%). The education level among most participants was at the associate level or above (*n* = 69, 73%). Fewer than a quarter of the participants held only a high school diploma (*n* = 33, 21%). Table 11 illustrates that the majority of the participants exercised at least 3-6 days per week (*n* = 70, 45%). Fewer than 2% of the participants in this study considered themselves in poor health (*n* = 3, 1.9%).

Table 11

Education, Marital Status, Veteran's Spouse, Frequency of Physical Activity, and General Health

		Number	Percentage
Education	High school diploma	33	21.0
	2-year degree	21	13.4
	4-year degree	43	27.4
	Graduate study	9	5.7
	Graduate degree	51	32.5
Marital status	Married	106	67.5
	Divorced	23	14.6
	Single	25	16.0
	Separated/widowed	2	1.3
	Missing data	1	0.6
Spouse is also a veteran	No	103	65.6
	Yes	51	32.5
	Missing	3	1.9
Days of physical activity	Less than 1 day a week	6	3.8
	1-2 days a week	10	6.4
	3-6 days a week	70	44.7
	5-6 days a week	47	29.9
	Every day	23	14.6
	Missing	1	0.6
General health	Poor	3	1.9
	Fair	25	16.0
	Good	94	60.3
	Very good	34	21.8

Note. $n = 157$.

Missing Data

The following variables had missing data from at least one respondent: service branch, rank, transition, gender, marital status, race, tour on active duty, and general health. All variables, with the exception of one, had less than 0.6% missing values. Because there was such a low percentage of missing values, there was a small likelihood that the missing values would cause biased conclusions. Therefore, no action was taken to remedy missing data. See the Limitations section in Chapter 5 for a full report of the number of missing values for each variable.

Dependent Variable Descriptive Statistics

To answer both research questions, Kruskal-Willis and Mann-Whitney tests were conducted between the independent groups: overweight at separation and not overweight at separation. The Kruskal-Willis test was employed to analyze the demographics. The Kruskal-Wallis test (also known as *one-way ANOVA on ranks*) is a rank-based nonparametric test that helps to ascertain whether there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. The analysis was inclusive of both significant and nonsignificant nominal *p* values. All analyses were conducted using SPSS Version 24.0, and statistical significance was assumed at a *p* value of .05.

Weight-related experiences. For the first research question, the dependent variable was weight-related experiences. A higher score indicated that the respondent had more weight-related experiences while in the service. Two respondents did not answer all the questions for weight-related experiences while in the military. Consequently, the *n* for

analyses involving weight-related experiences was 155. The independent variable was overweight at separation. The variable was defined by participants' responses to Item 23: "Were you overweight when you retired or separated from the military?" This item was coded 0 = no and 1 = yes.

The descriptive statistics are presented in Table 12. There were 133 military veterans who were not overweight at the time of separation from the military. Their mean number of weight-related experiences was 2.3 (*SD* = 0.5). There were 22 military veterans who were overweight at the time of separation from the military. Their mean number of weight-related experiences was 3.3 (*SD* = 1.2).

Table 12

Descriptive Statistics for Weight-Related Experiences by Overweight at Separation

DV	Overweight at separation	*n*	Mean	*SD*
Weight-related experiences	No	133[a]	2.3	0.5
	Yes	22	3.3	1.2

[a]Two respondents did not answer all the questions for weight-related experiences.

Ability to enlist. The dependent variable for the second research question was ability to enlist. The value for this variable was computed by summing Items 2, 15, and 16 (Appendix B). The scores could range from 0 to 3, with a midpoint of 2.0. A higher score indicated that the respondent had more unsuccessful recruitment efforts due to weight. One respondent did not answer all of the questions for recruitment efforts. Consequently, the *n* for analyses involving ability to enlist was 156.

The independent variable was overweight at separation. Among participants who were not overweight at separation, the mean number of unsuccessful recruitment efforts was 0.3 (*SD* = 0.5). There were 22 military veterans who were overweight at the time of separation from the military. Their mean number of recruitment efforts was 1.2 (*SD* = 1.0). These results are summarized in Table 13.

Table 13

Descriptive Statistics for Recruitment Efforts by Overweight at Separation

DV	Overweight at separation	*n*	Mean	*SD*
Recruitment efforts	No	134[a]	0.3	0.5
	Yes	22	1.2	1.0

[a]One respondent did not answer all of the questions for enlistment efforts.

Statistical Assumptions for Data Analysis

The independent *t* test was the statistical method of choice to test the hypotheses. To further test for the effects of the demographics (rank, branch of service, age, and gender), a two-way ANOVA was the statistical method of choice. The assumptions for *t* tests and ANOVA were similar.

Assumption 1. The dependent variable was measured at the interval or ratio level. The dependent variables were the sum of the responses to the survey questions regarding weight-related experiences while in the military and ability to enlist. These were interval variables; thus, the assumption was supported.

Assumption 2. The independent variable was identified as categorical. Overweight at separation was coded 0 or 1 (yes or no), which was categorical. The demographic variables consisted of rank, branch of service, age, and gender; these were

also categorical variables. This assumption was supported.

Assumption 3. There was no relationship between the observations in each group or between the groups. The veterans completed the survey independently. This assumption was also supported, based on the observations being independent.

Assumption 4. There were no significant outliers. According to authors Hoaglin and Iglewicz (1987), the Outlier Labeling Rule is used to determine whether there were any outliers in the weight-related experiences and ability to enlist distributions by whether or not the veteran was overweight at separation. The formulas for determining the lower and upper limits for the distributions are:

$$\text{Lower limit} = Q1 - [(Q3 - Q1)*2.2] \quad (1)$$

$$\text{Upper limit} = Q3 + [(Q3 - Q1)*2.2] \quad (2)$$

Any values found to be outside of the lower and upper limits were considered outliers. The minimum score for weight-related experiences for both groups was 2.0, and for ability to enlist the minimum for both groups was 0. These scores for both variables are greater than the lower limits for both variables, indicating no low outliers. The maximum score for those who were overweight at separation for ability to enlist was 3.0, which was lower than the upper limit, indicating no high outliers. The maximum score for military veterans who were not overweight at separation for ability to enlist was 1.0, which was lower than the upper limit, indicating there were no outliers for either group of veterans. The maximum score for those who were overweight at separation for weight-related experiences was 6.0, which was lower than the upper limit, indicating no high outliers. The maximum score for those who were not overweight at separation for weight-

related experiences was 4.0, which was higher than the upper limit, indicating that there were high outliers (Table 14). The assumption of no outliers was thus supported for enlistment efforts, but not for weight related-experiences.

Table 14

Outlier Tests for Weight-Related Experiences and Ability to Enlist

	Q1	Q3	Min	LL	Max	UL
Weight-related experiences						
Yes, *n* = 155	2.00	4.00	2.00	-2.40	6.00	8.40
No, *n* = 156	2.00	2.00	2.00	-2.00	4.00*	2.00
Recruitment efforts						
Yes, *n* = 155	0.75	2.00	0.00	-2.00	3.00	4.75
No, *n* = 156	0.00	1.00	0.00	-2.20	1.00	3.20

Note. Q1 = 25th percentile or first quartile, Q3 = 75th percentile or third quartile, LL = lower limit, UL = upper limit, Min = minimum, Max = maximum, Yes = overweight at separation, No = not overweight at separation.
*Maximum greater than UL indicates outliers present.

Assumption 5. The dependent variable is approximately normally distributed for each combination of the groups of the two independent variables. The skewness statistic was used to determine whether the variable distributions approximated normality. If the skewness statistic is between -1 and +1, the distribution can be considered approximately normal. For the military veterans who were overweight at separation, the skewness statistic for both dependent variables met this criterion, indicating that they were approximately normally distributed. For the group who were not overweight at separation, the distribution of both dependent variables had a skewness greater than 1 and thus did not meet the assumption of normality (Table 15).

