MILITARY READINESS IMPLICATIONS OF THE UNITED STATES OBESITY EPIDEMIC: A SYSTEMATIC REVIEW WITH META-SYNTHESIS

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Abstract

Military readiness relies upon the health of servicemembers and the ability to perform the duties of their position. Rates of overweight or obese body compositions have been found to be increasing in prevalence within the United States armed forces (Yang et al., 2021). To identify further gaps in knowledge, consolidate and synthesize information, and inform future study, a systematic review with meta-synthesis was performed under the lens of a socio-ecological framework. When searching EBSCO, PubMed, and Google Scholar, 194 results were analyzed within the PRISMA guide. Twenty articles met inclusion after review. After NVivo and manual theme identification from those marked for inclusion, information was synthesized based on the frequencies found in the collective group of articles. The results indicated 95% of the articles found rising rates of obesity in the United States armed forces were problematic for military readiness. The need to intervene was discussed in 85% of the articles found, while only 65% discussed the need to curve chronic disease related to obesity. As the Department of Defense has 1.33 million active duty and approximately 1 million more in a reserve status, policy changes are likely to have a sweeping impact (DOD Demographics, 2020). Further study is recommended to inform future policy decisions. These include researching efficacy of current standards for retention or recruitment, more analysis of reserve and guard forces, civilianizing some non-deploying active duty positions, and trending a greater number of years' worth of data to assess temporal relationships.

Keywords: Body Composition, Obesity, Overweight, Military, Deployment, Readiness, Military Standards

To a loving spouse, family, and coworkers for the greatest understanding.

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Chapter 1: Introduction

Readiness across the United States Armed Forces is a prime human capital concern for the ability to deploy members in support of military operations. Conceptually the term readiness has two main considerations. First, readiness is primarily framed for service members to be medically able for worldwide assignability. Secondly, readiness can be illustrated as those in the medical profession possessing the knowledge, skills, and abilities to perform the duties required of their position (Howell, 2020; Melton & Quick, 2020). This is spoken within the Military Health System as a medically ready force and as a ready medical force. Uniquely, where most health systems consider the triple aim of cost, quality, and access, the Military Health System is trying to quantify the concept of readiness in what is deemed the quadruple aim.

Rising obesity and overweight prevalence are not just factors of the general population but also have prime military readiness concerns. Body composition standards are a feature of a medically ready force (Williams, 2016) and a consideration for healthcare system costs (Shiozawa et al., 2019). If a statistically significant rise in numbers failing to meet body composition standards continues, medical readiness will likely decline, translating to fewer mission-ready service members.

To guide policymaking, identification of common gaps for future research, and building consensus across peer-reviewed articles, this dissertation used a systematic review methodology. More specifically, a qualitative meta-synthesis (Hansen, Steinmetz, & Block, 2021; Chrastina, 2018). Finding overarching themes, trends, and gaps is the objective of the research. Recognizing that obesity has risen in the general population as well, this study does not aim to find the causation of the obesity epidemic on personal levels. Rather, population-level trends are most helpful in the policy arena. Potential exists for correlation statements to be found in

literature, though unlikely to be helpful in the pursuit of the unifying themes in research, as body composition is multifactorial.

Background of the Study

Members of the United States Armed Forces were all at one time a member of the general public. After all, the labor pool from which members were screened came initially from the civilian sector. Trends within the general population point to the increasing prevalence of overweight or obese status (Zhang et al., 2020). Zhang et al. pulled data from the National Health and Nutrition Examination Survey (NHANES) to illustrate trends. Within this data, obesity in both categorized genders increased from 2007 to 2016. While the authors mentioned physical activity was a corollary to reducing the risk of abdominal obesity, weight trends for the overall population level increased. These trends increased throughout previous NHANES periods, consistently illustrating increased prevalence across all sociodemographic groups from 1988 to 2004 (Li et al., 2012).

Furthermore, within the general population, the magnitude of change varied within racial and ethnic groups among adults in the United States (Liu et al., 2021). If members of different ethnic or racial backgrounds are impacted at different magnitudes, there exists a potential for disproportionate disqualifications for military service based on body composition. Considering Liu et al. (2021) and Zhang et al. (2021), the general population trends correlate to impacts on the labor pool of those considering military service.

When analyzing those already accessed into active military service, who therefore have a direct impact on military readiness data, military rates of overweight and obesity status have increased in prevalence over time (Yang et al., 2021). Yang et al. studied the difference between body mass index scores for active-duty populations and whether electronic health records were

coded using an International Classification of Diseases code (IDC) for obesity; discrepancies were found between readiness and medical record data points. However, when factoring in body mass index alone, over 300k Soldiers, 146k Airmen, 155k Sailors, 50k Marines, and 5k Coast Guard members were categorized as obese. Additionally, there was a trend of age and prevalence, pointing to suggestions for earlier career intervention. Omar, Leong, and Moy (2020) performed a systematic review for trends across global militaries, also finding increasing trends in all but one researched article, finding that prevalence of obesity went up in European and the United States populations.

Statement of the Problem

Servicemembers seeking accession and those currently in uniform are exhibiting an increased prevalence of overweight or obese status (Yang et al., 2021). Trends have shown in various literature increasing rates over the previous two decades. To address the relationship between overweight or obese body composition within the Armed forces, the primary research question is: What policy or practical statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military readiness of the United States active-duty Armed Forces? Secondarily, does a content analysis of non-peer reviewed publications yield different themes than peer reviewed articles? If so, are themes described differently between academic and non-academic journal publications?

Using the PICO(T) format for research statements, the research problem context can be further identified (Abbade, 2016). The population considered in the review are members of the United States Armed Forces and the labor pool for new accessions into military service. Interventions are not used in systematic reviews directly but may be identified from previous studies. Comparison groups showing are those in different year groups within the population in

trend analysis. The timeline considered for this review is the previous two decades for purposes of trend analysis. With respect to the non-academic journal literature, the same timeline is under consideration in the content analysis portion of the study.

Purpose of Study

While there is a general understanding of body composition trends in the research literature, the purpose of systematic reviews, and more specifically a meta-synthesis is to identify unifying themes and research gaps across multiple articles, services, and time ranges (Lachal et al., 2017). As such, a systematic review is the most logical approach to answer explore the primary and secondary research questions (Munn et al., 2018). Systematic reviews are used to investigate conflicting outcomes, generate statements to aid in policy, and identify areas for future research. When complete, policymakers, researchers, or unit leaders within the Department of Defense would have more information to aid in programming and policy making. Synthesizing information across studies also helps summarize salient points, aiding in the reader's ability to efficiently process information across a wider breadth of information sources. Therefore, by identifying commonalities and research gaps, the purpose of this study is to provide direction to policy makers for future research and to educate leaders on the current trends within the researched phenomena.

Research Questions

As listed in the problem statement, the primary research question addressed is: What policy or practical statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military deployment readiness of the United States active-duty Armed Forces? Secondarily, does a content analysis of non-peer reviewed publications

yield different themes than peer reviewed articles? If so, are themes described differently between academic and non-academic journal publications? However, in the course of analysis and cataloging themes, other aspects related to the primary research question may be identified, such as intervention programming and proposed policy changes.

Significance of the Study

Body composition, via Body Mass Index or further body fat percentage, is a calculated element of individual health statistics, related to military health readiness, often performed at least yearly during physical fitness tests. While there are articles written about the topic, a systematic review has not been published to synthesize information related to deployment readiness. Nonetheless, other articles show an approximate $1.5 billion annually in associated Department of Defense (DoD) healthcare costs (Voss, Pavela, & Stanford, 2019). These costs might be conservative considering additional long-term costs of continued care within the separate Veterans Affairs (VA) Health System. This is likely the case as those who are in active service with honorable discharges generally qualify for VA health coverage. Additionally, in 2017 figures, Voss, Pavela, & Stanford cite an annual loss of 655k workdays for those on active duty. As stewards of taxpayer funds, it is important to ensure the wellness of members of the United States Armed Forces.

When considering physical performance, age, overweight status, previous injuries, and current performance in physical training runs, all are strong factors of musculoskeletal injuries, therefore impacting readiness (dos Santos et al., 2021). Many of these factors cannot be manipulated, such as age and previous injury history. However, in this meta-analysis by dos Santos et al., measuring overweight status, the relative risk for injury was found to be 1.27 [1.08-1.48, 95%] for musculoskeletal injuries. Therefore, further information that expands on the

relationship between overweight status and injury could further inform DoD body composition programs.

While all of these concepts are concerns for policymakers, this population-level topic must be approached in a considerate manner without creating unnecessary stigma towards individuals. While there is an assumption that body composition does impact military readiness figures, one cannot be assumed that heavier body composition impacts national security at the same magnitude without strong evidence. Bodyweight stigmatization is an increasing concern within both the general public and military populations. Other readiness and entry screened factors exist as well, such as educational attainment, other medical screening conditions, injury, and security clearance attainment. Using a systematic review may identify themes across articles while trying to reduce an author's use of hyperbole, improving the usability of the information.

Definitions of Terms

For the purpose of clarification, the following terms found in this study have been defined.

Body Mass Index (BMI). The ratio measure of one's weight to height, where kilograms are divided by the square height in meters (Centers for Disease Control and Prevention, 2021).

Body Fat Percentage. The total mass of fat as a percentage of total body mass (Centers for Disease Control and Prevention, 2021).

Obese. Those with a body mass index greater than 30.0 are statistically considered obese (Centers for Disease Control and Prevention, 2021).

Overweight. Those with a body mass index between 25.0 and 29.9 are statistically considered overweight (Centers for Disease Control and Prevention, 2021).

Underweight. Those with a body mass index below 18.5 are statistically considered underweight (Centers for Disease Control and Prevention, 2021).

Department of Defense. The United States Department of Defense is a federal agency responsible for supervising the United States military forces (Department of Defense, n.d.).

Active Duty. A service member who is considered on active duty is one whose position is full-time within the military and can deploy anytime (United States Department of Veterans Affairs, 2012).

Reservist. Reservist members are those screened to deploy, are members of the Armed Forces, but are not generally full-time employed in a uniformed service (United States Department of Veterans Affairs, 2012).

Military Health System. Comprising of the direct care and private sector care systems via TRICARE, the Military Health System is overseen by the Defense Health Agency for over 1.4 million Active-Duty Members and a total of 9.6 million beneficiaries (Defense Health Agency, n.d.).

Assumptions and Limitations

One major confounding element is the impact of the COVID-19 pandemic on body mass within the Armed Forces. One piece of literature from Dietz & Santos-Burgoa (2020) suggests that lockdowns, increased hardships, stress, and altered eating behaviors will likely worsen body composition within the general population. However, due to the recency of the pandemic, there likely does not yet exist a large body of literature related to the COVID-19 pandemic to body composition within the Armed Forces. It may take a number of years to collect and correlate data during the peak case rates during the pandemic.

During a cursory literature search, other militaries have published articles related to obesity and military readiness. France's Armed Forces have shown statistically significant increases in body fat amongst service members, but at a lower magnitude than other countries in Western Europe (Quertier et al., 2022). In another such case, the Iranian Military has uniquely performed a systematic review of the literature to assess their military personnel, also finding an increasing prevalence of obesity (Salimi et al., 2019). Because of cultural differences, location, and an inability to shape policy in other geographies, this systematic review is limited to those articles within the United States.

One of the cursory research questions relates to impacts on the Military Health System. As the Military Health System covers 9.6 million beneficiaries, with only approximately 1.4 million being on active duty, the focus of this review only considers impacts related to active-duty populations (Defense Health Agency, n.d.). For example, Dall et al. (2011) researched quantitative data for lifetime expenditures related to body composition which also encompasses dependents and retirees in TRICARE's managed care plan.

Organization of the Dissertation

Similar to other dissertations, a five-chapter model will be utilized (Bloomberg & Volpe, 2018). With the chosen methodology of a systematic review and meta-synthesis of literature, there are similar topics found in each chapter. The first chapter is to introduce the topic. Additionally, the second chapter is still a literature review but is more focused on providing background and context, rather than being a systematic review within itself. Chapter 3 follows the traditional format of describing the systematic review and meta-synthesis methodology. Additionally, the content analysis of non-academic journal literature methodology is described. Chapter 4 is the performance of the systematic review and content analysis, where the tabled data

and identified themes are collected. Lastly, Chapter 5 summarizes the results and provides the consolidated list of items identified for future research. A post-script has been added to discuss a personal take on applying the information in this profession.

Chapter Summary

Disparate sources allude to correlations between increased prevalence of overweight or obesity status and lowered military readiness. To further explore common themes and identify areas for further study, a combined systematic review and meta-synthesis is necessary to aid policymakers and planners. Additionally, to address language found within the Defense sector, a content analysis is performed to identify themes outside of academic journals. As the United States Department of Defense has over 1.4 million active-duty and approximately 800k reservists, even small percentage changes are likely statistically significant (DoD Demographics, 2018). Improving service member health, reducing injuries, and forecasting military health system needs are worthwhile as stewards of taxpayer funding.

Chapter 2: Background and Context

Literature found within Chapter 2 of this dissertation is meant to provide context to the problem statement and information related to the methods chosen. As the chosen methodology is a systematic review of literature as well as content analysis, the literature review below is not the same as the comprehensive analysis performed in chapters four and five. Chapters four and five are limited to the scope of the research question, supporting search terms, analysis of themes presented, and items for further study.

Concepts, Models, and Themes

Four major elements were taken into consideration leading to the dissertation proposal: public health's socio-ecological model, overweight and obesity prevalence in the United States general population, overweight and obesity prevalence in the United States Department of Defense, and the use of systematic reviews to synthesize bodies of peer-reviewed information. All considered, using synthesized information aids policymakers to make informed decisions based on holistic information on a given topic.

Socio-ecological Model

The socio-ecological model of health is a common framework within public health to conceptualize interactions between people and their lived environments (Centers for Disease Control and Prevention, 2015). Four levels exist that interreact: individual (intrapersonal), relationships (interpersonal), community, and society at large. When a researcher or policymaker develops an intervention or a focus, it is best to focus on one or two of the socio-ecological model levels.

Within the individual level, considerations exist for biology, age, education, income, and chronological health history. Following the next level is that of the relationship level, where the focus is on the partners, family members, and social circle. Community refers to the social relationships in workplaces, neighborhoods, and wider social circles. Lastly, the societal level includes norms that consider wider socioeconomic inequities. All levels have some impact on one's health.

For example, Alber and Hamilton-Hancock (2012) performed a policy analysis for the United States obesity management using the socio-ecological framework. In the publication year, four out of ten Americans viewed themselves as overweight. As such, the authors collected policy examples at each socio-ecological model level. Within the individual level, the authors listed corporate/business program incentives for members to incentivize members to workout. At the interpersonal level, discussion of using church or community groups to address dietary practices at specific socio groups. At the community level, Alber and Hamilton-Hancock listed zoning restrictions of fast food in proximity to various residential areas. Lastly, at the societal level, the authors listed limits to advertising or taxation of unhealthy foods/behaviors. While the policies may vary in popularity, their article was able to articulate policies at each socio-ecological level.

Considering the socio-ecological model within the dissertation is important as each intervention or policy may vary from interpersonal (unit), community (base or area of responsibility/region), and societal (service) levels. This allows those to develop programs the ability to focus interventions on a specific level. Should policy considerations be identified at a base or area of responsibility, further study or interventions need to be focused on the

corresponding socio-ecological level. Likewise, if a specific unit is outside of a standard deviation for reporting data, interpersonal interventions may be required.

Overweight and Obesity Prevalence in the United States

According to an article in *The Lancet*, multiple decades of data are featured to trend obesity trends within the United States (Rodgers et al., 2018). While they cite a survey of 300 policymakers, 90% of whom believed personal motivation was a strong influence on trends, the National Health Examination Study and National Health and Examinations Surveys (NHANES) illustrate there may be far more to consider. The prevalence of obesity was relatively consistent until the late 1970s across the whole United States population. Considering the upward trend, the authors found it implausible that every demographic group had the same decline in willpower for nutrition and exercise. Trends within each age group, regardless of gender, increased at approximately the same slope over time. Predisposition to obesity via genetics is not typically seen in periods of just a few years, rather tends to be generational.

The rise in obesity prevalence impacts risk factors for other comorbid conditions, such as cardiovascular disease (Peters, Muntner, & Woodward, 2019). Temporal trends indicate rising Body Mass Index appeared to be consistent over time regardless of gender. However, obesity is not the only factor for cardiovascular disease. While research shows links between body mass index to cardiovascular disease, data for the previous decade may be misleading due to pharmacological interventions and lower rates of smoking. As such, recent trends are unable to show causation, but obesity is still listed as a factor of consideration for non-treatment groups.

In an article by Fan et al. (2023), cohorts were examined in each decade birth group starting in the 1940s. With the exception of those born in the 1940s, severe obesity increased significantly in every age. Younger birth cohorts found a higher prevalence of severe obesity

than older cohorts. Therefore, those in more recent birth decades are statistically more likely to be obese. While the makeup of the Department of Defense is not directly similar to the general population of the United States, the trend impacts the labor pool in recruitment as those come into eligible age groups (Webber et al., 2023).

Overweight and Obesity Prevalence in the Department of Defense

Members of the United States Department of Defense are not immune to the United States obesity epidemic (Smith et al, 2012). As the population of the active-duty military is approximately 0.5% of the overall U.S. population, there is a low magnitude effect in general civilian population studies. However, when comparing civilian numbers to service members, there are slight differences, but still, a statistically significant percentage of the military population is found to be overweight or obese, contrary to what may be the public perception.

Due to a large body of data for analysis, there are multiple ways to capture the changing body composition information, whether it be sample surveys or systems-level data medical record data. For example, Eilerman et al (2014) addressed data from 2009 to 2012 from a Military Data Repository called M2. By using this source, population-level data was captured. In this date range, active-duty service members showed an increase in overweight prevalence. For the active-duty population, the overweight prevalence was 52.7-53.4%. Obesity prevalence ranged from 18.9%-18.3%. These statistics are significant portions of the active-duty population. Smith et al. (2012) found the combined overweight or obese statistics to be 60.5%.

In a 2017 article, Schvey et al. describe overweight or obesity prevalence tripling in the fifteen years prior to publication. This trend also studied the stigma associated with overweight or obese statuses. Stigma was found in nearly half of those identified as overweight or obese,

leading to harmful thoughts and behaviors. Considering these related thoughts, the authors recommend stigma reduction efforts to correspond to the physical mitigation efforts.

Cancer and Obesity Prevalence

As obesity incidence has been increasing over previous years, epidemiological studies have examined the comorbidities with cancers (Louie, Roberts, & Nomura, 2013). While the linkage to type II diabetes and cardiovascular disease is well known, the body of knowledge continues to grow related to cancers. Relationships between white adipose tissue and cancer rely on lipid signaling, inflammatory response, and insulin resistance.

Harvey, Lashinger, and Hursting (2011) also discuss this mechanism wherein there is thought to have relationships with increases in proinflammatory conditions found in obese populations which have a correlation to cancer cell formulation. While there is mention of weight gain and other chronic diseases, cancer research is still progressing. Using prospective studies in order to study these mechanisms is key to progressing the knowledge in this field.

On a global scale, obesity and cancer prevalence rates are rising similarly (Arnold et al, 2016). These trends translate into a greater future burden on hospital systems to maintain oncology and chronic condition care. Understanding that these changes are found at a large scale, it is likely that all systems need to factor in a proportional change in care, just at different magnitudes.

Intervention Studies

Intervention, reduction, and mitigation measures vary in scope and methodology for obesity within the armed forces. Nadolsky (2018) provides a case in *Military Medicine* for the use of obesity pharmacology. With 13-18% of the military population exhibiting a body mass

index of greater than 30kg/m^2, Nadolsky argues that a business case exists to include obesity reduction medications. As the DoD spends $1.1 billion per annum on medical care related to excess weight while also having to consider chronic costs for those who enter the Veterans Health system, promoting weight management programs may likely reduce long-term appropriated fund costs. Five medications were proposed: orlistat, lorcaserin, phentermine, malexetrone, and liraglutide. Each has various mechanisms, contraindications, and side effects.

Within unit or service levels, each service has its own physical fitness mitigation programs (Miggantz et al., 2021). One program featured in both Miggantz et al. (2021) and Wisbach et al. (2018) was an evidence-based program called ship shape. This featured diet and physical training programs to curve obesity trends. In Miggantz et al. (2021), the participants in Ship Shape used similar programming, but in post surveys, participants were found to have a greater prevalence of emotional eating.

Traditionally, the Navy used a program called the Fitness Enhancement Program (FEP), one that used exercise and regular interval body composition measurements (Afari et al. 2019). Congressionally mandated, services are to test fitness and physical readiness. This usually includes some form of body composition assessment and a physical readiness test. Varied by service, this mostly includes weight, body fat checks, and physical fitness tests. Fitness Enhancement Programs for the Navy usually repeat these tests for those who failed to monitor progress. Shipshape, as mentioned above, is complementary to the fitness enhancement program to improve education and fitness. However, Afari et al. do posit that the program falls short as it could benefit from acceptance and commitment therapy to improve the long-term results of the program.

Relevance to Healthcare Administration

Obesity-related conditions are a stressor on healthcare systems (Specchia et al., 2015). The cost of illness impacts direct and indirect costs and requires further planning. Conditions related to obesity absorb a huge number of resources. These costs can further justify public health promotion strategies to reduce the overweight and obesity prevalence. Surgical interventions, such as bariatric surgery, are services that may have long-term positive impacts but may require further understanding of whom to prioritize to yield the best outcomes (Casimiro Perez et al, 2018). In this 2018 article, the authors mention a need for a standardized scoring system to screen patients and require a larger body of literature.

Planning for future product lines and access to care is highly affected by chronic obesity-related conditions (Kirk & Penney, 2013). Should obesity rates remain steady or continue to climb, this complex issue will overwhelm the health system's capacity for chronic diseases. These include diabetes, coronary heart disease, osteoarthritis, hypertension, and a number of cancers.

Considering military members are not immune from obesity conditions, both the Military Health System and Veterans Administration health system need to consider obesity management initiatives (Breland et al, 2017). Hospital administrators, policymakers, and executives need to plan for the changing needs of the population. While the focus of this dissertation is national security / military deployment readiness related to obesity, hospital systems are a prime stakeholder in any intervention related to this population.

Chapter Summary

Systematic reviews and further meta-synthesis processes are an appropriate methodology to synthesize information related to a topic. Various articles found in the literature review used

this methodology, illustrating how the proposed research questions may be appropriately explored. Further articles were found that underpinned the importance of this topic. Prevalence throughout all samples increased over each decade, lending to the idea that this is a population-level concern. Should this status not be mitigated within either the general or military populations, higher risks for chronic conditions such as cardiovascular, orthopedic, and cancers are likely to occur. Health systems have a high likelihood of impacts to cost and access to care due to chronic comorbidities related to obesity.

Chapter 3: Methodology

Further described in this chapter are both systematic review with meta-synthesis and content analysis methodologies. The systematic review is used to address the primary research question related to peer reviewed articles and consensus themes. The content analysis that proceeds the systematic review is aimed to address non-peer reviewed popular articles. While similar in that both drive identifying themes and codes, they are separate methodologies. As such, this chapter is broken into items related to systematic reviews of peer reviewed literature with meta-synthesis, content analysis of non-peer reviewed literature, and considerations driving performance of this dissertation.

Use of Systematic Reviews

Systematic reviews are a common methodology due to the availability of publicly available information (Gurevitch, 2018). A number of methodologies are similar, but require differentiation. Systematic reviews with meta-analysis are more analytical in nature, where those that are meta-synthesis tracked are focused more in a qualitative space. In an Ebsco search, none were found specifically related to United States military deployment readiness, though literature is available for related topics or performed under these methods by other nations. Globally, cardiometabolic risk factors are a concern in military personnel as obesity prevalence rises (Baygi et al., 2020). Using PubMed, MEDLINE, ISIS, and SCOPUS, a meta-analysis was possible where the authors determined that due to the statistically significant prevalence of obesity and related cardio risk factors, actions should be taken to reduce risk.

Sanderson, Clemes, and Biddle (2011) synthesized information in articles related to the treatment of obesity in military populations. To perform this analysis, the authors identified 17 papers related to treatment and corollaries. In these papers, it was found that successful

treatments included exercise, healthy eating education, behavior modifications, relapse prevention, and follow-up methods. All of these process steps required the use of trained personnel.

These interventions were supported in another systematic review by Malkawi et al. (2018). Of screening 136 studies, only 38 included an educational or behavioral change element and were the only studies included. Synthesizing the information, the interventions were effective at least for 12 months in military personnel. The authors do mention that while the data is promising, more studies are required outside of Europe and the United States.

These concerns transcend western countries and are also a consideration of the Islamic Republic of Iran, where Salimi et al (2019) published a systematic review of overweight or obese members of the Iranian armed forces. While the authors mentioned the increased prevalence in other countries, they noted Iran had pooled overweight and obesity prevalence of 41%. This high prevalence is impactful on their readiness and considers the armed forces as a high-risk occupational group. They write that further large representative studies are required for better estimation of prevalence in Iranian military personnel.

Related to body composition is the topic of eating disorders (Bartlett & Mitchell, 2015). Within their systematic review, the authors found that features unique to military life may increase the risk of eating disorders including military sexual trauma, adhering to strict body composition and fitness standards, and combat exposure. Based on their systematic review, they highlight a need for screening, intervention, and further study.

Use of Similar Methodologies in Dissertations

In January 2023, while searching ProQuest's repository of dissertations, using the Boolean phrase "healthcare administration" and "systematic review", 227 results were shown for

doctoral dissertations in the previous ten years. Schools that authorized this methodology ranged from University of Maryland University College, Walden University, California State University, Pepperdine, Northcentral University, University of Arizona Global, and Utica College. Of the top ten dissertations reviewed, the authors were submitting requirements for professional doctorates with the exception of one. One PhD student at Texas A&M used a systematic review, though was used part of mixed methods with another methodology.

When replacing the term systematic review with meta-synthesis, 16 results appeared in ProQuest in dissertations using a meta-synthesis methodology. One New York University doctoral researcher looking at HIV risk amongst IV drug users employed the meta-analysis technique for the quantitative data portion, but utilized synthesis coding for the descriptions, such as the number of studies that were coded for a certain theme or term (Pennington, 2017). Houghton (2022) used a combined systematic review and meta-synthesis for a doctoral study work in a Doctorate of Psychology. Houghton's methods used inductive coding, a table of terms by the number of studies using a term, and the relevant terms related to a code. Her focus was to identify common terms within sexual assault as listed in peer reviewed articles. Logan (2017) utilized meta-synthesis to identify themes in Nursing Education related to caring for a University of South Dakota Doctor of Nursing Practice program. Within her review, she was able to incorporate findings from 38 studies to find general themes across literature.

Validity and Reliability

Unlike primary research methodologies, using secondary data or articles requires analysis into the methods of individual studies to determine whether they were originally valid and worthy of inclusion. Thompson, Tiwari, and Fu (2012) discussed applying some questions to an overall systematic review to determine whether a study is valid for inclusion. These questions

include assessing whether the methods were well founded, transparent, and used a search strategy. Additionally, clearly defined inclusion and exclusion criteria is required prior to executing the search for information. With respect to reliability, addressing whether the studies provided similar results between studies is a good indicator of the quality of work found for inclusion.

According to Nussbaumer-Streit et al. (2016), systematic review methodologies by design offer the highest level of reliability and validity for health policy decision making. This is due to the number of peer-reviewed articles found for inclusion, each having their own consideration of reliability and validity within their text. Each parent article should clearly define their methods as well as reliability and validity. Should an article dismiss these elements, the parent article is not suitable for inclusion in the review and synthesis. Because these methodologies include the best available evidence whose parent articles are reliable and valid, these methodologies are found effective to identify evidence-based practices (Slocum, Detrich, & Spencer, 2012)

Systematic Reviews with Meta-Synthesis

Systematic reviews of literature aim to collate bodies of evidence that meet eligibility criteria in response to a research question (Higgins et al., 2019). By defining the eligibility criteria, methods, and sources of literature, systematic reviews use protocols aiming to reduce bias. Systematic reviews, while broadly understood and found in peer-reviewed research journals, can be further defined. By doing so, one can clearly identify the steps being used to collect information. For example, a Cochrane collaboration method is commonly used for systematic reviews within healthcare. Similarly, a framework method analysis of qualitative data

uses similar steps for indexing and coding, initially intended for social research (Gale et al., 2013).

While Cochrane and framework methods have broad applicability and have generally similar steps, the research question and methods can follow the eight steps adopted from Hansen, Steinmetz, and Block (2021). This methodology is called the qualitative meta-synthesis, an offset of the slightly broader systematic review. In another peer-reviewed guide, these steps are outlined visually but use the same flow (Tawfik et al, 2019). Both incorporate the PRISMA flow method to illustrate the articles reviewed versus the number that met full-text inclusion criteria. PRISMA is a unifying way to report systematic reviews and meta-analysis research (Page et al, 2021). PRISMA is an academic group with an aim to provide standardization regardless of the medium of reviews collected.