Table 15

Skewness Test for Approximate Normality

Overweight at separation	Statistic	Skew < 1
Weight-related experiences, *n* = 155		
No	1.82*	No
Yes	0.941	Yes
Recruitment efforts, *n* = 156		
No	1.77*	No
Yes	0.682	Yes

*Skewness greater than 1 indicates that the distribution is not normal.

Assumption #6: There was homogeneity of variances for each combination of the groups of the two independent variables. Levene's test for homogeneity of variances was employed to test for equal variances for both groups of veterans. Levene's test tests the null hypothesis that there is no difference in variance between the two groups. For both variables, the null hypothesis was not retained, so the assumption was not supported for either group of veterans (Table 16).

Table 16

Levene's Test for Equal Variances

	Levene *F*	*p*
Weight-related experiences, *n* = 155	33.7*	.000
Recruitment efforts, *n* = 156	15.4*	.000

**p* < .01.

Table 16 summarizes the results for the assumption tests as they pertain to both research questions.

Table 17

Summary of Assumption Testing Results

	Outliers		Normality		Homogeneity
	Yes	No	Yes	No	
Weight-related experiences	OK	No	OK	No	No
Recruitment efforts	OK	OK	OK	No	No

Note. Yes = overweight at separation, No = not overweight at separation, OK = assumption supported, No = assumption not supported.

On the basis of the assumption tests, some changes were made to the data analysis plan. For the first research question, regarding weight-related experiences, the *t* test could not be used to test for group differences because there were outliers, the distribution was non-normal, and the variances between groups were not equal. Therefore, the nonparametric Mann-Whitney test was used to test the hypotheses for this research question. Because the Mann-Whitney test works with ranks and medians instead of mean scores, there are no assumptions regarding outliers, normality, or homogeneity. In order to test for effects of the demographics (rank, service branch, age, and gender), the nonparametric Kruskal-Wallis test was used. Kruskal-Wallis is similar to the Mann-Whitney and is used when there are more than two groups.

For the second research question, regarding ability to enlist, the *t* test could still be used, because the lack of normal distribution among veterans who were not overweight at

separation was not due to skewness. The independent *t* test assuming unequal variances was thus used to test the hypothesis. In order to test for effects of the demographics (rank, service branch, age, and gender), the nonparametric Kruskal-Wallis test was used.

Hypothesis Testing

Research Question 1. The Mann-Whitney test results were significant ($p < .001$; Table 18). There was a significant difference in weight-related experiences between the military veterans who were overweight when they separated from the service and those who were not overweight at separation. The null hypothesis was not retained. Military veterans who were overweight when they separated from the service had more weight-related experiences (median = 3.0) than military veterans who were not overweight when they separated from the service (median = 2.0).

Table 18

Results of Mann-Whitney Test for Differences in Weight-Related Experiences Between the Two Groups of Veterans

Overweight at separation	Min	Max	Median	Mean	*SD*
No	2.0	4.0	2.0	2.3	0.5
Yes	2.0	6.0	3.0	3.3	0.2

Note. n = 155a. Probability calculated using Mann-Whitney = .000.
[a] Two respondents did not answer all the questions for weight experiences.

Table 19 illustrates the results of the test for effect due to demographics for research question 1. Branch of service had no significant effect among either veterans who were overweight at separation ($p = .932$) or for the military veterans who were not overweight at separation ($p = .415$). There were also no significant differences among the ranks for the veterans who were overweight at separation ($p = .179$) or for the veterans

who were not overweight at separation (p = .121). Rank did not affect the difference in weight-related experiences for the two groups of veterans. The age groups presented no significant differences for veterans who were overweight at separation (p = .193) or for those who were not (p = .399).

Table 19

Results of Tests for Effects of Demographics on Weight-Related Experiences Between the Two Groups of Veterans

	Overweight at separation				Not overweight at separation			
	n	Min	Max	Med	*n*	Min	Max	Med
Branch of service								
Overweight at separation $p = .932$ not overweight at separation $p = .415$[b]								
Army	13	2.0	6.0	3.0	86	2.0	4.0	2.0
Navy/Marine	3	2.0	5.0	3.0	20	2.0	3.0	2.0
Air Force	6	2.0	3.0	4.0	26	2.0	4.0	2.0
Rank								
Overweight at separation $p = .179$ not overweight at separation $p = .121$[b]								
E1-E6	9	2.0	3.0	6.0	38	2.0	4.0	2.0
E7-E9	3	3.0	4.0	5.0	41	2.0	4.0	2.0
O1-O3	4	2.0	3.0	2.5	22	2.0	4.0	2.0
O4-O10	5	2.0	4.0	2.0	32	2.0	4.0	2.0
Age								
Overweight at separation $p = .193$ not overweight at separation $p = .399$[b]								
25-34 years	4	3.0	6.0	4.0	8	2.0	3.0	2.0
35-50 years	10	2.0	4.0	6.0	39	2.0	4.0	2.0
50 or more	8	2.0	4.0	3.0	86	2.0	4.0	2.0
Gender								
Overweight at separation $p = .971$ not overweight at separation $p = .040$[c]								
Male	14	2.0	6.0	3.0	84	2.0	4.0	2.0
Female	7	2.0	6.0	3.0	49	2.0	4.0	2.0

Note. $n = 155$a.

[a]Two respondents did not answer all of the questions for weight-related experiences. [b]Probability calculated using Kruskal-Wallis. [c]Probability calculated using Mann-Whitney.

When analyzing gender, there were no significant differences between men and women for the military veterans who were overweight at separation ($p = .971$). There was a statistically significant difference between men and women who were not overweight at separation ($p = .040$). Gender affected the difference in weight-related experiences for military veterans who were not overweight at separation (Table 19). Boxplots for men and women who were not overweight at separation were constructed to further understand the differences in weight-related experiences for men and women. All but five of the 84 men had two or fewer weight-related experiences. Among women, 75% ($n = 37$) had three or fewer weight-related experiences. Female military veterans who were not overweight at separation thus had more weight-related experiences while in the service than their male counterparts (Figure 5).

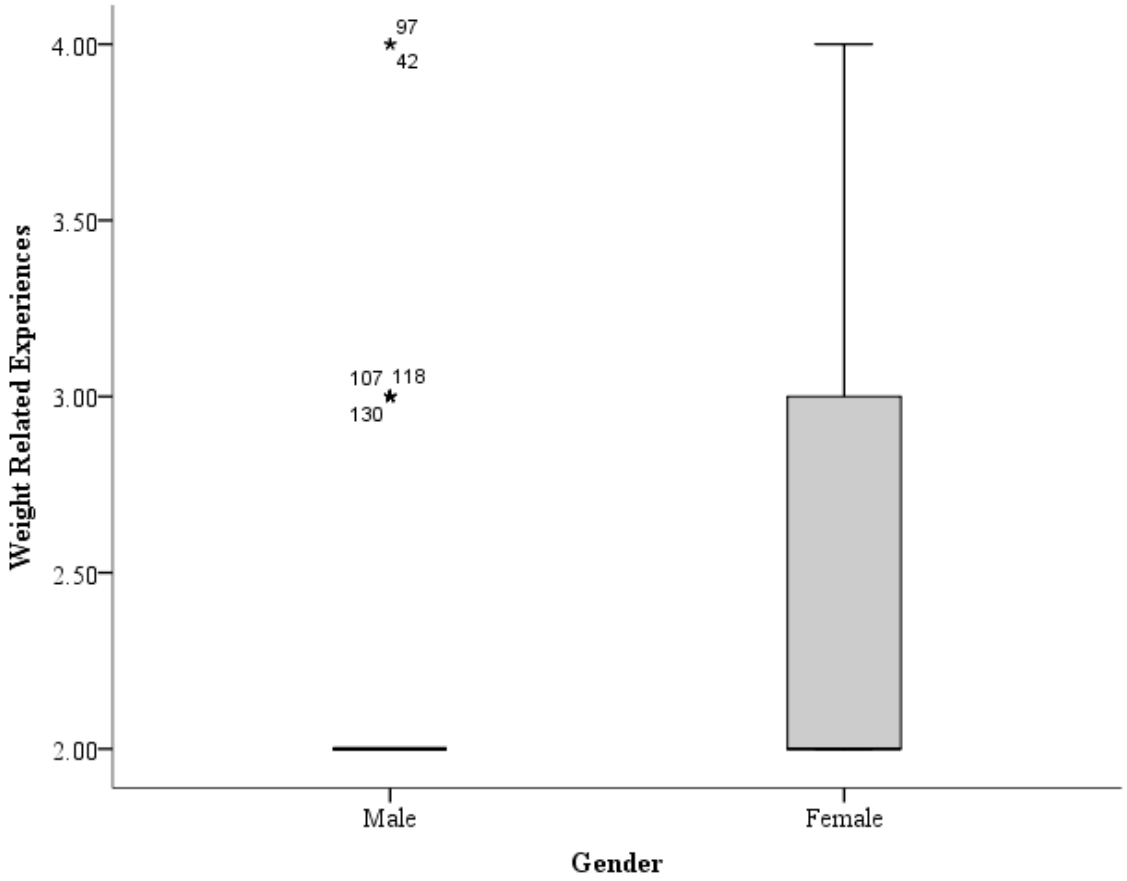

Figure 5. Boxplot of weight-related experiences by gender and overweight at separation.

Research Question 2. The results for the independent *t* test for the second research question implied that, when variances are unequal, test results were significant, 9(23.0) = 6.37, $p < .001$; Table 20). The null hypothesis was not retained. There was a statistically significant difference in recruitment efforts between the veterans who were overweight when they separated from the service and veterans who were not overweight at separation. Military veterans who were overweight when they separated from the service had more recruitment efforts affected by weight (mean = 1.2) than military veterans who were not overweight when they separated from the service (mean = 0.3).

Table 20

Results of t Test With Unequal Variances for Differences in Recruitment Efforts Between the Two Groups of Veterans

Overweight at separation	*n*	Min	Max	Mean	*SD*
No	134	0.0	2.0	0.3	.5
Yes	22	0.0	3.0	1.2	1.0

Note. $n = 156$a. $t\ (23.0) = 6.37$, $p = .000$.
[a]One respondent did not answer all of the questions for recruitment efforts.

The results of the test for effect due to demographics for research question 2 revealed that there were no significant differences, as evident in Table 21. There were also no significant differences among the services branches for military veterans who were overweight at separation ($p = .604$) or for the military veterans who were not overweight at separation ($p = .560$). Similarly, there were no significant differences by rank among veterans who were overweight at separation ($p = .530$) or those who were not ($p = .300$). The same was true for age; no significant differences were found among the age groups for the veterans who were overweight at separation ($p = .153$) or those who were not ($p = .380$). There were no significant differences between males and females among the veterans who were overweight at separation ($p = .799$) or among those who were not ($p = .091$).

Table 21

Results of Tests for Effects of Demographics in Recruitment Efforts Between the two Groups of Veterans

	Overweight at separation				Not overweight at separation			
	n	Min	Max	Med	*n*	Min	Max	Med
Branch of service								
Overweight at separation $p = .604$ not overweight at separation $p = .560$[b]								
Army	13	0.0	3.0	1.0	0.0	2.0	0.0	0.0
Navy/Marine	3	1.0	3.0	1.0	0.0	2.0	0.0	0.0
Air Force	6	0.0	3.0	1.0	0.0	1.0	0.0	0.0
Rank								
Overweight at separation $p = .530$ not overweight at separation $p = .300$[b]								
E1-E6	9	0.0	3.0	2.0	38	0.0	2.0	0.0
E7-E9	3	1.0	2.0	1.0	42	0.0	2.0	0.0
O1-O3	4	0.0	1.0	1.0	21	0.0	2.0	0.0
O4-O10	5	0.0	1.0	1.0	34	0.0	2.0	0.0
Age								
Overweight at separation $p = .153$ not overweight at separation $p = .380$[b]								
25-34 years	4	0.0	3.0	3.0	7	0.0	1.0	0.0
35-50 years	10	0.0	3.0	1.0	39	0.0	1.0	0.0
50 or more	8	0.0	1.0	1.0	88	0.0	2.0	0.0
Gender								
Overweight at separation $p = .799$ not overweight at separation $p = .091$[c]								
Male	14	0.0	3.0	1.0	86	0.0	2.0	0.0
Female	7	0.0	3.0	1.0	48	0.0	2.0	0.0

$n = 156$a.

[a]One respondent did not answer all of the questions for recruitment efforts. [b]Probability calculated using Kruskal-Wallis. [c]Probability calculated using Mann-Whitney.

Summary

It was evident from the results for the first research question that military veterans who are overweight or obese at separation had more weight-related experiences while in the military (mean = 3.3 experiences) than the veterans who were not overweight at separation (mean = 2.3 experiences). There were a possible six experiences the veterans could choose. There were no demographic differences except among veterans who were not overweight at separation; among that group, women had statistically significantly more weight-related experiences than the male veterans.

For the second research question, it was found that veterans' obesity at separation was significantly associated with a delay in their ability to enter the military or enlist. There were a possible three recruitment efforts the veterans could choose. Veterans who were overweight when they separated from the service had greater problems with their weight when being recruited (mean = 1.2) than the veterans who were not obese when they separated from the military (mean = 0.2). There were no demographic effects.

Chapter 5 offers an interpretation of study results. It also contains a discussion of the limitations, recommendations, and future implications.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

It is well documented that service members and veterans alike are impacted by the obesity epidemic. Regardless of the abundance of existing research and intervention programs to combat obesity, the disease and the problematic health concerns it generates persist. For example, obesity directly affects the military readiness of the armed forces and their ability to recruit men and women who are likely to meet or maintain weight standards throughout their careers (Cawley & MacLean, 2012; Defense Health Board, 2013; Mission Readiness, 2010; Piche et al., 2014; Reyes-Guzman et al., 2015).

The purpose of this quantitative study is to illustrate the impact of overweight and obesity on service members' careers, which could have implications for national security and the recruitment of qualified individuals. In this quantitative study, a previously validated and reliable tool, the Survey of Health Related Behaviors Among Active Duty Military Personnel, was used to collect data from both military retired veterans and veterans who did not retire but who separated from the service. The study findings add to the body of knowledge on obesity among military veterans. As the number of veterans separating from the military due to obesity mounts, there is an associated increase in the vulnerability of U.S. national security. In addition, the results of this study delineate the need for more comprehensive solutions to reduce overweight and obesity among military service members to ensure that they do not experience recruitment delays and that their careers progress in alignment with their merits and with the needs of the armed forces.