Qualitative Meta-Synthesis Steps

Performing the systematic review with a focus on qualitative meta-synthesis requires the use of six steps outlined by Lachlan et al. (2017). These are similar and follow a consistent path as both Hansen, Steinmetz, and Block (2021) and Chrastina (2018). The listed steps are consolidated below in Table 1. First, and already performed, is the identification of the research question and selection criteria. The focus needs to be broad enough to capture information though narrow enough as not to lose sight of the research question. Second, literature is selected and catalogued using a systematic methodology. Within this step, information is compiled and used within a flowchart. In this dissertation, a PRISMA diagram is used due to the common use in similar methodologies.

Third, the studies are assessed further for quality. In this case, they will use a Critical Appraisal Skills Program instrument to provide a standard method to illustrate the rigor in each

study. Scale considered are whether criteria is totally met, partially met, or not met (Lachal et al., 2017). Additionally, when all is considered, information on publication dates, sources, and methods is catalogued to provide descriptive information about the articles. Fourth in the process is to extract information to present in a table. These include in a systematic method the identification of study, summary, sample population information, methodology, and analysis.

Fifth, and at a deeper level, is the need for further analysis. Lachal et al. (2017) describe the need for a multidisciplinary team for coding and review. For the Lachal team's meta-synthesis, using the team in this fashion makes sense, as the team members are trained academic psychologists who are able to find nuance in qualitative psychiatric research. In the case of this dissertation, the deeper analysis and coding will be aided with the use of NVivo 1.6.2, which will assist in the automation of mapping common themes. The software will also allow for outputs that will help visualize the information.

Lastly is the writing of the synthesis. Similarly, in Chrastina (2018), this is referred to as expressing the synthesis. Both intend to present the findings and themes found after performing the previous steps. Importantly, limitations found in the studies also need to be listed to provide background on the generalizability for future considerations.

Table 1

Meta-Synthesis Steps

Number	Step
1	Deciding research questions and selection criteria
2	Selecting studies
3	Performing quality assessment
4	Extracting information for presentation
5	Performing data analysis
6	Expressing what was synthesized

Note: Adapted from Chrastina (2018)

In researching methodology guides, slight variations exist, though still follow a similar path. For example, Tawfik et al. (2019) further describe the steps needed to perform abstract and full-text reviews in order to screen inclusion and exclusion criteria. Additionally, Tawfik et al. recommend using the PICO(T) format in formulating the research question, which is being utilized in this question formulation. All in all, within evidence-based medicine, systematic reviews and complementary analysis methods are growing in importance and are more common due to access to electronic full-text articles.

Systematic Review Inclusion and Exclusion Criteria

Inclusion criteria for this systematic review and meta-synthesis were full-text peer-reviewed articles describing information for the previous two decades, 2002-2022. Quantitative articles may be included in this review, though must have descriptive language for analysis within the body text. This wider range was used for greater inclusion of peer-reviewed articles and to show trend analysis of service members after the start of the Global War on Terror. Only articles describing service member populations within the United States were included in the analysis. Articles were captured using Boolean terms related to the research question. Terms included, but were not limited to, the United States, active duty, military, obesity, overweight, readiness, and deployable readiness. Throughout the process of reviewing articles, common terms previously not considered may have been found. Should these terms relate to the original research questions, they may be considered in future searches. However, if during this period of discovery, the terms are found to lead away from the original research question, they may have been excluded from further consideration.

Exclusion criteria for this review included articles outside of the date range, retracted articles, documents without peer review, and items lacking full-text article access. As informed

by the literature review in Chapter 2, other countries may exhibit readiness issues related to obesity but are excluded from this particular systematic review to reduce the chances of confounding. White papers that are not peer-reviewed were also excluded due to the varying level of scrutiny required for publication. Descriptions of forces that are not active-duty members of the Department of Defense were also not included due to different levels of participation time while in uniform and outside factors potentially impacting their body composition.

Data Collection and Analysis

Two main sources were utilized to capture peer-reviewed articles, EBSCO and PUBMED. Google Scholar was used as well to capture other peer-reviewed articles not captured by EBSCO or PUBMED. Using Boolean phrases informed by inclusion criteria, the number of articles found were cataloged per each source and cross-referenced for duplicates. When the abstracts and articles were reviewed, full-text articles were downloaded, and information was catalogued in summary tables. Only those that met inclusion criteria were tabled. Many of the articles identified were quantitative in nature but included descriptive language that may be analyzed for themes and codes.

When the PDF copies were consolidated into a folder, they were then uploaded into NVivo. After which, identified codes and themes were queried, and visualizations were generated to assist in exploring the information. While performing a systematic review and meta-synthesis, Blashcke (2017) utilized the same process to perform a systematic review and further meta-synthesis with the aid of the NVivo suite. Due to technical limitations of being on government computers, some analysis was performed manually wherein the documents were printed and highlighted by coded theme for counting as a backup to the software suite.

Content Analysis Overview

Peer reviewed articles by nature are bound to more academic writing and methodologies than those found in the public sphere. For the second portion of this work, a content analysis was performed on a sample of publicly available articles and then analyzed. When complete, the themes were compared to those found in academic literature found previously. To perform this analysis, steps were conducted following those found in a paper by Bengtsson (2018).

The steps are planning, collection, analysis, and reporting. Within the planning phase, the problem is identified as well as the collection method. While this method may be used in interviews, it is applicable to various media. In this case, a sample of articles found on the public internet related to the research question were considered. Utilizing these criteria, the sources were collected and catalogued. For the analysis, items were coded to the primary intent of each article, not only to was said, but also a potential of what intent was said. When all the items were found, a summary report was generated to address overall what is commonly found within this topic in popular articles.

Ethical Considerations

Franklin University Institutional Review Board has deemed the proposed systematic review as IRB exempt due to not using primary human research participants per IRB-2021-62. That said, any systematic review needs to be performed ethically and in a transparent manner. Research papers for systematic review inclusion should not list personally identifiable or sensitive information (Suri, 2020). To address ethics within this framework, any review needs to maintain an appropriate purpose, requires the inclusion of relevant research, must consider the quality of evidence, connect understandings, and communicate appropriately with the intended audience.

Population Characteristics

Population characteristics were important to identify due to demographic differences when compared to the general population of the United States. The U.S. Department of Defense has presently on hand 1.33 million active-duty service members (DOD Demographics, 2020). Outside of analysis considerations are the approximate one million ready reserve and guard forces, 900 thousand DoD civilians, and 193 thousand retired reserve forces. Forces that are not on active duty are part of the total Department of Defense force but are not considered in this review.

Of those on active duty, 1.099 million members are categorized as enlisted and 234 thousand are in the officer cadre. This creates a ratio of approximately 4.7 enlisted members to officers in total force. While the number of active-duty females has increased 14.7 percent compared to the year 2000, males represent 82.8% of the active-duty population, compared to 17.2% of females.

The racial makeup of the active-duty force is 68.9% White, 17.2% Black or African American, 4.8% Asian, 3.0% Multi-racial, 1.2% Pacific Islander, 1.1% American Indian or Alaska Native, and 3.9% unknown. Ages skew younger where 45% of the active-duty force is 25 years old or younger. Other age groups break down as 21.4% aged 26-30, 14.8% aged 31 to 35, 10.8% aged 36 to 40, and 7.9% aged 41 years old or older.

Educational attainment within the active-duty force with an overall majority holding high school attainment. Only 1,454 or 0.1% of the active-duty population do not hold a high school diploma or GED. Of the total active-duty force, 66.9% hold only a high school diploma or have attained some college, 8.7% hold an associate's degree, 14.3% hold a bachelor's degree, and

8.2% hold advanced degrees. Of the officer cadre, 85.5% hold a bachelor's degree or higher, though 7.7% of officers have unknown educational attainment.

While the Department of Defense has a diverse population, demographics skew younger and have a larger portion of males as compared to the general population. As there was a statistically significant difference between Defense and general population statistics, studies that use servicemembers as the sole population should not be generalized to the general population.

Researcher Bias

This systematic review and meta-synthesis do not include conflicts of interest by the author. No grant funds were utilized to perform this dissertation and occurred after Department of Defense working hours. Methods and data tables were used to maximize transparency in source selection. While publication bias does occur where papers are more likely to be published than those without significant results, it is incumbent on the dissertation author to analyze each study for quality and applicability (Dwan et al., 2013).

Study Limitations

Aggregating or synthesizing information has many benefits including the ability to comprehend and summarize information from multiple studies. That being said, notable limitations exist when considering this methodology (Garg, Hackam, & Tonelli, 2008). Information leading into a systematic review and meta-synthesis is only as good as the primary studies. Errors in original studies need to be identified as they may be carried forward.

Furthermore, considering again publication bias, articles that did not have strong results may remain unpublished and unavailable for analysis (Dwan et al., 2013). As for published articles, they may not be available for analysis due to the academic institution lacking access to

the journal in which an article is published. White papers written internally to the Department of Defense may have merit in discussing the research question, but do not meet the peer-reviewed threshold for inclusion.

All told, the use of systematic reviews and meta-analysis or meta-synthesis has increased in importance and popularity (Gopalakrishnan & Ganeshkumar, 2013). In healthcare, these systematic reviews inform evidence-based medicine standards. Nonetheless, inherent flaws in the primary studies and the potential for conflicts with studies published after the review need to be considered when drafting these reviews.

Chapter Summary

A primary and secondary research question is being considered for research. The primary relates to building consensus statements related to obesity within an Active Duty population within the United States Armed Forces. To analyze what consensus exists in academic literature, a systematic review with meta-synthesis was described. Similar steps are found in Christina (2018), Lachal et al. (2017), and Hansen, Steinmetz, and Block (2021). To address those items found in public, non-academic journal articles, a content analysis was discussed. These steps follow those identified by Bengtsson (2018). Upon completion of both, the results were compared to see how the researched phenomenon is described and what gaps may exist for future research.

Chapter 4: Findings

With respect to the findings, the first major element is the performance of the systematic review with meta-synthesis. This method was used to address the primary research question: What themes or consensus statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military readiness of the United States active-duty Armed Forces? The systematic review elements are described first.

After which, items related to performance of the content analysis are herein described. This was performed to address the secondary research question: Does a content analysis of non-peer reviewed publications yield different themes than peer reviewed articles? If so, does the language describe different phenomena or themes related to obesity, body composition, and military readiness of the United States active-duty Armed Forces. Following these findings related to both methodologies are described, further discussion takes place to identify which themes were present in both academic and non-academic journal literature.

Systematic Review Findings

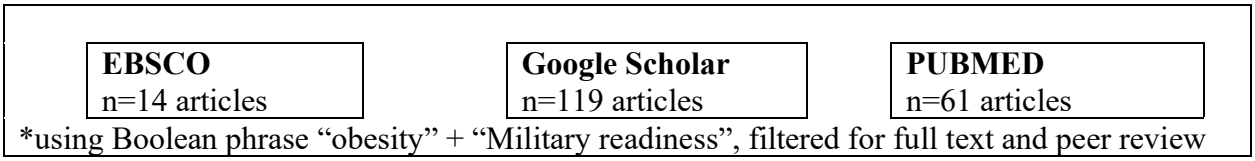
While a general assumption of military readiness impacts was discussed in the literature review, using methods found in Chrastina (2018), a systematic review and meta-synthesis was performed. Initial results yielded over 1,050 articles in Google Scholar. After refining the search terms to be specifically related to the primary research question, 194 articles were found between Ebsco, Google Scholar, and PUBMED. Though Google Scholar yielded more overall results, EBSCO and PUBMED were the main sources where relevant articles were found. Many of those found in Google Scholar did not meet inclusion criteria due to a foreign military focus or lacking access to the full text article. In total, 20 articles met inclusion based on written elements of both the obesity epidemic and a relationship to United States military readiness.

Description of the Articles

Searches were performed in August 2022 for available full text articles with the phrase combination of "obesity" and "military readiness". Advanced search criteria also narrowed the search by only selecting peer reviewed articles published between 2002 and 2022. Of the 21 articles meeting inclusion criteria, 14 were published in the journal *Military Medicine*. Three of the articles included Dr. Gordon Wisbach as either the primary or supporting author. Other listed journals include the *American Journal of Preventative Medicine, Annals of Epidemiology, Obesity Science Practice, the American Journal of Public Health, Clinical Trials Communication,* and the *Journal of Public Health Management*. The figure below details the number of peer reviewed articles from each source.

Figure 1

Article counts by database

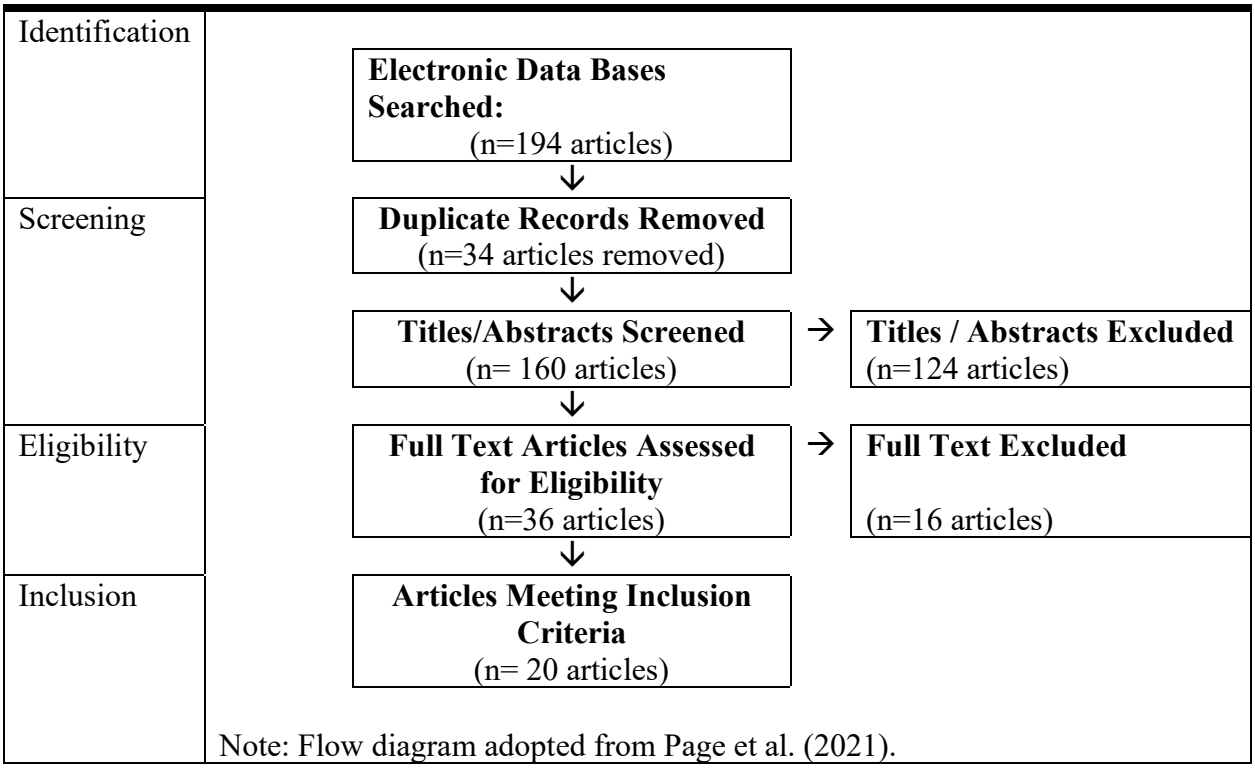


To provide a framework to guide the selection of articles, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, or PRISMA, was used in this dissertation (Page et al., 2021). As PRISMA is the established method of flow and visualizing the selection of articles in such reviews, its use was applicable for this research. The process as illustrated below in Figure 2 shows the iterative steps to performing the PRISMA flow. Various flow diagrams exist depending on the sources of articles with the PRISMA group. In this case, the various steps are the identification of articles, screening, assessing eligibility, and illustrating which meet inclusion.

One major note of those articles meeting inclusion, most employed quantitative methods, though some included systematic reviews and interviews as well. Inclusion criteria was rigid to differentiate the active duty versus veteran or reserve population status. Appendix B lists the 194 articles found between the data bases and which met the inclusion criteria. Nonetheless, even the quantitative articles provided discussion sections that were rich with language and descriptors for use in synthesis.

Figure 2

PRISMA Flow Diagram for the Systematic Review



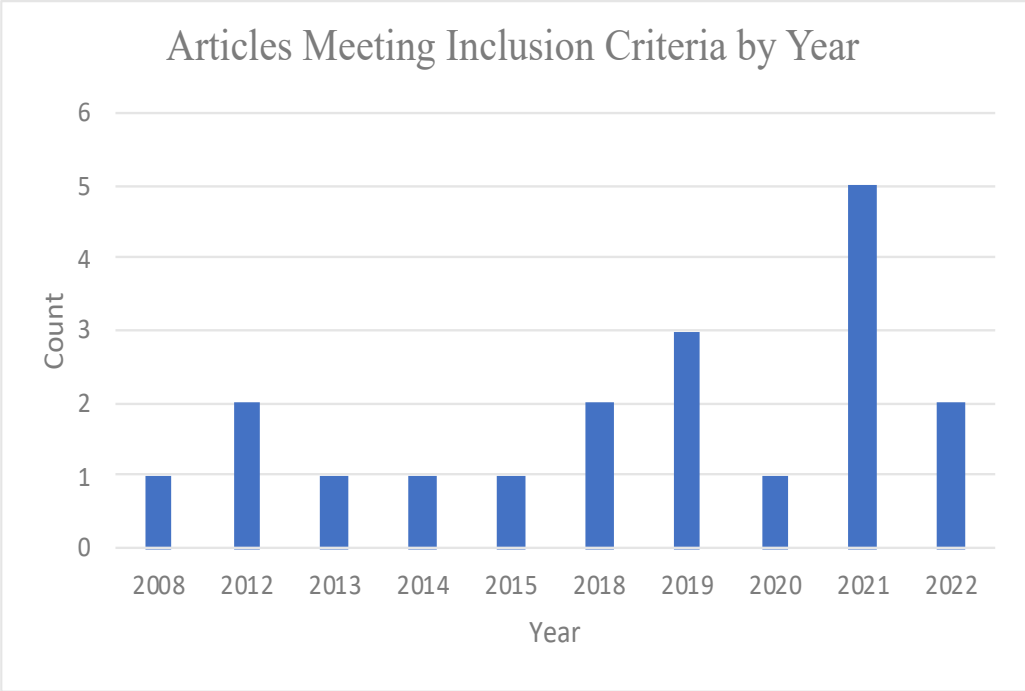
Note: Flow diagram adopted from Page et al. (2021).

Those articles excluded were due to having obesity as a secondary factor as a comorbidity, authors using data from non-United States militaries, evidence of peer review not being performed, and the full text article being unavailable at the time of the search. While the search years were between 2002 and 2022, articles meeting inclusion were published between

2008 and 2022, though many used data throughout the focused search years. The three most published years for articles meeting inclusion were 2021, 2019, and 2022 as illustrated in Figure 3. As the research question has a focus within military health, the journal *Military Medicine* was the ultimate source of 66% of articles meeting inclusion, or 14 of the 21.

Figure 3

Graph of Article Year Distribution



Validation of the articles were performed using a tool called the CASP, or the critical appraisal skills program checklist (Long, French, & Brooks, 2020). By analyzing the articles using a known tool, further judgement on the methodological quality of the article descriptions within articles may occur. The ten questions posed with the tool are standard and found in Table 2 below. While CASP's creators mention this is not a scoring tool, each question was considered for inclusion. Not all questions were applicable depending on each study's methodology. CASP was developed in the United Kingdom but appears to have a general popularity amongst review researchers.

Table 2

Critical Appraisal Skills Program Checklist

Question	CASP Systematic Review	CASP Cohort Study Research
1	Did the review address a clearly focused question?	Did the study address a clearly focused issue?
2	Did the authors look for the right type of papers?	Was the cohort recruited in an acceptable way?
3	Do you think all the important, relevant studies were included?	Was the exposure accurately measured to minimize bias?
4	Did the review's authors do enough to assess quality of included studies?	Was the outcome accurately measured to minimize bias?
5	If the results of the review have been combined, was it reasonable to do so?	Have the authors identified all the important confounding factors?
6	What are the overall results of the review?	Was the follow up of subjects complete enough?
7	How precise are the results?	What are the results of the study?
8	Can the results be applied to the local population?	How precise are the results?
9	Were all the important outcomes considered?	Do you believe the results?
10	Are the benefits worth the harms and costs?	Can the results be applied to the local population?

From Critical Appraisal Skills Programme (2022)

To catalogue the findings, Table 3 follows with pertinent summary items from each article selected for inclusion. Main topics include the article's authors from the citation, publication year, methodology employed, key findings, and items identified for further study. Two reasons for performing this summary table include easy identification to cross reference and a cursory look to see common themes prior to using coding and visualization software.

As discussed in the methodology, one of the strengths of systematic reviews is the identification of gaps and further study (Ganeshkumar & Gopalakrishnan, 2013). By cataloguing the last column is to find gaps or to see if the item of further study was actually performed since publication within the sample of articles.

Table 3

Review of Literature

Authors	Year	Method	Key Findings	Items for Further Study
Afari et al.	2019	Randomized Control Trial Design Concept	The paper was merely a proposal of incorporating acceptance and commitment therapy into a Navy fitness program. The proposal was pitched due to the high potential for improved budget and military readiness aspects of a fit force.	The authors argue for an easily deployable supplemental intervention to fitness enhancement programs to increase efficacy, leading to better body composition and military readiness to deploy.
Bornstein et al.	2019	Quantitative Analysis of Big Data	The authors found that there is a statistically significant difference in body mass index and cardiovascular fitness based on Army recruit home states, mostly found in the South and Southeast of the United States.	Policy changes at state levels may need consideration for accession into military service as 11 states were found to disproportionately impact injury and military readiness.
Carey et al	2021	Analysis of the Millennium Cohort Study	Of the 22,995 Army and Marine Corps service members, those who were on longer deployments statistically were less likely to maintain healthy weight versus those on shorter deployments.	The authors recommend further study in post deployment maintenance of healthy weights. By doing so, service member readiness and deployability may be further optimized.
Clerc, Mayer, & Graybill	2022	Review of BMI Methodologies	The authors argue that Body Mass Index may be less accurate in Servicemembers when other methods with higher accuracy exist.	To improve service readiness and potentially reduce future costs, the authors recommend further study and piloting scalable assessment methods to understand body fat percentages.

(Continued)

Authors	Year	Method	Key Findings	Items for Further Study
Cszimar & Irwin	2021	Systematic Review	According to the systematic review performed of seven studies, the authors posit that military weight loss interventions have insufficient evidence in research papers.	As the authors agree that decreased fitness and higher Body Mass Index of servicemembers degrades military readiness, they argue that programming should have studies with larger sample sizes for bodies of evidence.
Eilerman et al	2014	Quantitative Analysis of Big Data	Compared to the general population, adult Military Health System beneficiaries had higher rates of being overweight and relatively lower rates of obesity in study years 2009-2012.	Eilerman et al. recommend further ongoing research to identify risk factors and behaviors to curve obesity in this target population as the argument relates to decreased operational readiness.
Gantt et al.	2008	Quantitative Analysis of Navy Physical Readiness Data	For a large Navy Medical Treatment Facility, 53% of active duty staff were found to be overweight or obese, which is argued to impact operational readiness.	Gantt et al. propose pursuing system changes to identify and treat high risk for early intervention.
Gollust, Niederdeppe, & Barry	2013	Survey	Surveys amongst general public discussing what rationales may drive public policy for obesity. Military readiness, bullying, and healthcare costs were the messages that surveyed as impactful.	Authors recommend future studies need to explore public health messages in novel domains and diverse values.
Gregg & Jankosky	2012	Quantitative Analysis of Navy Physical Readiness Data	Prevalence of obesity in the data was higher in submarines than aircraft carriers, though submarines had higher fitness element test passing.	The authors recommended further studies with a more diverse population. Construction of additional on-site fitness facilities were recommended for continued focus on physical readiness.

(Continued)

Authors	Year	Method	Key Findings	Items for Further Study
Johnson et al.	2021	Quantitative analysis of TRICARE claims and encounter data	When considering post-partum active-duty members, most women remained in their baseline body mass index.	Weight management for readiness standards should consider the timelines for women postpartum to ensure the best health of this population of servicemembers.
Kao et al.	2012	Survey Analysis	Active-duty uses of body building, weight loss, and performance enhancing supplements were shown to be used primarily in those overweight or obese. Less than 30% discussed supplements with healthcare providers.	The authors claim the use of the dietary supplements for weight or performance may impact individual health and readiness. As one in four active-duty members use dietary supplements, the potential adverse effects should be communicated and studied.
Lennon Oberhofer, & McQuade	2015	Quantitative Analysis of Retrospective Data	Analyzing annual body composition data of >300K servicemembers, BCA failure was statistically significant in ages 36 to 40, ranks E5 to E6, males heavier than 201 lbs, and females with heights of 68 to 69 inches	As the authors note the growing obesity epidemic has implications for military readiness, resources and studies should be devoted to the higher risk populations to target potential interventions.
Miggantz et al.	2021	Analysis of Program Data	Those enrolled to the shipshape program skewed female, non-Hispanic, and overweight.	Survey results indicate a likely comorbidity with potential mental health conditions which may interfere with results
Pebley et al.	2020	Results from intervention	Authors in this Air Force study list obesity as a potential impact to military readiness. On their base, 51% are found overweight and 15% are found to be obese. For those enrolled in a weight management program, those who achieve >5% weight loss performed better at PFT	Further research is suggested as to whether long-term results may be maintained and confirmation of Pebley et al paper results.

(Continued)

Authors	Year	Method	Key Findings	Items for Further Study
Reyes-Guzman et al.	2015	Survey Analysis	Combined overweight and obesity rose from 50.6% to 60.8% between 1995 and 2008 in Active-Duty Forces. Related obesity to a readiness impact.	Recommended future study related to interventions and weight maintenance programming while understanding nuances.
Shiozawa et al.	2019	Quantitative analysis of TRICARE claims and encounter data	Related to the US Army specifically, it was noted 70% of soldiers were overweight or obese in FY2015. System utilization and costs to readiness were related to this figure. Related health concerns and long-term impacts to readiness were discussed, including ability to field a medically ready force.	Four items for further study were identified: 1) investigating amongst other services, duty statuses, and genders 2) better estimations for absenteeism associated with obesity 3) more accurate field testing for BF% 4) establishing realistic BMI standards for operational needs
Winik & Bonham	2018	Nursing Doctoral Project / Mixed Methods	Project aimed for programming and methods for screening aided in potential prevalence reduction. Noted impact was the need to deploy ready and fit members to maintain US defense posture.	Authors note a need for addressing barriers to healthy behaviors are required for future programming.
Wisbach et al.	2018	Mixed methods: Cost Analysis and Interviews	Focused at one major Naval Medical Center, 53% of staff were overweight or obese. Of total sample, 4% was a consistent figure of fitness test failures, an item to consider for readiness. Weight Management Programs were found to have return on investment considering cost to recruit, train, and retain.	The authors recommended maximizing use of weight management programs at commands and increase the participation of the Assistant Command Fitness Leaders (those who led weight management program sessions).

(Continued)

Author	Year	Method	Key Findings	Items for Further Study
Wonn & Khan	2021	Retrospective Cohort Study	Authors related obesity impacts to cost and readiness as justification to perform the study. Study found that of 8,336 soldiers, those who attended 4-6 weight loss program sessions lost significantly more weight than those who attended 1-3 sessions.	Wonn & Khan recommend further study in compliance and attendance with the weight management programs, or as they deemed, fit for performance programs.
Yang et al	2022	Analysis of Clinical Repository Data	Comparing clinical data and diagnosis codes, those with BMI ranges of >/= 30 were underdiagnosed as obese (only 42.4% of females and 35.1% of males were diagnosed under these criteria). Authors note this discrepancy is consistent amongst services and BMI ranges.	In a population with universal healthcare and with careers with body composition standards, the authors recommend further study why service members may be obese and what barriers to care may exist.

With the articles collected for inclusion and pertinent points having been catalogued in table 3, common points are apparent throughout the articles. Nonetheless, to aid in theme identification, the use of NVivo software was utilized for machine learning and statistics capabilities to see if there are further commonalities throughout the articles. Additionally, the software package was able to visualize many of the frequencies of certain themes and codes. Table 4 below highlights the top frequencies of each key word. Consideration of the common themes and frequency of words used in the language of the articles were then used to synthesize the information.

While analyzing the frequency table, the terms obesity, weight, health, military, and BMI were the top five used terms. The word fat did not appear in table four below of the top fifty words, illustrating a sensitivity to terminology found in the sample of peer reviewed articles.

Interestingly, the term readiness was the 29th most frequent term, which was generally used as a justification for performing the study as well as the item most impacted by the increasing prevalence of service members categorized as obese or overweight.