Interpretation of the Findings

This section presents the implications of the study findings, which were detailed in the previous chapter. The results for the first research question indicated that military veterans' overweight at separation contributes to their likelihood of adverse weight-related experiences while in the service. Women who were not overweight at separation had more weight-related experiences than their male counterparts, but there were no demographic differences among participants who were overweight at separation. Veterans who were overweight when they separated from the military had more experiences with being passed over for promotion, as well as being denied rewards and advanced schooling. These findings align with the concepts associated with the socioecological model, in that military veterans' weight-related experiences, impact national security, and can also be induced by the multiple levels of influence. The results for the second research question indicated that military veterans' overweight at separation affects their likelihood of delays in enlisting. The ability to enlist was thus significantly related to overweight or obesity at separation, regardless of demographic characteristics.

The findings of this study contradict general statistics about overweight and obesity rates in the military. According to the Department of Defense, 61% of men and 39% of women on active duty are overweight, and 12% (men and women together) are obese (Sanderson et al., 2011). However, in this study, only 14% of participants reported that they were overweight upon separation from the military. This indicates that the research sample for this study was less overweight, on average, than the general military population. Although this discrepancy does not alter the interpretation of the results, it

should be taken into consideration when applying the results to broader military populations, in that the research sample may not have been representative of the military population in terms of weight.

These results support existing findings indicating the potential adverse effects of overweight and obesity on awards, promotion, recruitment, and advanced schooling among military service members. A study conducted by Maguen (2013) revealed that 75% of 500,000 Iraq and Afghanistan veterans continued to display higher risks of gaining weight as they separated from the service. Peer-reviewed research also reinforces a higher obesity rate among retired military veterans when compared with the civilian adult population (Wolf et al., 2010). The literature review also showed that soldiers, airmen, sailors, and marines who continually struggle to make weight for admittance into the military have a greater likelihood of failing weight or physical fitness assessments as their career progresses (Hurby et al., 2015; Packnett et al., 2011; Tanofsky-Kraft et al., 2013). This study found that veterans who were overweight at separation had more problems being recruited due to weight issues than veterans who were not overweight at separation from the military, and that they went on to have more weight-related experiences during their military careers, supporting these existing studies. The findings of the present study strongly support claims that overweight and obese service members may also be at increased risk of receiving administrative actions, including discharge from the service.

The findings of this study also support research showing that the military is losing experienced service members due to overweight and obesity, and that weight issues

prevent service members from advancing in their careers. Although poor job performance can jeopardize an individual's military career, this may be accelerated in a service member who is obese, as documented by the Institute of Medicine (2004), which reported that obesity is correlated to poor job performance in military professions. Previous studies showing that military members can be denied promotions, advanced schooling, bonuses, transfers, awards, and leave (Purvis et al., 2013; Tanofsky-Kraft et al., 2013) confirm the data presented here. The results demonstrated that among the 16% of the veterans surveyed who were overweight at separation from the military, encountered delays with enlisting or entering the military and experienced issues with career advancement due to their weight. Such adverse experiences may have contributed to their decision to separate from the military. Fewer than 70% of participants in this study retired from the military; the remainder separated voluntarily under honorable conditions, indicating that they chose not to continue serving. Although the results of this study do not permit any conclusions regarding why participants separated from the military, it is possible that continued delays of career advancement owing to weight-related experiences led overweight service members to conclude that their prospects in civilian life might be more advantageous. Allowing overweight/obese recruits to join because the likelihood of them overcoming their obesity simply sets them up for failure (i.e., being forced to leave because of barriers to career advancement).

According to Tanofsky-Kraft et al. (2013), service members who exerted immense efforts to meet weight standards prior to entering military service had a higher incidence of failing to meet established weight standards during their service. The

findings of the present study support this research, in that participants who were overweight at separation had both greater delays in entering and more weight-related experiences. It is possible that those who had greater delays were more likely to have weight-related experiences, although this study did not specifically test for such an association, so further research will be required.

Despite the telling nature of the association between weight-related experiences and overweight at separation, it is important not to conflate weight and fitness. According to Niebuhr et al. (2013), applicants who failed to meet weight standards on enlistment did not have a higher prevalence of separating 18 months after joining the military than those who did meet the standards. Likewise, it is not clear whether participants in this study who were overweight at separation had more weight-related experiences because they were less fit, or simply because they did not meet weight standards and were accordingly sanctioned. It should not be concluded from the results of this study, therefore, that those who were overweight at separation were less fit than their nonoverweight counterparts.

The findings of this study also supported existing literature suggesting that the military's ability to recruit qualified service members is impacted by the obesity epidemic. Hruby et al. (2015) found that nearly 20% of men and women who attempted to enter the military failed to qualify or were delayed at military processing centers due to being overweight or obese. The results from this study indicated that greater than 23% of the male veterans and more than 32% of the female veterans had difficulty meeting weight or body fat standards and experienced delayed entrance to the military as a result. Although this study did not include individuals who were permanently barred from the

military (because all participants in this study were veterans), the connection between overweight and entrance delays among veterans suggests that there may be even more qualified and eager individuals who never ultimately enter the service, owing to their weight.

Interestingly, this study revealed no associations between military rank and weight-related experiences among either group (those who were overweight at separation or those who were not). This finding partly contradicts existing research conducted by Reyes-Guzman et al. (2015), who demonstrated that there was a greater increase in obesity among those holding higher ranks. Although it is possible that, in the Reyes-Guzman et al. study, higher rank merely served as a proxy for advancing age, this present study also found no association between age and weight-related experiences among either group in the analysis.

One possible reason for this discrepancy in findings is the fact that the present study looked only at overweight or obesity at separation from the military, rather than weight during service. Therefore, it is possible that the Reyes-Guzman et al. (2015) finding reflected longer duration of service, rather than rank per se. This conclusion would support findings from Tanofsky-Kraft et al. (2013), who showed that weight gain within the Air Force accumulates over the course of military careers, such that those who have served longer will have gained more weight. It is not possible to assert this as a firm conclusion, however, in that the present study did not test for differences according to duration of service. Further research will therefore be required to elucidate the reason for this discrepancy in findings, and to disentangle the potentially close relationship between

age and duration of service.

Another surprising finding of this study related to the higher prevalence of weight-related experiences among female participants who were not overweight at discharge, compared with their male counterparts. According to Crawley & Maclean (2013), the required body fat percentage for women entering the armed forces is higher than that for men. Nevertheless, research has shown that more women than men report trouble meeting weight standards during their time in the military (MSMR, 2011; Tanofsky-Kraft et al., 2013). The findings of the present study support this research. However, little information is available to explain this gender effect. It is possible that, owing to women's natural composition, their body fat percentages are predictably higher than those of men, and that the gender differences in body fat requirements are not wide enough to account for these natural differences. However, not all research is in agreement on this point; Hruby et al. (2015), for example, showed that women enlisting and remaining on active duty were less likely to be considered overweight or obese than men. More research will be required to elucidate the reasons for this gender difference.

Limitations of the Study

This study was subject to certain limitations related to its design and methodology. Although the findings of this study provide important information regarding the effects of overweight and obesity on service members' careers, they may not be generalizable to all military members or veterans in the United States. The nongeneralizability of the study is further confirmed by the fact that the sample of this study had a lower rate of overweight than the general military population. The number of

respondents was not consistent with the total military population for the categories of race and gender. Therefore, the results may be subject to sampling bias, and the sample of the study may have been especially healthy or health conscious compared with the general military population. As a result, the prevalence of weight-related experiences may be underreported in this study.

There were also limitations stemming from the self-report nature of the study. When employing web-based surveys that use anonymous self-report measures, researchers presume that participants will respond in a truthful manner. Although participants were assured that their responses would remain anonymous and that no harm could come to them from participation in the study, there is some chance that participants underreported their weight-related experiences, delays with enlistment, or weight at discharge, owing to social desirability bias.