Table 4

NVivo Word Frequency Output

Word	Length	Count	Weighted Percentage
Obesity	7	920	1.07%
Weight	6	909	1.06%
Health	6	784	0.91%
Military	8	685	0.80%
BMI	3	519	0.60%
overweight	10	476	0.55%
Study	5	455	0.53%
Fitness	7	326	0.38%
Service	7	326	0.38%
Duty	4	320	0.37%
Active	6	305	0.35%
physical	8	301	0.35%
Data	4	293	0.34%
Loss	4	276	0.32%
Body	4	273	0.32%
Navy	4	271	0.32%
personnel	9	268	0.31%
participants	12	267	0.31%
prevalence	10	265	0.31%
Obese	5	255	0.30%
Among	5	246	0.29%
program	7	244	0.28%
May	3	237	0.28%

(Continued)

Word	Length	Count	Weighted Percentage
population	10	237	0.28%
members	7	231	0.27%
management	10	203	0.24%
Army	4	196	0.23%
Age	3	195	0.23%
readiness	9	189	0.22%
women	5	189	0.22%
research	8	181	0.21%
medicine	8	169	0.20%
risk	4	167	0.19%
medical	7	164	0.19%
intervention	12	163	0.19%
results	7	163	0.19%
med	3	155	0.18%
rate	4	155	0.18%
use	3	152	0.18%
states	6	150	0.17%
based	5	147	0.17%
public	6	144	0.17%
soldiers	8	143	0.17%
used	4	139	0.16%
compared	8	138	0.16%
table	5	137	0.16%
https	5	133	0.15%
time	4	133	0.15%
care	4	132	0.15%
milmed	6	132	0.15%

Another way to represent the data is by illustrating the top fifty terms in a word cloud. Relative frequencies of each word are depicted by the size of text relative to the other terms.

Highlighted within this depiction are the bold top three terms of military, weight, and obesity relative to the frequencies of other words. The word cloud generated in NVivo is illustrated below in Figure 4.

Figure 4

NVivo Word Cloud

Framing with the Socio-Ecological Model

Framing with the socio-ecological model, while there was mention of the individual level's responsibility, all studies at least mentioned population level characteristics. The articles that met inclusion featured both the community and society levels, dependent on whether the

study took place at unit or command level or a service level. These socio-ecological models and their relative popularity make sense due to the search terms and inclusion criteria, especially at service level findings. To catalogue the population targeted for each study, Table 5 lists the articles that met inclusion and their associated socio-ecological level.

Table 5

Socio-Ecological Levels by Article

Article Information		Socio-Ecological Level			
Authors	**Year**	**Individual**	**Relationship**	**Community**	**Societal**
Afari et al.	2019			X	Background
Bornstein et al.	2019				X
Carey et al.	2019				X
Clerc, Mayer, & Graybill	2022				X
Cszimar & Irwin	2021				X
Eilerman et al.	2014				X
Gantt et al.	2008			X	Background
Gollust, Niederdeppe, & Barry	2013				X
Gregg & Jankosky	2012			X	Background
Johnson et al.	2021				X
Kao et al.	2012				X
Lennon, Oberhofer, & McQuade	2015				X
Miggantz et al.	2021			X	Background
Pebley et al.	2020			X	Background
Reyes-Guzman et al.	2015				X
Shiozawa et al.	2019				X
Winik & Bonham	2018				X
Wisbach et al.	2018			X	Background
Wonn & Khan	2021				X
Yang et al.	2022			X	Background

Seven of twenty studies (35%) were focused on a community / unit level where they studied an individual unit. Thirteen of twenty studies (65%) focused on either entire service branches or the Department of Defense as a whole. If the study was not directly studying the societal / service branch level, there was background discussion in all studies at this level to

discuss the overall trend. These levels are in keeping with expectation due to the public health nature of the journal articles.

Synthesis from Systematic Review

After reviewing the academic literature that met inclusion criteria, themes emerged with commonalities. These themes were tagged within each article while manually reviewing articles within software and in hard copies. Each was then counted to see the frequencies for those meeting inclusions. Table seven illustrates the themes found in both the academic literature and the non-academic journal literature performed in the secondary content analysis. Framing these themes with Temple University's Meta-Synthesis Guide, there were no contradicting themes, rather reciprocal (Meta-synthesis guide, 2022). Of the major reciprocal themes, a picture emerged related to the research question of: What themes or consensus statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military readiness of the United States active-duty Armed Forces?

Within consensus statements in the academic literature, 90% of the reviewed papers explicitly mentioned a rise in prevalence of overweight or obese body composition throughout the armed forces and general population. As a justification for performing the studies, 95% of the papers related the impact of cost, borne by training and staffing, lost productivity, or costs to the health system at large. And while the term "readiness" was only the 29th most common term found by NVivo output, lowered military and deployment readiness were listed in 95% of the literature as a related impact to the rising rates of obesity classification. Due to the changing rates of obesity, 85% of the articles either presented an intervention or argued for curving these rates by intervention.

While still reciprocal in nature to the reviewed literature, less common, though still relevant themes discussed longer term impacts. Chronic / comorbid health conditions were found as an identified impact to individual health in 65% of the studies listed. And though population level views were targeted, 55% discussed the need for individuals to be drivers or accountable in changing the status quo. With a focus in active duty populations, it stands to reason that impacts to future recruitment was only a cursory mention within 40% of the reviewed articles.

Commonly found in military writing is the Bottom-Line Up-Front statement, simply referred to as a BLUF (Sehgal, 2016). Ranking members often look for these sentence summary statements in correspondence or policy statements. If one were to formulate a BLUF for the synthesized items above, one would write: Exhibited in literature by a rising rate of overweight or obese classifications within the active duty population in the United States Armed Forces, related impacts listed were deployment readiness, associated appropriated dollar costs, recruitment and retention challenges, and chronic disease states.

Content Analysis Findings

Restating the secondary research question: Does a content analysis of non-peer reviewed publications yield different themes than peer reviewed articles? In order to capture information related to the secondary research question, a generalized Google search was performed on January 3rd, 2023. The top five relevant links were reviewed for content in keeping with the methodology found in Chapter 3 and outlined in Bengtsson (2018). Those linked and previously reviewed from Google Scholar are excluded, as were articles from countries other than the United States. Each source found is catalogued in Table 6 and described in further detail. The Boolean phrased searched was "Obesity + Deployment Readiness + United States".

After the top articles were reviewed for relevance, and the academic articles were removed due to previous consideration, each article was reviewed for surface and deep structures in accordance with Bengtsson (2018). In other words, each article was analyzed for what themes were explicitly written as well as if any themes or concepts were present that were intended in the deep writing by the authors. When all cataloguing was complete, the differences in language and writing was captured between the academic systematic review and meta-synthesis to the non-academic journal writing in the content analysis.

Table 6

Content Analysis Sources

Authors	Year	Source	Medium	Title	Themes
None listed	2022 & 2017	Centers for Disease Control & Prevention	Infographic / PDF	UNFIT TO SERVE: Obesity is Impacting National Security	Readiness Impacts, Ineligibility and Recruitment, Costs to Healthcare System
Legg et al.	2022	Health.Mil	White Paper	Obesity prevalence among active component service members prior to and during the COVID-19 pandemic, 2018-2021	Trend Analysis, Eligibility and Recruitment, Readiness
Trivette	2019	Army War College	Master's Thesis	Obesity and Army Readiness	Trend Analysis, Continued Profiles, Adjusting Standards
Myers	2018	Army Times	Article	America's obesity is threatening national security, according to this study	Trends, Recruitment, Readiness / ability to perform occupation
Phillips	2019	New York Times	Article	Trouble for the Pentagon: The Troops Keep Packing on the Pounds	Trends, Health Impacts and Deployment Readiness

The most popular article link found was Unfit to Serve: Obesity is impacting national security (2022). By and large, the link is found to be an infographic showing impacts to cost, readiness, and trends. This was previously published in 2017 with a few changes, though the

cost assumptions were unchanged and methodology undefined. While useful for talking points and from a reputable source, the Centers for Disease Control and Prevention, there is an implication from the title that those that do not meet body composition standards are unfit to provide military service. In a challenging recruitment environment and potentials for civil service support to the Department of Defense, the language may need reexamined.

Secondly, Legg et al. (2022) published an article on health.mil related to Obesity Trends during the COVID-19 Pandemic. Based on mostly self-reported data of Physical Health Assessments (PHAs), this article was structured as a research paper and used largely academic language in its description. The authors found that members categorized as obese were slightly increasing between 2018-2021. Commentary about general ineligibility of young adults for military service was featured with a caveat that there is a high likelihood that the pandemic will further impact service recruitment. In total, the trend was mentioned to be problematic overall when framed in military and deployment readiness, but gives further context into the data and strategies to provide initiatives for better dietary options at dining facilities and exercise facility hour expansion.

Third in popularity was a copy of a Master's Thesis from the Army War College (Trivette, 2019). The author, a physician by trade, showed a strong association of those found to be categorized as obese and being on a long-term limited duty profile. As found in his conclusions, those on a long-term profile are not deployable, leading to negative impacts to the Army service at large. He recommended various policy changes linked to body composition standards, as metabolisms slow in age. Nonetheless, the author used the language of fitness to service and obesity as related directly to an inability to perform combat occupations.

Fourth in popularity was an article found in the *Army Times* (Myers, 2018). Myers used stronger language then previously seen in the content analysis search, giving a call-to-action tone found in the article. While largely based on a couple of studies, the author did gain interviews from General Officers in the United States Army. The main concerns were disqualifying body composition standards and risk of injury. Language in this article included "weak links", "unhealthy", "unprepared", and recognized these as harsh terms. In one case, a quote from a retired General was "You know, lieutenant, fat people don't make good soldiers." As the context within the article was a call to action, these sentiments appeared congruent with a Mission Readiness group whose focus is to improve fitness and nutrition programs within schools.

Fifth in popularity is an article published in the *New York Times* (Phillips, 2019). While the article claims body fat percentage increases is problematic for the Department of Defense, the authors relate the main concerns to be to individual health. Phillips writes that one in five members of the armed forces are categorized as obese despite some changes for gyms and nutrition programs. For the year written, the author does make mention that the Navy took the spot with the highest prevalence, with the Marine Corps shown as leanest. Admittedly, the authors do say that the Department of Defense reflects the greater society and is not completely separate from trends throughout the United States.

Comparison to Peer-Reviewed Articles

Legg et al. (2022) and Trivette (2019) both used academic language and writing styles when presenting information. Legg et al. (2022) was structured as a journal article, where Trevette (2019) was an academic thesis. These writings are very similar to what was found in the structured systematic review and meta-synthesis. However, it is apparent that the other three articles were published for a general public audience and departed from some of the norms.

The infographic that was first reviewed, Unfit to Serve (2022), was easy to read and provided talking points for those that would require information. Though some of the data was not updated between the 2017 and 2022 versions, it was still the number one publicly found link. With the link appearing on the Centers for Disease Control and Prevention website, it could easily provide background information for further study. The term "unfit" in the title seems deliberate, though does not appear to be a common term within peer reviewed research.

While Philipps (2019) and Myers (2018) were found in paper articles, Phillips (2019)'s publication in the *New York Times* was quite different than that of Myers (2018) in the *Army Times*. Myers (2018) was a strong departure from all other literature reviewed, as the terms were deemed harsh even by the author. The terms unhealthy and quotes that deem fat soldiers to be bad soldiers departed from other sampled articles, as this language was not found elsewhere. One may question whether this viewpoint and language may be more prevalent in discussion elsewhere, or only within the context of the Myers article.

Consolidated Themes

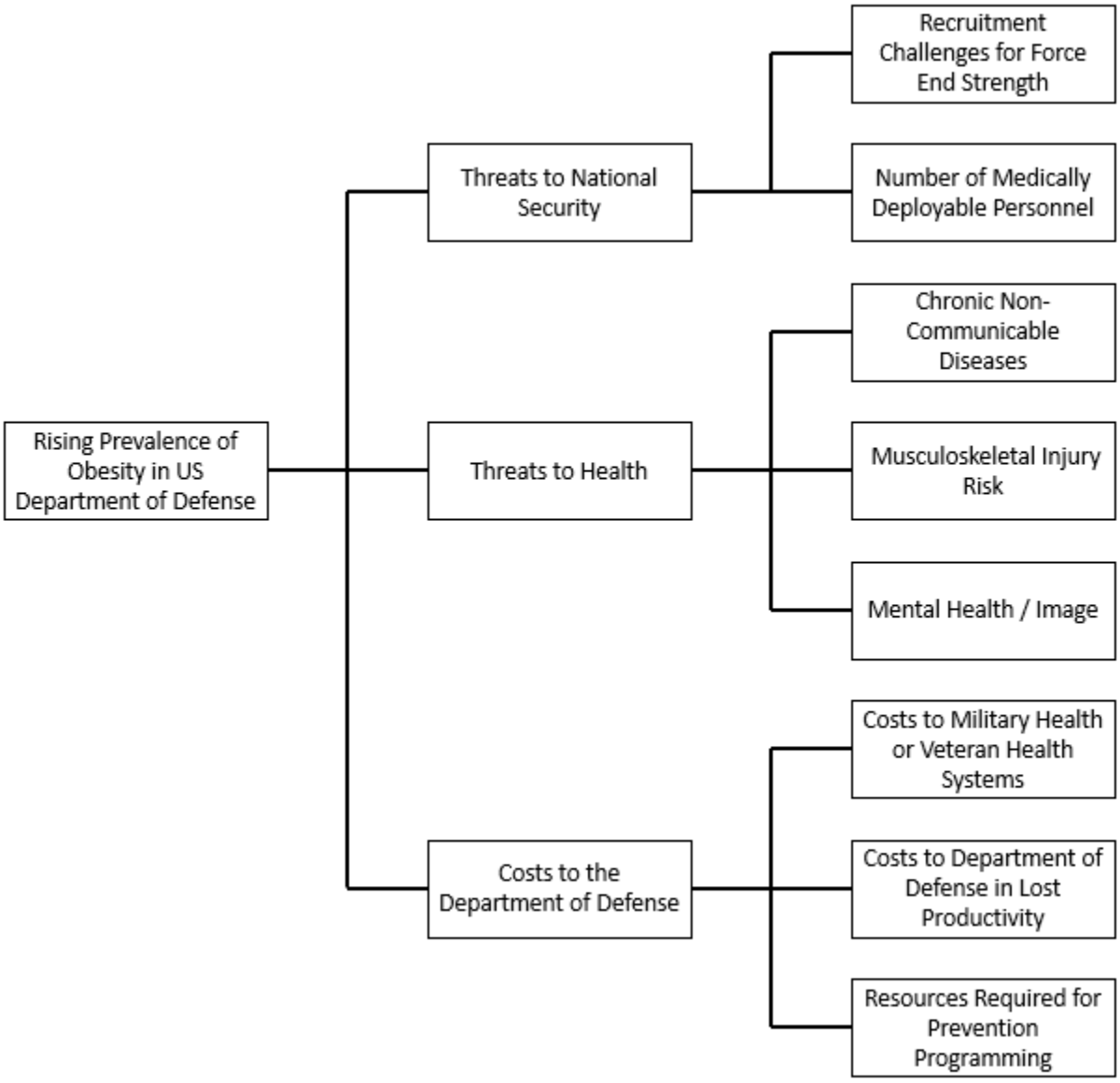
Themes found in the systematic review with meta-synthesis as well as the content analysis of non-journal public articles were remarkably similar. Generally, the language used with this subject matter was similar with the exception of Myers (2018), which, by the author's admission, included harsher language in quotes. Aside from Myers, the other authors have more direct affiliation with the Department of Defense and seemed to use similar language in their description of the overall researched phenomena.

When viewing the totality of all the information reviewed, each coded theme fell into one of three categories: threats to the national security apparatus of the United States, threats to the health of individuals, or various monetary costs to the United States Department of Defense.

Many of the articles included multiple elements within these groupings, but did not include every theme presented in Figure 5 below. Because of this, synthesis of information becomes vital to provide a holistic picture of the phenomena researched where individual papers do not include all themes.

Figure 5

Categorized Themes Derived from Consolidated Analysis



General similarities in themes were those of impacts to military and deployment readiness, obesity prevalence rates rising, related chronic disease and comorbidity conditions linked to body composition, and costs to the Department of Defense. While found at a different frequency, the content analysis yielded more discussion of overall national security, personal accountability, and threats to recruitment and retention. While not entirely related to the primary search terms, there were superficial discussions about meeting standards. Academic papers mentioned standards in 25% of the reviewed papers and in one article in the non-peer reviewed literature. One may take this further implicitly in the evaluation of standards with the need to balance recruitment and retention versus the medical readiness and long-term chronic care costs. Table 7 below details the frequencies of each major theme as both a count and percentage of the total number of articles present.

Table 7

Consolidated Themes from Review and Content Analysis

Themes	Frequency Found in Literature:	
	Academic / Peer Reviewed	**Non-Journal Literature**
Threats to National Security	3 (15%)	3 (60%)
Costs to the Department of Defense	19 (95%)	3 (60%)
Personal Accountability	11 (55%)	3 (60%)
Military or Deployment Readiness	19 (95%)	5 (100%)
Need for Intervention	17 (85%)	4 (80%)
Changing Standards / Eligibility	5 (25%)	1 (20%)
Recruitment or Retainment	8 (40%)	4 (80%)
Obesity Rates Trending Up	18 (90%)	5 (100%)
Health Comorbidities / Chronic Disease Linkage	13 (65%)	4 (80%)

Items for Future Research Identified from Articles

For the purposes of Chapter 4, the items identified for future research listed herein are those consolidated directly from those identified by the academic authors. Additional items identified for future research are found in Chapter 5 based on gaps and implications from the

sum of the synthesized information. Found in the academic literature, the items the authors identified for future research can roughly be categorized as more evaluation of proposed interventions, identifying risk factors for earlier intervention, and greater assessment of current policy or conditions.

For those that recommended further evaluation of interventions, these items included scalable fitness programs (Afari et al., 2019), post deployment fitness programming (Carey et al., 2021), studying the current propensity for use of dietary supplements (Kao et. al, 2013), and expanding use of current command fitness enhancement programs (Wisbach et al, 2018 & Wonn & Khan 2021). With those proposed by Wisbach et al. (2018), there were dietary and mental aspects that were recommended to be expanded. As the test site was a major Medical Center, one would need to see if these interventions were scalable at other sites with different staffing mixes. By and large, those that recommended various intervention programs were requesting other validation studies to understand if their plan was feasible in other settings.

The authors that recommended further study into identifying risk factors of obesity classification requested further study beyond what they were able to accomplish. Yang et al. (2022) argued that body composition classification was underreported and recommended further study using data to find risk factors and what barriers service members may report from seeking assistance. Eilerman et al. (2014) and Gantt et al. (2008) recommended further study in the field of risk factor identification to help target interventions and predict future states. Lennon, Oberhofer, & McQuade (2015) identified many of these risks by demographic group, but recommended further study in the target risk demographics. Miggantz et al. (2021) reviewed demographics identifying an intervention at a command level, but recommended studying comorbidities with mental health conditions.

Regarding assessments of current policy or conditions, the recommendations were generally of validation or requests to dig deeper into phenomena. Bornstein et al. (2019) identified eleven states that were found disproportionate to have higher prevalence of obesity and recommended policy makers address changes in these states found in the Southern United States. In a systematic review, Csizmar & Irwin (2021) recommended future studies utilize larger sample sizes to create bodies of evidence. Gregg & Jankosky (2012) argue for further studies of environmental factors such as construction or expansion of current base fitness facilities. Johnson et al. (2021) looked at women who were post-partum active duty returning to deployable status and recommended further analysis of timelines and standards for this population.

By and large, the authors recommended further study in the phenomena they measured and requested validation data in other settings or further analysis of risk factors that lead to approaching higher body mass indexes. In consideration of these recommendations and the study texts, this topic is more complex than simple statements such as those with higher body mass index values are linked to lowered readiness. Elements identifying risk factors, geographic locations, occupational specialty, years of service, former habits, and current interventions need consideration when building future studies and policy statements.

Chapter Summary

Employing a systematic review with meta-synthesis for academic peer reviewed research and a content analysis of what was found in the public domain yielded more insights into the complexity of the research questions. While 90% of the academic literature discussed rising prevalence of obesity categorization in active duty, 95% of the academic papers were concerned with associated costs to the Department of Defense and the impacts to military or deployment

readiness. When compared to academic literature, the public sites yielded similar themes. One outlier was found in use of language, and that was by Myers (2018), where the author highlighted quotes utilizing, by her admission, harsher language. Future research considerations included validation of interventions, assessment of current policy or methods, and risk factors of those susceptible to categorization of overweight or obese based on body mass index.

Chapter 5 – Results, Conclusions, and Recommendations

Considering the literature that met inclusion for the products in Chapter 4, it is evident that body composition of United States unformed members within the Department of Defense continues to skew towards obesity and away from prescribed standards. When considered these products under a socio-ecological framework, similar to Alber (2012) or Lubens & Bruckner (2018), the interventions described in the reviews were focused on unit/community levels. When the studies included service or societal levels, the authors meant to discuss overall trends within each branch or the Department of Defense overall. While short term favorable results were described in intervention studies with sound methodologies, such as those by Wisbach et al (2018), the overall service/society socio-ecological level studies still indicate high prevalence of overweight or obesity within active duty forces. Society at large was found to have increased prevalence of overweight and obesity classifications (Rodgers et al., 2018). As the military is not fully insulated from population trends, especially in garrison settings, general population trends are likely to relate to trends in the armed forces.

Described within this chapter are the implications from the results, as well as suggestions for further study. With the findings of Chapter 4, there are associations that the status quo for policy is not effective to aid in recruitment or retention for service members. Policy makers are at a crossroads when thinking of strategic human resources that are impacted by obesity and labor pools. Individual impacts from body composition are also described by the World Health Organization as a major cause to non-communicable diseases (World Health Organization, n.d.). Changing standards for uniformed service members can broaden the recruitment and retention labor pools, but could also impact injury and non-communicable disease rates. Should the standards remain status quo, the Department of Defense may decide to change and prioritize

which positions they recruit for in order to ensure readiness for national military tasking. For those positions that are not tied to deployable platforms, perhaps a conversion to non-uniformed civil service or reservist positions are warranted in some cases.

Results Summary

Results found in Chapter 4 are in direct response to the research questions posed. Restated below as well as the research questions posed in Chapter 1: What themes or consensus statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military deployment readiness of the United States active-duty Armed Forces? Secondarily, does a content analysis of non-peer reviewed publications yield different themes than peer reviewed articles? If so, are themes described differently between academic and non-academic journal publications? Addressing each of the questions individually, below are the bulleted results gleaned from the literature sources:

Q1: What policy or practical statements exist within peer-reviewed research articles regarding obesity and body composition as related to the military deployment readiness of the United States active-duty Armed Forces?

R1: Military deployment readiness was cited as an impact related to obesity rates in 95% of peer reviewed articles (19/20). Based on NVivo word analysis, "readiness" was only the 29th most common term found, though was cited commonly as an impact in the majority of articles.

R2: Costs to the Department of Defense were mentioned as an impact from obesity in 95% of the reviewed articles, those costs borne by training or staffing, lost productivity, or impacts to the Military Health System (19/20).

R3: The majority of articles, 17/20 (85%), argued for or proposed interventions to improve the percentage of those meeting body composition standards.

R4: While cited as a reason for changing the trends, only 65% of the articles reviewed explicitly mentioned the need to reduce the prevalence of obesity due to comorbidities or correlation to chronic diseases.

R5: Surprisingly, while deployment readiness and national security are linked, only 15% of articles featured discussions of national security. As such, researchers may have less success in finding materials using national security in Boolean search terms.

Q2: Does a content analysis of non-peer reviewed publications yield different themes than peer reviewed articles?

R1: As both were coded similarly and used similar search terms, the non-peer reviewed publications yielded similar themes, as illustrated in table seven. With the exception of one article, the focus and terms were generally similar throughout.

Q3: Are themes described differently between academic and non-academic journal publications?

R1: As the top public Google searches for non-academic publications were from academic writers, the themes were described similarly. Only one article was found to deviate from the writing within the top search results, and that was of Myers (2018). Myers used quotes from retired general officers which described those in admittedly harsh terms.

All considered, there is a large body of information throughout the internet, both academic and not, related to the topic of military readiness and prevalence of obesity. The pamphlet called Unfit to Serve (2022) seems to deliberately use the term “unfit” as if those within the category of obese or overweight cannot serve in uniform. Commonly cited, this Centers for Disease Control and Prevention illustrates the impacts and costs to military recruitment and readiness. Throughout executing the methodologies, gathering information, and

drawing conclusions, there are still gaps in knowledge and potential policy arguments to pursue, discussed further below.

Limitations

A major limitation in any systematic review, synthesis, or any other related methodology is that of publication bias (Bax & Moons, 2011). A general bias throughout research, this phenomenon within this methodology set relates to only including positive and publishable information in the review. Exists is an unknown number of studies that were not published due to statistically insignificant results, therefore favoring those that skewed significant.

While the methodology in Chapter 3 promoted a systematic way of finding related articles, there also exists a possibility that some articles were not found due to use of keyword searches versus citation searches (Linder et al., 2015). In a study assessing strategies for locating other studies, keyword searches were effective in bibliographic databases such as Pubmed, but had low precision in Google Scholar. Due to the number of articles found in the PRISMA flow within Chapter 4, there was a body of studies found for inclusion, so the effect of exclusion is reduced. One other search term limitation is that based on the actual terms searched. Terms were searched based on the research question and informed by the literature review. While a limited chance, there exists a potential that other terms exist to inform searches that were not found during the exploratory literature review.

Lastly, accessing articles may have been prohibitive when executing the search due to lack of institutional access to some peer reviewed journals or non-publicly available information, presentations, or lectures. Accessing a bevy of journals via databases such as Ebsco can be cost prohibitive to institutions (Bergstrom et al., 2014). While bundled subscriptions are an option, subscriptions for research institutions can collectively cost millions, creating a balance between

access for students and costs to the institution. Additionally, with respect to accessing other sources, there is almost certainly internal memorandum and presentations related to this topic within the Department of Defense for briefing purposes. Due to the internal nature of these documents, they were unable to be accessed for this dissertation, which may have impacted the content analysis portion of the review.

All told, there are various limitations that may have prevented accessing elements that would further inform the study. Those are due to institutional access, using concise search terms, and availability of memorandum and internal documents. Nonetheless, what was found was rich with information to respond to the research questions posed, further painting an extensive picture of the phenomena researched.

Additional Observations

Renewed interest has occurred in this topic. In an April 4th, 2023 interview with SiriusXM Doctor Radio, Dr. Koehlmoos from the Department of Defense / Uniformed Services University discussed the magnitude of the Covid-19 pandemic on the Body Mass Index of the Active-Duty Forces (Koehlmoos-Perez, 2023). Temporally, this is likely to show a spike during these years and her graduate student research team is working on this angle. As discussed in the program, the military base as an ecosystem of a place to live and work needs to cater to a healthy force structure. Improvements have been exhibited, whether in dining facilities or athletic complexes, but there are still changes that need to be made socially. These changes impact retention and in a preventive sense, likely create less health burden on the health system at large.

Some articles found during the initial search and inclusion and exclusion determination presented some particularly interesting items, but did not meet inclusion criteria. For example, articles that were not focused on military readiness or retention of active duty forces still had

some salient points worth mentioning in this section. Tanofsky-Kraff et al. (2013) does mention overweight and obese statuses pose threats to public health and national security, but the focused population are family members of military servicemembers. In this paper, the authors describe challenges to family members in that stress of relocation and deployments impact this population, while also sharing public health concerns with civilian families. These concerns are not only for effective programming and care within the military health system, but also a realization that family members may want to qualify for military service at adulthood too.

Musculoskeletal injuries were cited in the Chapter 2 literature review as one of the corollary effects of military service and increased prevalence of obesity (Mullinax et al., 2021). While Mullinax et al., cite obesity as one of the potential risk factors, there were concerns that there were increased numbers of those being seen for back pain in the Military Health System, and calls for attention to this phenomenon. The reason as to why this article is being mentioned in this section was it did not meet inclusion criteria due to obesity only being one of the factors, but it stands to reason that addressing concerns of body composition for deployment readiness has other impacts to resourcing within Physical and Occupational Therapy access within the Military Health System.

Additionally, Gagnon and Stephens (2015) did not meet inclusion criteria due to focusing on recruitment versus active duty readiness. However, the authors went against the narrative being discussed in that they do not anticipate recruitment challenges based on body composition. They used Military Entry Processing (MEPS) data to trend the number to see the number of those disqualified for body standards versus other measures. While the article used older data, and it did not factor the number that self-selected not to go into military, it is an interesting point to discuss which disqualifiers are commonly found at MEPS. Of note though, should

recruitment targets remain unmet, reasons for disqualifying at MEPS increases in significance, especially when considering waiving other entry standards.

Bornstein et al. (2019) was one article that was found for meeting inclusion, but deserves further discussion. Bornstein et al. discussed geographical differences in fitness levels for those in Army recruit training. Within was a population of younger recruits that have accessed and completing initial phases of training. This cross-sectional study used 170K recruits for analysis. This study shows a great base for further study in order to see if those trends continue as people progress through the military. As the military is very transient, changing duty stations every few years, there is room to see if fitness decreases in areas with negative environmental factors that are not promoting healthy behaviors. Related to Bornstein, Voss et al. (2014) writes of lowered prevalence of obesity found in those stationed at high altitude duty stations. With more study, there are opportunities to identify more environmental factors that would impact active duty body composition. Additionally, when thinking of geographies, the United States recruits heavily in the south, which has higher prevalence of obesity (Yamane, 2007). This region would benefit from targeted interventions, should they be taken at community or societal levels. Ensuring those meeting standards for entry in targeted geographies may assist with retention and readiness of active duty in the longer term.