Missing data can impact a study's findings. Missing data were found for all variables with the exception of age. The average missing data rate across all categories was .6%. Because the missing percentage values were low, it is unlikely that the missing values caused biased conclusions. The exact rates of missing data were as follows:

- (*n* = 1) Respondent branch of service, **0.64%** error
- (*n* = 3) Respondent military retired, **1.91%** error
- (*n* = 1) Respondent gender, **0.64%** error
- (*n* = 0) Respondent age, **0.00%** error
- (*n* = 5) Respondent race, **3.18%** error
- (*n* = 1) Respondent marital status, **0.64%** error

- (n = 1) Respondent Military rank group, **0.64%** error
- (n = 3) Respondent spouse is also a veteran, **1.91%** error
- (n = 2) Respondent years-ago transitioned, **1.27%** error
- (n = 1) Respondent weekly physical activity, **0.64%** error
- (n = 1) Respondent enlistment delayed, **0.64**% error
- (n = 1) Respondent ever passed over for promotion, **0.64**% error

The presence of missing data suggests that I did not set the option in Survey Monkey that would have required each respondent to answer each given question before advancing to the next question. This led to missing data and allowed respondents to skip questions. To assure data completeness, the feature requiring respondents to answer each given question should be enabled. Furthermore, when using ranges such as age or rank, survey response options should not include portions of another range. This could introduce sampling errors, thus making the data invalid.

The small sample size presented another limitation of the present study. With a small sample size, caution must be applied, as the findings might not be transferable or applicable to all members of the armed forces. A larger sample with a more rigorous sampling method could have resulted in a more accurate representation of the population of interest. Such changes were outside the scope of the present study due to time and resource limitations but are recommended for future research.

A final limitation of the study was the relative overrepresentation of Army (64%) and Air Force (33%) veterans in the study population. Fewer participants had served in the Navy (7.7%) or Marines (7.0%), potentially biasing the data toward patterns relevant

in the Army and Air Force. To obtain a clearer understanding of the impact of overweight and obesity on the careers of service members in all branches, a more evenly distributed sample would be needed, or analyses would need to be conducted with members of each branch individually (which would require substantially larger sample sizes).

Recommendations

The results of this study raise additional questions that indicate a need for further investigation. One of the most pertinent pertains to the potential long-term health concerns of veterans with multiple combat deployments and the environment in which they served. Studies regarding the potential long-term health concerns of retired military veterans have not adequately explored the effects of multiple combat deployments typically associated with active-duty military service in the 21st century and the relation to the obesity trend among retired military veterans.

The ramifications of military deployment begin long before military service members receive orders and persist long after service members return to their day-to-day responsibilities. Years of commitment to military service are required to achieve a successful military career. However, with the ever-increasing number and pace of deployments along with the vast number of service members prematurely separating from the military based on issue of obesity, there is an opportunity to ask additional questions regarding the association of veteran health, obesity, and national security (Spera, Thomas, Barlas, Szoc, & Cambridge, 2011).

I also recommend that future research be conducted with a sample that is larger and more representative of the general military population. One way to achieve such a

sample would be to use incentives for participation because there typically are fewer barriers to recruiting if incentives valued by the targeted population are offered (Singer & Cong, 2013). A probability sampling method or purposive sampling could also be used to ensure that the sample is representative. The participants in this study were recruited using a convenience sample from one organization. As a result, the findings of this study are not generalizable and may be subject to sampling bias. A more strategic approach to sampling could overcome these limitations and shed additional light on how overweight and obesity affect the careers of military service members.

Further research is recommended to overcome some of the design limitations of the present study. First, the present study used overweight at separation as its independent variable, so it is not known how participants' weight changed over the course of their military careers, and how much those changes contributed to their weight-related experiences. Second, it is not known why the participants in this study separated from the military, so it was not possible to draw any conclusions about weight-related separations. Third, this study did not contain any variables related to overall fitness or aptitude for service, although existing research suggests that BMI and weight may not necessarily be related to fitness. These limitations were largely due to the use of an established research instrument that did not ask about many variables that might have been related to the study's outcomes. Future research should attempt to overcome these limitations by including additional pertinent variables using new or established scales that have been thoroughly validated through pilot studies.

Finally, to further enhance the research findings and add to current knowledge, a

mixed methods approach should be strongly considered. The insights from the addition of focus groups would supplement and improve the quantitative data by providing added value and deeper, wider, fuller, more complex responses (Creamer, 2017; Johnson & Christensen, 2014).

Implications

Now that obesity prevention efforts have some momentum in the Department of Defense and our society in general, the use of a socioecological model to identify behavioral settings and sectors of influence in which and by which additional actions can be implemented should be considered. The strategies for taking supplementary action are multifaceted and interrelated and should include revisiting current policy and practices, health communication, and purposeful interventions in health care settings. Although the approach to the obesity problem varies from service branch to service branch, existing frameworks and successful models offer guidance on how to confront the obesity epidemic utilizing a systems approach.

As discussed in Chapter 2, the cost and consequences of obesity to service members and veterans are substantial. However, the payoff of efficient, effective, and appropriate intervention can be immediate by reducing human, societal, and financial cost to the Department of Defense by reducing and preventing the development or exacerbation of obesity-related diseases. The results of the present study suggest that, by implementing additional, socioecological weight interventions, the Department of Defense can prevent service members from being held back in their careers due to adverse weight-related experiences.

Gradual weight gain during adulthood is typical and is commonly, although erroneously, viewed as a part of normal aging (Lewis et al., 2000; Williamson et al., 1990). Instead of turning applicants away when not qualified, or separating active duty members when they fail to meet weight standards, effective programs must be available to address weight issues early on and to better comprehend the experiences that service members and veterans incur regarding with weight management during active duty years and the transition years that follow. Many of those retiring from the military after 20 years are between the ages of 41 and 50. This easily allows for the launch of a second career. Despite the lack of an age association found in the present study, much of the obesity literature supports the claim that weight gain begins at the age where many service members are retiring or contemplating retirement (Littman et al., 2013). Obesity education and prevention, in alignment with appropriate organization policy beginning early in a service member's enlistment or commission, could facilitate the launch of a second career without the multiple medical conditions that accompany obesity.

In addition, military recruiters could use the information in this study to help design fitness programs to ensure that new recruits meet their weight allowances before shipping off to basic training, suggesting a collaborative responsibility shared by the individual and the entire organization. According to the socioecological model, the complexity of weight and obesity issues necessitate an approach to intervention that includes multiple levels, starting at the individual and cumulating with the policy level. New programs and updated policies could help to focus on weight and nutrition throughout a service member's career instead of at certain pivotal points. Positive social

change could originate from transforming an institution and policy framework that contributes to obesity into one that sustains a healthier work environment and healthier way of life through applying research like this study into the expansion of new programs and policies. For example, since this study shows that even non-overweight women experience more adverse weight-related experiences than men, attention could be given to supporting women in their weight challenges or reassessing weight requirements for women within the armed forces.

Positive social change may also stem from an increased understanding of how obesity impacts military veterans and the struggles they faced concerning weight. This research could help to illustrate to leaders how essential it is introduce information about obesity at the inception of new military members' careers, instead of after they are overweight or obese. Positive social change could also result from this study if it leads to the development of one standardized mechanism for all branches to identify those who are overweight or obese. This could help facilitate better research in the future and ensure that all services members are treated equally.

The results of this study could bring about a positive social change by orchestrating a discussion that views obesity as more than just a behavioral or biological factor, also examining the environmental influences on behavioral change. There must be a shift in the way the military views individual service members who are considered obese. Service members who are obese should not be viewed in isolation. They should be observed as part of a larger social unit entailing the environment, family, and organizations that support and promote behavioral change. Research has shown that

converging on a single level or an isolated individual has met with only limited success.

It is imperative that the United States Armed Forces embark upon a journey that addresses obesity to ensure that we have service members who are physically and mentally fit to respond when the safety of our nation and the defense of our freedom demand it.

Conclusion

It was the purpose of this study to examine whether obesity impacts a veteran's career in the form of more difficult recruitment and more adverse weight-related experiences while in the military. The findings from this study imply that military veterans who are overweight or obese at separation have more negative weight-related experiences than the military veterans who were not overweight when they separated from the military. The results from the analysis also revealed that military veterans who were overweight when separated from the service had greater problems with their weight when recruited than the veterans who were not obese when they separated from the military. The only demographic effect was found among participants who were not overweight at separation from the military; among this group, women experienced statistically significantly more adverse weight-related experiences than men.

The United States Department of Defense spends an estimated $1.5 billion in healthcare expenses and resources to replace unhealthy and unfit personnel attributed to obesity (Voss et al., 2018). These recruits are a subpopulation of the general population, among whom 36% are estimated to be obese. It has been shown that obesity not only affects potential applicants by delaying their entrance into the military, but also keeps

recruiters from attaining recruitment goals. This reduction of eligible recruits from a labor market plagued by obesity fuels the concern that there will be a shortage of experienced leaders and new recruits. If this shortage is realized, will our country be able to answer the call to duty when facing an unpredictable threat? It is incumbent upon the nation as a whole and us as individuals to ensure that the obesity threat is minimized and ultimately eliminated. As the global War on Terror continues, and given the knowledge that future conflicts may be inevitable, our country must ensure that soldiers, airmen, sailors, marines, and veterans are afforded the best opportunities to attain and maintain optimum health.

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Appendix A: Permission for Use of Tool

Sent from my BlackBerry 10 smartphone on the Verizon Wireless 4G LTE network.

From: Bray, Robert <rmb@rti.org>
Sent: Thursday, June 9, 2016 12:45 PM
To: Lewis, Tracy (CDC/OPHPR/DSLR)
Subject: RE: DOD survey of health related behaviors

Dear Tracy,

Thanks for your inquiry and interest in the DoD Health Behavior Survey Questionnaire (attached). You are free to use or adapt items from the 2008 questionnaire as it is considered in the public domain.

Good luck with your research.

Bob

Robert M. Bray, Ph.D.

Chief Scientist, Behavioral Health/Criminal Justice Division

RTI International

3040 Cornwallis Rd

Research Triangle Park, NC 27709

Ph: 919-541-6433

Email: rmb@rti.org

From: Lewis, Tracy (CDC/OPHPR/DSLR) [mailto:ils7@cdc.gov] **Sent:** Wednesday, June 08, 2016 12:46 PM **To:** Bray, Robert <rmb@rti.org> **Subject:** DOD survey of health related behaviors

Good afternoon Dr. Bray,

I am Tracy Lewis a retired Army Sergeant Major and a doctoral student at Walden University. I am interested in using the 2008 DOD Survey of Health Related Behaviors Among Active Duty Military Personnel in my dissertation. I would like to know how I go about obtaining permission to use the survey.

Is it available for public use? Any information you can provide me would be greatly appreciated. Walden University requires me to have in writing permission in order to utilize the survey.

Thank you,

Tracy

Tracy Lewis

Public Health Advisor

Division of State and Local Readiness

Centers for Disease Control and Prevention

1600 Clifton Road, MS-D75

Atlanta, GA 30329

404-639-3901 (o)

678-471-2033 (cell)

Ils7@cdc.gov

Telework: Mon & Thur

Appendix B: Questionnaire

1. What is the branch of the service you were in?

a. Army
b. Navy
c. Marine Corps,
d. Air Force

2. What is your pay grade?

a. E1 – E3
b. E4 – E6
c. E7 – E9
d. 01 - 03
e. 04 – 010

3. How long did you serve in the military?

a. 1 – 12 months
b. 1- 3 years
c. 3 -5 years
d. 6-10 years
e. Greater than 10 years (not retired)
f. Retired

4. Was your enlistment into the military delayed due to not meeting the weight standards?

a. Yes
b. No

5. What is your highest level of education?

a. GED or ABE certificate
b. High school diploma
c. 2- year college degree
d. 4- year college degree
e. Graduate or professional study
f. Graduate or professional degree

6. Are you male or female?

a. Male
b. Female

7. What is your current marital status?

a. Married
b. Single
c. Separated
d. Divorced
e. Widowed

8. Is your spouse currently or previously on active duty?

a. Yes
b. No

9. What is your race?

a. White
b. Black or African American
c. American Indian or Alaska Native
d. Asian (Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese)
e. Native Hawaiian or Pacific Islander (Samoan, Guamanian, Chamorro)

10. How old are you?

a. 19-21
b. 22-24
c. 25-29
d. 30 -34
e. 34-50
f. 50 and older

11. Below are some statements about things that may happen to military personnel. How many times in the past 12 months did each of the following happen to you?

a. I had an illness that kept me from duty for a week or longer?
    a. 3 or more b. 2 c. 1 d. 0
b. I had an injury or pain that restricted my duty or physical activity for a week or longer
    a. 3 or more b. 2 c. 1 d. 0
c. I had health problems?
    a. 3 or more b. 2 c. 1 d. 0
d. How often do you have a drink containing alcohol?
    a. Four or more times a week
    b. Two to three times a week
    c. Two to four times a month
    d. Monthly or less
    e. Never

12. How many days did you engage in physical activity while in the military?

a. Every day
b. 5 -6 Days a week
c. 3-6 Days a week
d. 1 – 2 Days a week
e. Less than 1 day a week

13. Where you ever enrolled or placed on a weight control program?

a. Yes
b. No

15. Did you have to lose weight to join the military?

a. Yes
b. No

16. Did you have difficulty meeting your service weight and/or body fat?

a. Yes
b. No

17. Were you ever passed over for promotion due to exceeding weight standards?
a. Yes
b. No

18. Were you ever prohibited from attending a school due to exceeding weight standards?
a. Yes
b. No

19. Were you ever prohibited from receiving an award due to exceeding weight standards?
a. Yes
b. No

20. Did you ever fail your physical fitness test?
a. Yes
b. No

21. Were you ever returned to your unit from a school due to exceeding the weight standards or failing a physical fitness test?
a. Yes
b. No

21. If you gained weight in the past year, how much weight did you gain?
a. I did not gain weight in the past year
b. 10 or more pounds
c. 6 to 9 pounds
d. 3 to 5 pounds
e. 1 to 2 pounds

22. Did your weight play a role in your decision to separate the military?
a. Yes
b. No

23. Were you over weight when you retired, or separated from the military?
a. Yes
b. No

24. How long have you been out of the military?
a. 1-3 years
b. 3-5 years
c. 5-10 years
d. Greater than 10 years

Appendix C: E-Mail for Participants

Hello Veteran,

I am (SGM, Ret) Tracy Lewis a PhD candidate at Walden University. I am currently completing my research study on how obesity impacts a veteran's career. I am contacting you in hopes that you will participate my survey.

Personal information is not requested or collected, but any information you provide in this study that could identify participants will be kept confidential. Only the results of the research study will be published. Identifiable information, such as your name, email address, IP address, social security number and/or date of birth is not requested or collected with your survey response. In any written reports or publications, no one will be able to identify participants.

Participation in this study is voluntary. Veterans can decide not to be in the study and they can change their mind about being in the study at any time, and/ or refuse to answer any questions they don't want to answer and still remain in the study. There will be no penalty to the service member. Participants may end their participation in the study at any time by closing the web browser.