As mentioned in Chapter 3, women represent 17.2% of the overall active-duty population (DOD Demographics, 2020). While the research question relates to the overall trends in active duty populations, considerations for postpartum timelines must be considered to ensure healthy postpartum recovery to medical readiness as discussed by Johnson et al. (2021) and Rogers et al. (2020). Johnson et al. (2021) met inclusion criteria due to the discussion of the overall trends within the body of the literature. Rogers et al. (2020) focused on the specific population of

postpartum recovery, citing an adjusted odds ratio of 3.88 of failing the physical readiness test within the United States Navy up to 2.5 years after delivering. As there exists a potential of taking the physical readiness test at six months postpartum depending on when the test is held, the authors recommend interventions and programming to ensure healthy return to deployment readiness throughout the first postpartum year.

All considered, while the overall goal of this dissertation was to glean information from unit and service level research with respect to prevalence of obesity and deployment readiness, the additional observations from these articles have the ability to impact recruitment and retention of a ready military force. Realizing the challenges for healthy military families, differences in geographies impacting rates, entry data, and realistic timelines for postpartum servicemembers are items that deserve greater attention.

Discussion of Findings

As described by the articles meeting inclusion, the trends continue to show rising overweight and obese prevalence in the United States active duty servicemembers throughout the reviewed years. Considering the general population of the United States was found to have concurrent rising rates as well, it is evident that the armed forces are susceptible to rising obesity prevalence. While some considerate programming and interventions were proposed and studied within the included articles, the service level articles still show rising prevalence. Summarized concisely by Police & Rupert (2022), these rising rates impact military readiness, health of the servicemembers in acute and chronic conditions, and costs to the healthcare system at large.

The tone of the articles appeared to show the need to intervene, but also had a sense that these trends were a forgone conclusion. After all, every article in the review somehow mentioned the rising prevalence regardless of the year published. Other countries have shown similar trends

within their armed forces, but the impacts are felt differently (Quertier et al., 2022). Quertier et al. (2022) describes the trends of overweight and obesity prevalence in France. However, based on the data provided by Military OneSource, the United States armed forces have 1.33 million strength at present, largest of any other allied nation (DOD Demographics, 2020). When combined with reservists, civil servants, and contractors, the Department of Defense represents the world's largest employer. Any policy changes would have sweeping impact as the active duty forces represent 0.7% of the United States population. With 7% of the general population having veteran identities, post-service care will be impacted by these prevalence shifts (Schaefer, 2021).

As these trends are impactful to the United States, any policy changes or interventions have consequence for established prevalence of obesity trends. To progress in this space, further research is required. Discussions in further detail of the practical implications of this phenomenon is also required at policymaker levels. All told, these service entities are publicly funded and interventions are required for consideration to be effective stewards of public funds.

Recommendations for Future Research

A major benefit of completing systematic reviews and related methodologies is to consolidate recommendations for future research (Lachal et al., 2017). Whereas an individual study has the potential to recommend future research based on the scope of their research question, consolidating study recommendations can show if other studies recommend the same items for future research. Additionally, when viewing trends throughout the articles, one may deduce items for further research based on the totality of results. In these aspects, this section is broken into two subsections, one that summarizes the recommendations from the authors found in Chapter 4, another that was informed by the entirety of the results.

With respect to those items found in the academic literature, the recommendations the authors identified for future research are roughly categorized in three categories. These were greater evaluation of proposed interventions, identifying risk factors for earlier intervention, and further assessment of current policy or conditions. With two of the articles, Eilerman et al. (2014) and Gantt et al. (2008), the focus appeared to be risk factor identification, which would present opportunities to target further study in higher relative risk groups. Regarding the content analysis portion of the dissertation, the public articles found appeared to be more of a call to action, which could back the momentum for further research and policy changes. Within the articles of Chapter 4, the researchers approached the research questions often from different population samples, time periods, and intervention methods. Building on the previous research articles provides policy makers informed decisions, which would require efficacy testing.

Recommendations Based on Synthesis

Extending past what the individual authors recommended, the systematic review's consolidated results and themes informed the recommendations for future research below. Six items recommended relate to ensuring realistic standards for career fields, studying this phenomenon in Reserve and National Guard units, questions of civilianizing some positions, age related standards, more extensive trending, and better cost identification.

The first recommendation is related to service standards. News of a Department of Defense Instruction 1308.03 hit the Military Times with discussion of allowing services to have more flexibility in developing service specific standards and screening methodologies (Nostrant, 2022). Since the overarching guidance was published, individual service branches are next to evaluate and identify the standards and methods that are most practical for each branch. These decisions take time to study and identify what measures are practical for recruitment and

retention of a ready force. There is a balance in decision making required, whether it be to recruit and retain the target numbers versus the likelihood of injury and long-term costs. Age, gender, and height give variation and the techniques used to measure are being studied for accuracy (Britzky, 2021). With validation of measurement technique, understanding changes in metabolic age and being realistic with overall service standards, further study is possible in this arena to keep informing policy makers to make informed decisions regarding body composition standards.

Secondly, the population studied within this dissertation was of active duty servicemembers in the Untied States Department of Defense. However, with approximately one million in the Ready Reserve or the National Guard, the reserve population would serve as a great sample for further study in order to understand the needs and differences with respect to body composition standard attainment (DoD Demographics, 2020). Held to the same physical fitness standards as their active duty colleagues, Reservists and National Guardsman generally are only required to serve one weekend a month and two weeks a year to maintain standards. However, with a Rand sponsored publication, it was noted that 63.1% of Army Reservists were found to be overweight or obese (Meadows et al., 2021). With the potential of deploying with their active duty counterparts, the impact to readiness deserves further academic attention.

Third consideration for further study relates to a potential of shifting some uniformed positions into civilian status. Civilianization of military positions is not a new concept, but has social consequences when working together, as discussed in a dissertation by Kelty (2005). All considered, as a manpower management strategy, civilianization may need consideration should recruitment targets remain unmet in this challenging era. Should the United States military retain the same standards and not be able to incentivize those that can meet entry standards for

employment, then some positions may need to be considered for switching to a federal civilian employment scheme. For this, further study in these policy shifts and the required National Defense Authorization Act language would necessitate evaluation.

The fourth recommendation for further study relates to career specific standards for servicemembers. With respect the previously mentioned Department of Defense Instruction 1308.03, the Department of Defense has a wider ability to make service specific standards (DOD Instruction 1308, 2022). The instruction requires service branches write reports to the number of separations due to fitness or body composition, the number of waivers granted to members, and those entering remedial programs. With this flexibility, further study may be proposed to see if services would entertain different standard tables for body composition and fitness based on the criteria of each occupation. In other words, would services be amenable to creating a different scale for arduous versus more sedentary occupational codes? Perhaps this could relate to the likelihood for injury based on the need for physical fitness in various occupational specialties.

The fifth consideration relates to wider trend analysis to better assess changing prevalence. Within the articles that met inclusion, for those quantitative in nature that discussed the overall population, the trend analysis only provided a snapshot of five to ten years, such as the articles by Reyes-Guzman et al. (2015) and Eilerman et al. (2014). To assess any temporal relationships to longer trends, a multidecade analysis would prove helpful. By doing so, deeper analysis of policy or generational changes can be identified and targeted for future policy implementations. Using data of approximately a decade would not yield the same results. Meta-analysis of similar data sets over different time periods is a potential methodology to see the data ranges and confidence intervals as well for each data set.

Lastly, the cost data that was cited in pamphlets and papers would benefit from more

detailed explanation as to how the authors derived the figures. Unfit to Serve (2022) was the first result when searching the public internet. However, the pamphlet was published previously in 2017 and used the same cost data without listing the source. Voss, Pavela, & Stanford (2019) cite the same $1.5 Billion per annum monetary and 655K lost work days costs found in Unfit to Serve (2022) and a brochure by Mission Readiness, a non-profit with support from the Robert Wood Johnson Foundation (Christeson, Clifford, & Taggart, 2017). However important cost data is for justification of change, updated numbers and transparent explanations of the methodologies for deriving these figures may prove helpful for those trying to validate the claims.

Practical Implications

Considering the combined number of Active Duty, Reserve, and Civilian employees, the United States Department of Defense is found to be the World's largest employer (McCarthy, 2015). With any policy changes that impact the strategic human resources of such a large entity, the results are likely to be significant. Maintaining a deployment-ready reaction force is necessary to the National Security of the United States (Yang et al., 2021). Another threat to maintaining the target numbers prescribed in public law is that of the overall recruitment challenges posed in a time of low unemployment and (Mongilio, 2022).

With the established trends in body composition impacting elements of readiness, recruitment, and retention, the status quo needs require reconsideration. A delicate balance between entry statistics and numbers needs careful consideration. Furthermore, the health of the armed forces not only impacts the immediate needs of readiness, but also the long-term health costs fielded by the Veteran Health Administration (Breland et al., 2017)

Should the United States Department of Defense not have the human resources to

maintain the programs required in public law, some items may go unmet. For example, assessing the costs borne by new procurements as well as the challenging recruitment environment, the United States Navy has cut the recommended number of staffed ships in the fleet from the commonly discussed 355 ship fleet to 327 (Eckstein, 2021). Technology may enable meeting targets with a concept to develop additional unstaffed ships to combat the staffing shortages.

All discussions of obesity and the impact to military readiness and end strength of the Department of Defense is needed for policy spaces and structure planning. However, induvial health statuses are also a prime concern. Costs of treatment and lost work days is an important metric, but health of individuals reducing risk of comorbid conditions provides greater quality adjusted life years (Baygi et al., 2020). With impacts to cardiology, musculoskeletal conditions, and linkages to cancers, there is a likely shared benefit between the individual's health status and the military readiness of the Department of Defense.

Chapter Summary

After reviewing the materials meeting inclusion criteria for both academic peer reviewed articles and those items found on the public internet, it is apparent the authors viewed the trending prevalence of obesity within the United States armed forces as problematic to military readiness, cost, and impacting to the health of individual servicemembers. Considering the consistent messaging throughout the years reviewed, the status quo related to meeting body composition standards appears untenable from the collective articles reviewed. Further study is recommended in trending longer periods of data, studying the impacts within National Guard and Reserve forces, changing standards, and better descriptions of how cost impact data is derived.

Should the standards continue impacting the force structure during periods of low

unemployment, policy decisions are needed to reconcile the recruitment and retainment goals posed in the annual National Defense Authorization Act. Articles reviewed were found at the unit (community) and service (society) socio-ecological levels. As such, changes in policy have the potential to impact the public health and retention of uniformed members in the United States Department of Defense.

Within the Defense Health Agency specifically, the quadrupole aim is to maximize the elements of cost, quality, access, and readiness (Howell, 2020). As body composition impacts each element, the topics posed for future study and actionable policy changes are in the best interest of the DoD. Health of the members is paramount on an individual level, but also to ensure a ready reactionary military labor pool.

Postscript

Taking what was gleaned from the performance of this dissertation into my professional life, our command is feeling the impacts of gaps in billeted positions. A labor shortage in key areas is making operations more challenging where labor may be shared between commands, dependent on availability of these positions at area commands. When sailors select orders to our carrier, they must undergo an operational duty screening. The purpose behind this screening is to determine whether the carrier's medical department has the capability to address medical conditions that were presented after joining. We, as the command's medical department, receive inquiries about sailors who may be in question. Some may be related to chronic conditions, recent musculoskeletal injuries, or mental health treatments. Anecdotally, we have received inquiries of those with chronic heart, pulmonary illnesses, and skeletal injuries while also showing higher body mass indexes.

When our department denied a rash of sailors accepting orders to our ship due to preexisting conditions, we took a look at the commonalities. Without speaking to specific cases, body mass index was a factor in many. Carriers are the largest warship within the Department of Defense, but have steep ladders, escape trunks, and diameter limiting scuttles. In an emergency, sailors are required to access narrow scuttles and steep stairwells (ladder wells). Additionally, in this environment, sailors often live on the ship and have to sleep onboard while underway. The design of the sleeping arrangements is bunked racks with mattresses that may be too narrow for some of higher body mass indexes.

A balancing act is required at our decision-making level. Do we accept to our ship those with a higher risk of injury and safety concerns to fill much needed gapped positions? Some of the criteria for denying members is very objective, which all relates to our ability for the

appropriate resources for continued care of health conditions. Some are subjective, such as the concerns for reinjury or body mass index. Informed by the trends found in this dissertation and the needs of sailors approaching our carrier's medical department, I have recommended to our higher echelon type commander to develop additional objective standards for accepting members to the carrier based on body composition and the ship's design. For example, objective criteria based on width of current mattress widths, diameters of escape scuttles, and stair widths. The intent is to ensure members are able to work and escape in emergencies within the design of the ship.

Another item worthy of local review is that of our fitness programs. The difference between what was reviewed and our setting is the operational nature of our carrier. The programs offered in the literature were shore based and on short time frames. An assessment of our onboard fitness and diet programs could provide more than a worthy research paper, but rather small changes to the quality of life of those at the command.

Aside from the practical elements of performing this review related to my chosen topic, the methodology employed is relevant to my current and likely future roles within the Department of Defense's policy sphere. I anticipate having to again perform staff work and write short white papers to inform senior leaders. Approaching a problem statement, using a systematic way of finding reliable sources, and finding consensus between sources is a requisite skill to develop these white / briefing papers. In all, this dissertation experience is value added within a scholar-practitioner lens in my career field for years to come.