I really appreciate your time. The survey will take about 10 - 15 minutes to complete. If you have any questions, please feel free to contact me using the below e-mail address. Anyone who decides to take part in this study must be willing to provide informed consent, which I have attached for your review. I greatly appreciate your help.

P.S. Your answers will be completely anonymous. By clicking on the survey link, you are granting permission for your totally anonymous responses to be included in the research study.

Link to Survey

Thank you for your participation,
Tracy Lewis
tracylewis3@waldenu

Appendix D: Reminder E-Mail to Participants

Hello. Recently you received an invitation to complete a survey that I am conducting regarding a retrospective review of the impact obesity has on veterans. I would really appreciate your time and taking 10-15 minutes to complete this survey at your earliest convenience.
As a reminder, your survey may be accessed via this website: http://
Remember, your responses will be kept anonymous. If you have already taken the survey or have decided not to participate, please disregard this message.
Thank you for being a part of this important activity.

Sincerely,
Tracy Lewis
Tracylewis2526@gmail.com

Appendix E: Air Force Fitness Program Standards

Minimum Component Requirements

Must have composite score of 75.0 AND meet all requirements below to pass test				
MALE				
Age	**Body Comp (AC)** (max)	**Run Time** (max)	**Situps** (min)	**Pushups** (min)
30	39.0"	13:36	42	33
30-39	39.0"	14:00	39	27
40-49	39.0"	14:52	34	21
50-59	39.0"	16:22	28	15
60+	39.0"	18:14	22	14
FEMALE				
30	35.5"	16:22	38	18
30-39	35.5"	16:57	29	14
40-49	35.5"	18:14	24	11
50-59	35.5"	19:43	20	9
60+	35.5"	22:28	11	7

Appendix F: Army Fitness Test

ARMY PHYSICAL FITNESS TEST Standards

PUSH-UPS

MALE

AGE GROUP	17–21	22–26	27–31	32–36	37–41	42–46	47–51	52–56	57–61	62+
MAXIMUM 100%	71	75	77	75	73	66	59	56	53	50
MINIMUM 60%	42	40	39	36	34	30	25	20	18	16

PUSH-UPS

FEMALE

AGE GROUP	17–21	22–26	27–31	32–36	37–41	42–46	47–51	52–56	57–61	62+
MAXIMUM 100%	42	46	50	45	40	37	34	31	28	25
MINIMUM 60%	19	17	17	15	13	12	10	9		7

SIT-UPS

MALE and FEMALE

AGE GROUP	17–21	22–26	27–31	32–36	37–41	42–46	47–51	52–56	57–61	62+
MAXIMUM 100%	78	80	82	76	76	72	66	66	64	63
MINIMUM 60%	53	50	45	42	38	32	30	28	27	26

2-MILE RUN

MALE

AGE GROUP	17–21	22–26	27–31	32–36	37–41	42–46	47–51	52–56	57–61	62+
MAXIMUM 100%	13:00	13:00	13:18	13:18	13:36	14:06	14:24	14:42	15:18	15:42
MINIMUM 60%	15:54	16:36	17:00	17:42	18:18	18:42	19:30	19:48	19:54	20:00

2-MILE RUN

FEMALE

AGE GROUP	17–21	22–26	27–31	32–36	37–41	42–46	47–51	52–56	57–61	62+
MAXIMUM 100%	15:36	15:36	15:48	15:54	17:00	17:24	17:36	19:00	19:42	20:00

MINIMUM 60% 18:54 19:36 20:30 21:42 22:42 23:42 24:00 24:24 24:48 25:00

TABLE 2
PRT STANDARDS FOR MALES
"Maximum" is the highest number of points attainable for an event.

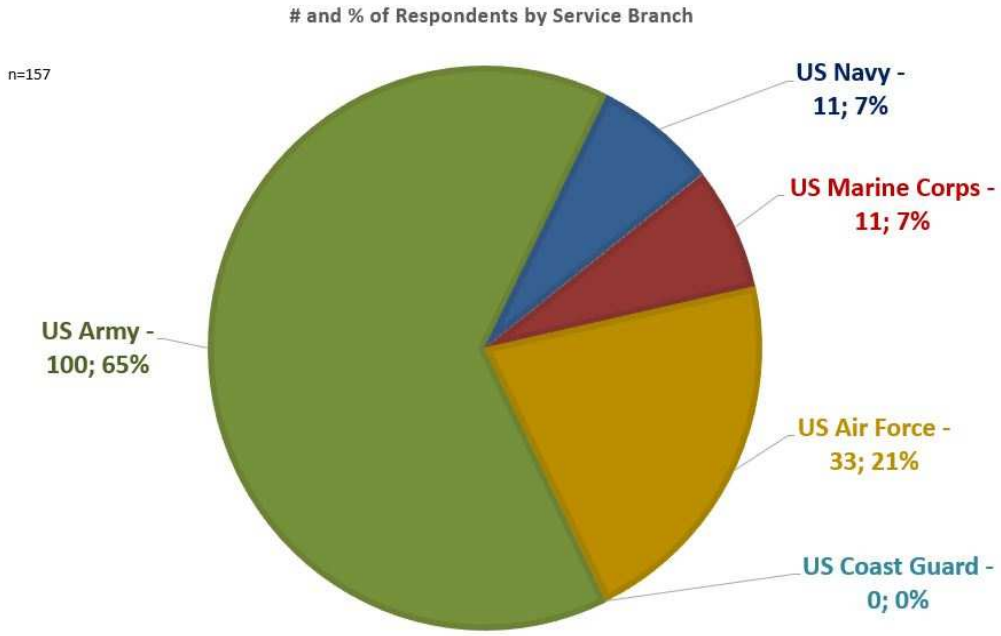
Performance Level	Points	Curl-ups	Push-ups	1.5-mile run	500-yd swim	450-m swim
		Males: Age 17-19 years				
"Maximum"	100	109	92	8:15	6:30	6:20
Outstanding	90	102	86	9:00	7:15	7:05
Excellent	75	90	76	9:45	8:30	8:20
Good	60	62	51	11:00	11:15	11:05
Satisfactory	45	50	42	12:30	12:45	12:35
Failure	<45	<50	<42	>12:30	>12:45	>12:35
		Males: Age 20-24 years				
"Maximum"	100	105	87	8:30	6:30	6:20
Outstanding	90	98	81	9:15	7:30	7:20
Excellent	75	87	71	10:30	8:45	8:35
Good	60	58	47	12:00	11:30	11:20
Satisfactory	45	46	37	13:30	13:00	12:50
Failure	<45	<46	<37	>13:30	>13:00	>12:50
		Males: Age 25-29 years				
"Maximum"	100	101	84	8:55	6:38	6:28
Outstanding	90	95	77	9:38	7:38	7:28
Excellent	75	84	67	10:52	8:53	8:43
Good	60	54	44	12:53	11:38	11:28
Satisfactory	45	43	34	14:00	13:08	12:58
Failure	<45	<43	<34	>14:00	>13:08	>12:58
		Males: Age 30-34 years				
"Maximum"	100	98	80	9:20	6:45	6:35
Outstanding	90	92	74	10:00	7:45	7:35
Excellent	75	81	64	11:15	9:00	8:50
Good	60	51	41	13:45	11:45	11:35
Satisfactory	45	40	31	14:30	13:15	13:05
Failure	<45	<40	<31	>14:30	>13:15	>13:05
		Males: Age 35-39 years				
"Maximum"	100	95	76	9:25	6:53	6:43
Outstanding	90	88	70	10:08	7:53	7:43
Excellent	75	78	60	11:23	9:08	8:58
Good	60	47	37	14:08	11:53	11:43
Satisfactory	45	37	27	15:00	13:23	13:13
Failure	<45	<37	<27	>15:00	>13:23	>13:13
		Males: Age 40-44 years				
"Maximum"	100	92	72	9:30	7:00	6:50
Outstanding	90	85	67	10:15	8:00	7:50
Excellent	75	76	56	11:45	9:15	9:05
Good	60	44	34	14:30	12:00	11:50
Satisfactory	45	35	24	15:30	13:30	13:20
Failure	<45	<35	<24	>15:30	>13:30	>13:20

Appendix G: Weight Programs Within Military Service Branches

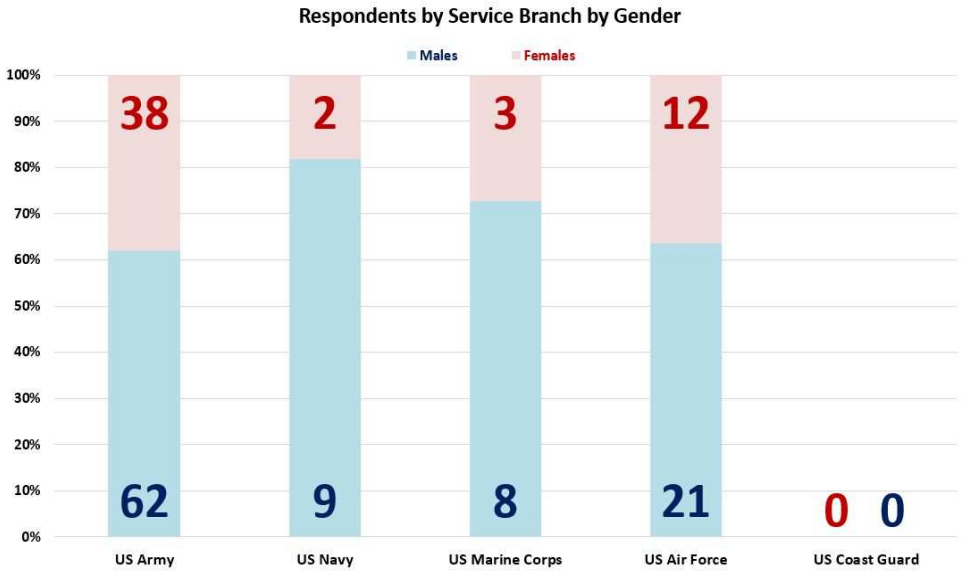
Service	Overweight BMI ≥ 25	Obese BMI ≥ 30		
Air Force	58.8%	13%	Air Force Fitness Program	
Army	61.0%	12.9	Army Move ; Army Body Composition Program	
Navy	62.7%	14.3%	Navy Fitness Program	
Marine Corps	55.1%	6.1%	Marine Corps Community Service Semper Fit Program	

Source:
Tanofsky-Kraff, M., Sbrocco, T., Theim, K. R., Cohen, L. A., Mackey, E. R., Stice, E., … Stephens, M. B. (2013). Obesity and the US Military Family. Obesity (Silver Spring, Md.), 21(11), 2205–2220. http://doi.org/10.1002/oby.20566

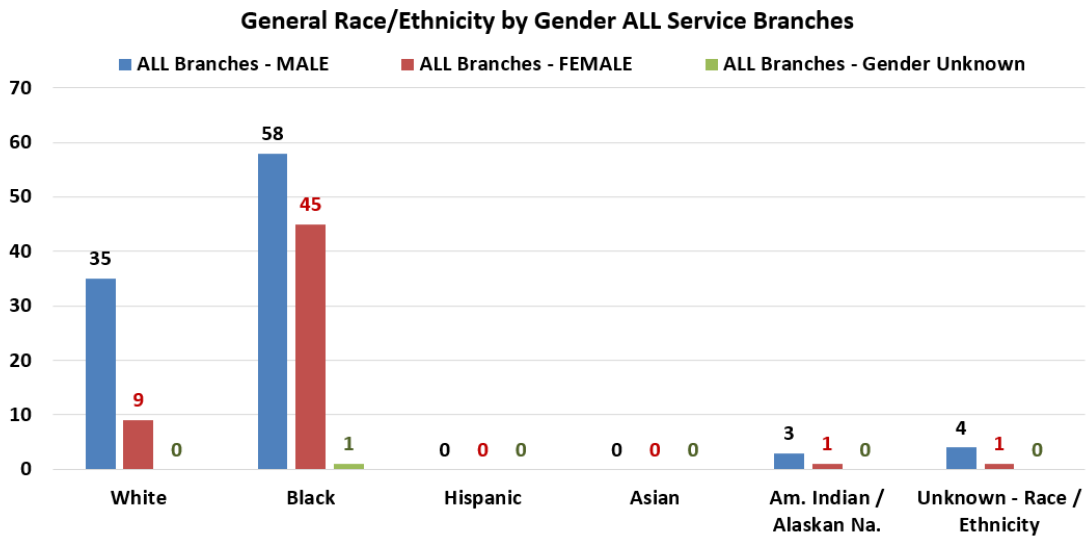
Appendix H: Respondents by Service Branch



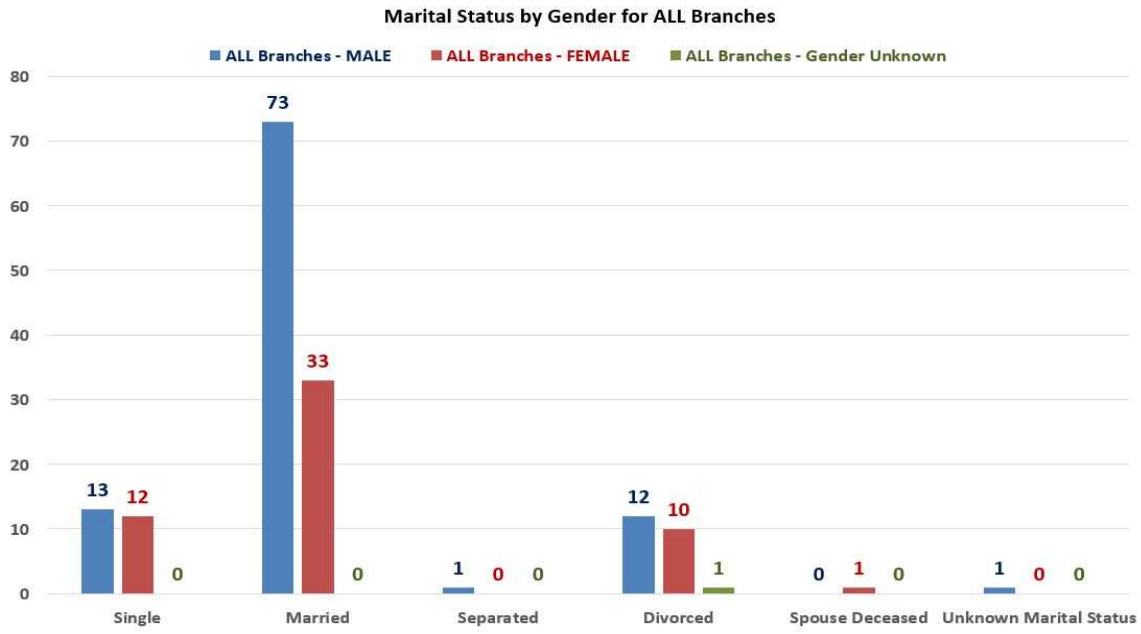
Appendix I: Respondents by Service Branch by Gender



Appendix J: General Race & Ethnicity by Gender and Service Branches



Appendix K: Marital Status by Gender for Military Service Branches



Appendix L: Educational Attainment Level