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Appendix A: Institutional Review Board Determination

Date: 1-17-2022

IRB #: IRB-2021-62
Title: MILITARY READINESS IMPLICATIONS OF THE UNITED STATES OBESITY EPIDEMIC: A SYSTMATIC REVIEW
Creation Date: 9-30-2021
End Date:
Status: Approved
Principal Investigator: Jesse Thomas
Review Board: Franklin University IRB
Sponsor:

Study History

Submission Type Initial	Review Type Exempt	Decision No Human Subjects Research

Key Study Contacts

Member Gail Frankle	Role Co-Principal Investigator	Contact gail.frankle@franklin.edu
Member Jesse Thomas	Role Principal Investigator	Contact thomaj38@email.franklin.edu
Member Jesse Thomas	Role Primary Contact	Contact thomaj38@email.franklin.edu

Appendix B: Search Results to Inform PRISMA Flow

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Afari et al	2019	Clinical Trials Communication		X			Y	Y
Ahola et al	2013	BMJ Public Health		X			N	N
Almond et al	2008	Military Medicine			X	Y	N	N
Ashby	2017	Proquest			X		N	N
Atoom	2018	JRMS			X		N	N
Bajjani-Gebara et al	2021	Women's Health			X		N	N
Barzin et al	2009	Iranian Journal of Endocrinology			X		N	N
Beauvais et al	2019	DTIC			X		N	N
Bookwalter et al	2019	Annals of Epidemiology			X		N	N
Bowles et al	2006	Military Medicine		X			N	N
Brager et al	2021	Sleep Health		X			N	N
Braun et al	2016	Military Medicine			X		N	N
Broderick et al	2010	Journal of Obesity			X		N	N
Burke et al	2020	Eating Behaviors			X		N	N
Canty	2003	Military Medicine			X		N	N
Bornstein et al	2019	Journal of Public Health Management		X			Y	Y
Carr et all	2022	Journal of Psychiatric Research			X		N	N
Cawley	2015	Journal of Health Economics			X		N	N
Cawley & Maclean	2011	Health Economics			X	Y	N	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Chao et al,	2011	Journal of Sexual Health			X		N	N
Chrisman & Hampton	2021	Child Obesity		X			N	N
Carey et al	2021	Obesity Science Practice		X			Y	Y
Collins et al	2020	Nutrients			X		N	N
Clerc, Mayer, Grabyill	2022	Military Medicine		X	X	Y	Y	Y
Dabbagah-Moghadam et al	2017	Bulemia and Obesity			X		N	N
Dall et al	2007	American Journal of Health Promotion		X	X	Y	Y	N
Dautrive et al	2015	Journal of American College of Gastroenterology		X		N	N	N
DeShazo, Hall, & Skipworth	2015	American Journal of Medicine			X		N	N
Dickey et al	2016	American Journal of Nurse Practitioners			X		N	N
Dyball et al	2019	International Review of Psychology	X	X		Y	N	N
Csizmar & Irwin	2021	Military Medicine			X		Y	Y
Espinola et al	2021	Obesity			X		N	N
Fleishhacker et al.	2020	American Journal of Clinical Nutrition		X	X	Y	N	N
Foster et al	2016	Current Pulmonology			X		N	N
Foulis et al	2021	BMJ Military Health		X	X	Y	Y	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Friedl	2012	Journal of Strenght Conditioning		X			N	N
Friedl & Leu	2002	Military Medicine		X	X	Y	Y	N
Fuad	2006	bvsalud			X		N	N
Eilerman et al	2014	Military Medicine			X		Y	Y
Gazdinska et al	2015	Medycyna Pracy			X		N	N
George et al	2021	Journal of Academy of Nutrition	X	X		Y	N	N
Gantt et al	2008	Military Medicine		X			Y	Y
Gonzalez et al	2022	International Journal of Sports Nutrition		X			N	N
Gollust et al	2013	American Journal of Public Health	X	X		Y	Y	Y
Grodecki	2012	UNC			X		N	N
Grotto et al	2008	Israeli Medical Journal			X		N	N
Gun et al	2022	Military Medicine		X			N	N
Haibach et al	2017	Journal of Behavioral Medicine			X		N	N
Hall	2017	Proquest			X		N	N
Haskell et al	2010	Journal of Women's Health			X		N	N
Heinrich et al	2008	Military Medicine			X		N	N
Hepburn	2018	Journal of Nursing Scholarship		X			N	N
Higgins et al	2022	Journal of Pediatric Psychology			X	Y	N	N
Hill et al	2013	Diabetes Care			X		N	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Hopkins & Wilson	2019	Military Medicine	X	X		Y	N	N
Horaib et al	2013	Saudi Medical Journal			X		N	N
Hruby et al	2017	Plos One		X			N	N
Hsu et al	2007	Journal of Adolescent Health			X		N	N
Huang et al	2015	Lancet			X		N	N
Gregg & Janosky	2012	Military Medicine		X			Y	Y
Jai , McCool, & Moy	2020	preprints			X		N	N
Johnson et al	2021	Military Medicine		X			Y	Y
Kao et al	2012	Annals of Epidemiology	X	X		Y	N	Y
Karadesh et al	2013	Journal of the Royal Medical School			X		N	N
Karl et al	2021	European Journal of Sport Science			X		Y	N
Kennedy	2014	Proquest			X		N	N
Khatod	2020	shareok.org			X		N	N
Koehlmoos et al	2020	Health Affairs		X	X	Y	Y	N
Kress, Peterson, & Hartzell	2006	Journal of Psychometric Research		X	X	Y	N	N
Kyrolainen et al	2018	Journal of Science of Sports Medicine			X	Y	N	N
LaFountain et al.	2019	Military Medicine		X			N	N
Lamson et al	2015	Contemporary Family			X		N	N
Le Abida	N/A	PJMHSonline			X		N	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Lee et al	2018	Korean Journal of Medical Science			X		N	N
Lennon, Oberhofer, & McQuade	2015	Military Medicine		X			Y	Y
Ligeza et al	2022	Journal of Lifestyle Medicine		X			N	N
Lim et al	2014	Surgery Obesity and Related Diseases			X		N	N
Luan et al	2020	Military Medicine		X			N	N
Ma et al	2016	Journal of Athletic Training		X			N	N
Malkawi et al	2022	Military Medicine		X			N	N
Manafi et al	2019	International Cardiac Research Journal			X		N	N
McCarthy et al	2017	Nursing Outlook		X	X	Y	N	N
McGinley	2008	Bariatric Surgical Practice			X		N	N
McGraw et al	2008	Journal of Cardiac Nursing		X			N	N
Mclaughlin & Wittert	2009	Obesity Reviews	X	X		Y	Y	N
Meadows et al	2018	Rand Health Quarterly		X			N	N
Menefee et al	2012	Journal of Exercise Science			X		N	N
Meyer & Cole	2019	Military Medicine		X			Y	N
Miggantz et al	2021	Military Medicine		X			Y	Y
Mobley	2006	Proquest			X		N	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Molloy et al	2020	Military Medicine			X		Y	N
Mon et al	2008	Journal of Business and Management			X		N	N
Mullinax et al	2021	Military Medicine		X			Y	N
Murray et al	2017	Sage Nutrition and Health			X	Y	Y	N
Murriel et al	2020	Prevention of Chronic Diseases		X	X	Y	N	N
Naito & Higgins	2012	Preventive Medicine			X		N	N
Nelson, Pflipsen, Kurina	2020	Military Medicine		X			N	N
Nye et al	2016	Sports Health			X		N	N
Omar, Leong, & Moy	2020	Preprints			X	Y	N	N
Opara, Ekanem, & Akwaowo	2014	Nigerian Journal of Nutritional Sciences			X		N	N
Pandey et al	2018	Journal of Women's Health			X		N	N
Pap	2019	Clinica Chimica	X				N	N
Park & Jang	2016	Korean Journal of Adult Nursing			X		N	N
Parrish et al	2015	American Journal of Respiratory and Critical Care		X	Y	N	N	N
Payab et al	2017	American Journal of Men's Health			X		N	N
Pebley et al	2020	Military Medicine	X	X		Y	Y	Y
Phillips et al.	2022	Military Medicine		X			N	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Piddudny et al	2022	Health and Sport			X		N	N
Pihlainen et al	2020	Journal of Science of Sports Medicine		X			N	N
Pine et al	2020	American Journal of Psychotherapy			X		N	N
Podraza & Roberts	2008	Military Medicine			X		N	N
Pratesya & Mardianti	2021	Atlantis-press			X		N	N
Quattlebaum et al	2019	Eating Behaviors			X		N	N
Quertier et al	2022	Military Medicine		X			N	N
Rahim et al	2021	research square			X	Y	N	N
Ramli	2013	IIUM Medical Journal of Malaysia			X		N	N
Reyes-Guzamn et al	2015	American Journal of Preventative Medicine	X	X	X	Y	Y	Y
Rhon et al	2021	European Journal of Sport Science			X		N	N
Rice et al	2021	Obesity			X	Y	N	N
Robson	2021	Rand / Defense Website			X		N	N
Rogers et al	2020	Military Medicine		X			N	N
Rush, LeardMann, & Crum-Cianflone	2016	Obesity			X		N	N
Salimi et al	2019	BMC Public Health			X		N	N
Sanchez-Chapul et al	2020	Cogent Medicine	X				N	N
Sanderson et al	2011	Obesity Facts			X		Y	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Sartang et al	2017	Journal of Occupational Health and Epi			X	Y	N	N
Schvey et al	2017	Stigma and Health			X		N	N
Sforzoet al	2017	American Journal of Lifestyle Medicine		X			N	N
Shams-Whie et al	2020	Obesity			X	Y	N	N
Shank et al	2019	Body Image			X	Y	N	N
Shay et al	2015	Kingdom of Saudi Arabia		X			N	N
Shier, Nicosia, Datar	2016	Social Science & Medicine			X		N	N
Shih, Meadows, & Martin	2014	Rand Health Quarterly			X		N	N
Shilisky et al	2015	Food Science Nutrition		X			N	N
Shiozawa et al	2019	Military Medicine	X	X		Y	Y	Y
Smith et al	2021	Obestiy			X		Y	N
Smith et al	2013	DTIC			X		N	N
Sokolov & Serdyukov	2020	Russian Military Medical Journal			X		N	N
Spieker et al	2015	International Journal of Environmental Res.		X	X	Y	N	N
Stanford, Taugeer, & Kyle	2018	Current Obesity Reports			X		N	N
Starr et al	2013	Wiley Online			X		N	N
Stefanovics, Grilo, & Pietrzak	2022	Journal of Psychiatric Research			X		Y	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Stefanovics, Potenza, Pietrzak	2020	Psychiatric Research			X	Y	N	N
Stephens et al	2014	Nutrition			X		N	N
Tabas	2007	DTIC			X		N	N
Tanofsky-Kraff et al	2013	Obesity		X	X	Y	Y	N
Tenconi	2011	K State			X		N	N
Thomas	2011	Journal of Diabetes Science and Tech			X		N	N
Tompkins	2020	DTIC			X		N	N
Tosche et al	2005	Journal of Obesity			X		N	N
True et al	2013	Military Medicine	X				N	N
Tsvibian et al	2022	Diabetes Research			X		N	N
Turner, Wagner, & Langhals	2022	Sports		X			Y	N
Vahdaninia	2020	Journal of Military Medicine			X		N	N
Verrall	2011	Journal of Army Medical Corps		X			N	N
Vieweg et al	2007	Acta Psychiatrica			X		N	N
Voss et al	2014	Plos One			X	Y	N	N
Walter et al	2022	Military Medicine		X			N	N
Wang et al	2021	Scientific Reports			X		N	N
Warner et al	2008	Military Medicine			X		N	N
West & Jeffrery	2018	Public Health Nursing			X		N	N
White & Deuster	2017	Current Obesity Reports			X		Y	N

(Continued)

Authors	Year	Journal	Ebsco	PUBMED	Google Scholar	Abstract Meets Inclusion	Full Text Meets Inclusion	Included in Review
Whitsel	2017	Progress in Cardiovascular Diseases			X		N	N
Williamson, Rossetto, & Murphy	2020	BMJ Military Health			X		N	N
Winik & Bonham	2018	Military Medicine	X	X			Y	Y
Wisbach et al	2018	Military Medicine	X	X			Y	Y
Wonn & Khan	2021	Military Medicine		X			Y	Y
Xavier et al	2014	Scielo Brasil			X		N	N
Yang et al	2022	Military Medicine			X		Y	Y
Zajdowicz & McKenzie	2003	Military Medicine		X			N	N
Zhu et al	2020	Biomed Central			X		N	N

Appendix C: Curriculum Vitae

Jesse Jac Thomas

Experience

Role	Organization	Years
Medical Service Corps Officer	**United States Navy**	**2017-Present**
	USS Theodore Roosevelt (CVN-71)	2022-Present
	-Principal Assistant for Medical / Head, Medical Administration	2022-Present
	Naval Medical Center San Diego	2019-2022
	-Department Head, Plans, Operations, & Medical Intelligence	2021-2022
	-Division Officer, Patient Support / Patient Administration	2020-2021
	-Head, Health Information Management	2019-2020
	Uniformed Services University (DUINS)	2017-2019
	-Legislative Resident – US Office of Personnel Management	2018-2019
	-Didactic Work / MHAP Program	2017-2018
Nuclear Machinist Mate	**United States Navy**	**2010-2017**
	USS George Washington (CVN-73)	2017-2017
	-Temporary Duty Prior to Commissioning	2017-2017
	USS Enterprise (CVN-65)	2012-2017
	-Nuclear Machinist Mate 1st Class – Supervisory Nuclear NEC	2012-2017
	Naval Nuclear Power Training	2010-2012
	-Protype Ex-USS Sam Rayburn (SSBN/MTS-635)	2011-2012
	-Nuclear Field A School (MM) / Nuclear Power School	2010-2011
Health and Safety / IH	**Rio Tinto, PLC**	**2005-2009**
	-Industrial Hygiene /Health and Safety - Mining	2005-2009

Education / Degrees

Degree	University	Year
DHA	Franklin University	2023
MBA	Escuela de Negocios Europea de Barecelona	In Progress
MHA	Uniformed Services University of the Health Sciences	2019
MPH	Capella University	2016
B.Arts	University of Wyoming	2009
A.Arts	Laramie County Community College	2008

Education / Certificates

Type	University	Year
Graduate	Escuela de Negocios Europea de Barcelona -Spanish for Business Program	2023
Graduate	United States Naval War College -Naval Command and Staff / JPME I	2022
Graduate	Uniformed Services University of the Health Sciences -Global Health Engagement	2021
Academic	Cornell University -Executive Leadership in Healthcare	2013

Professional Affiliations

Level	Organization	Years
Fellow	American College of Healthcare Executives	2015-Present
Member	American College of Epidemiology	2017-2022
Member	Association of Military Surgeons of the United States	2019-Present
Member	Southern California Association of Healthcare Leaders	2019-Present

Volunteer Experience

Organization	Years
Southern California Organization of Healthcare Leaders -Military Liaison and Board Member for Diversity, Equity, and Inclusion	2019-2023
Impulse Group San Diego -Director for Advocacy	2019-2022
Virginia Department of Public Health -Medical Reserve Corps Executive Board	2013-2016
Hampton Roads Pride -History and Entertainment Committees	2013-2015
Goose Creek Rural Fire Department – Charleston, SC -Fire Fighter / Medic	2010-2012
Rio Tinto Mine Rescue -Fire Fighter / Medic	2005-2009

Service Schools

Name	Location	Years
Joint Professional Military Education I	Newport, RI	2022
Surface Warfare Medical Department Officer	San Diego, CA	2022
Plans, Operations, and Medical Intelligence	Bethesda, MD	2021
Medical Regulating and Patient Movement	San Diego, CA	2019
Patient Administration Course	Bethesda, MD	2019
Basic Medical Department Officers Course	Bethesda, MD	2018
Officer Development School	Newport, RI	2017
Division Officer Leadership Course	Newport, RI	2017
Naval Nuclear Power School	Charleston, SC	2010-2012