Defense Health Board

Implications of Trends in Obesity and Overweight for the Department of Defense

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"Fit to fight, fit for life."

November 22, 2013

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Executive Summary

The prevalence of obesity in the United States has been on the rise over the last two decades; approximately 1 in 3 U.S. adults is obese and another one-third of Americans over age 20 are overweight.[1] Consistent with national trends, rates of overweight and obesity also have increased in the U.S. military population over time.

High rates of excessive weight and body fat have implications for national security if our Armed Forces are unable to recruit and retain a fit force and maintain fitness throughout military service. In addition, the Department of Defense (DoD), as the largest public healthcare provider in the United States, must address the challenges that obesity poses to the military healthcare system, which not only provides care to Service members, but also to beneficiaries and retirees. The rising rates of excessive weight and body fat have serious implications for DoD in four significant ways.

1. Excessive weight and body fat disqualify some otherwise qualified individuals from military Service, preventing them from serving their country in a military capacity. General population trends are of concern because DoD relies on an all-volunteer force, thereby drawing on the U.S. population to meet mission requirements.

2. Excessive weight and body fat among the Active Duty, National Guard, and Reserve populations reduces overall force fitness and readiness. Excessive weight and body fat have been associated with decreased military operational effectiveness as well as acute and chronic adverse health effects.

3. Data from 2007 show that the Department spent nearly $1.1 billion annually treating obesity-related illness for Service members and their families. Considering that the number of enrollees in TRICARE Prime and the prevalence of obesity have both increased steadily over time since then, the costs to DoD are likely even higher today.

4. Children of parents who serve are more likely to volunteer for Service themselves. The parents of these children are role models for their offspring, and their habits will influence the lifelong habits of their children. Furthermore, as this cohort is likely to be cared for through the Military Health System, it is important that efforts be made to ensure healthy weight not only for reasons of health but also to help support force readiness in the future.

For these reasons, it is imperative that efforts be made to understand the implications of these trends for the military specifically, and for the Nation's health more generally. On April 20,

[1] The most commonly used metric for determining obesity or overweight has been body mass index (BMI). BMI is calculated as weight (lb.)/height (inches)^2 x 703. Given that weight increases with height, BMI establishes healthy weight for height. For adults over age 20, normal range is 18.5-24.9, overweight is 25-25.9, obese is greater than or equal to 30.

2012, the Acting Under Secretary of Defense for Personnel and Readiness (USD(P&R)) endorsed a request by the then Deputy Surgeon General of the Air Force (now the Surgeon General) that the Defense Health Board (DHB) examine the rising rates of obesity and overweight in America and the implications for DoD, and recommend strategies to address this growing problem. In response to USD(P&R)'s April 2012 request, the Board convened a subset of its members to review the research literature and receive briefings from and consultations with the Department, Service recruiting commands, and recognized experts in adult and childhood obesity and weight management from other federal agencies and academia.

The resulting examination focuses on four sets of issues: 1) the effects of national trends in overweight and obesity on recruitment and retention of military personnel; 2) best practices for maintaining healthy weight in Service members; 3) optimal strategies for addressing overweight and obesity in DoD dependents and retirees; and 4) strategies and best practices for ensuring that children of military personnel specifically, and the overall population more generally, achieve healthy weight.

Findings and Recommendations: Recruiting and Retaining a Fit Force

The Armed Forces have long required that potential recruits meet certain physical fitness standards before being admitted into one of the Services. Accession standards determine fitness for military service following a formalized screening process. The purpose of physical fitness standards for military service has always been to recruit Service members who are able to meet the physical demands of serving. The ability to attract and recruit a fit force from the U.S. population has been a leading concern of several recent reviews. Reflecting overweight and obesity trends in the U.S. population, the proportion of applicants and accessions to the Services who are overweight or obese has been increasing over time.

The DHB reviewed the adequacy and appropriateness of current recruitment policies and standards with regard to weight and considered the implications of current trends on future Force requirements. It concludes that, presently, existing recruitment and accessions standards are appropriate and are not posing challenges to recruitment goals in the current environment. However, if recruitment demands increase, meeting recruitment goals could be more difficult, requiring that steps be taken to ensure that those who want to serve are able to meet fitness standards. Future planning requires systematic and regular review of trends in excess weight and body fat, scientific developments, and demographic changes in rates and how they align with regional and national recruitment rates.

> **Recommendation 1**: **There is currently no need to ease accession standards regarding overweight and obesity to meet recruitment targets. However, given the trends in the prevalence of overweight and obesity in the Nation, accession standards should be reassessed every three years to ensure that the ongoing objective of recruiting a fit force is met.**

Despite the adequacy of current standards, lack of data regarding those who are turned away from recruitment centers because of overweight and obesity indicators creates challenges in assessing the actual recruitment losses related to these factors.

> **Recommendation 2**: **The Services should require recruitment centers to collect data regarding the total number of interested citizens applying and the proportion turned away because of an initial determination of unlikelihood to meet height-weight and/or body fat standards.**

Recruiters should maintain a low threshold for determining whether potential recruits meet height and weight standards, and conduct measurements of body fat on a selective basis among recruits. These measurement efforts should not be labor-intensive for the recruiters and should not detract from the overall goal of engaging youth.

> **Recommendation 3: DoD should launch a pilot project in selected Service recruitment centers to assess the feasibility of training recruiters to calculate body mass index and collect circumference taping measurements (in accordance with the instructions noted in DoD Instruction 1308.3) for potential recruits who appear to be overweight but who may have normal levels of body fat.**

Data indicate that higher attrition rates are observed among obese recruits. Considering the cost of attrition among accessions, the results of accessioning more individuals through this pilot project who are overweight according to BMI but meet the standards for body fat percentage should be evaluated against attrition rates.

Certain military jobs or specialty areas may require more stringent fitness or body composition standards (e.g., Special Forces) based on differing physical demands. The DHB accepts this requirement but does not advocate for easing requirements for any specialist categories. A key tenet of military service is the need for readiness for any call to duty or action at all times. Specifically, any individual could be called up for deployment in a national security emergency or threat of war. As such, it is incumbent upon the Services to ensure that even though a job may not typically require a certain level of fitness, Service members must be able to operate in any environment or circumstance and not be limited by physical constraints.

> **Recommendation 4**: **The current accession standards of height-weight and/or body fat should be maintained as a minimal requirement for all positions in the military in the interest of ensuring the availability of an agile and responsive fighting force. The Services should be encouraged to impose stricter standards as needed based on meeting the needs of their missions.**

Findings and Recommendations: Attaining and Maintaining Fitness Among Service Members

Military service assumes a minimum level of physical strength and endurance. As such, regular fitness testing and physical exercise are key components of the training regimens of most military units, and most Service members must comply with Service-specific height-weight standards throughout their careers to remain in the military. In addition to the risks to health of overweight and obesity, obese or poorly fit individuals can be a hazard to themselves as well as to their units.

The most recent data on fitness of the Force can be found in the 2011 Health Related Behaviors (HRB) survey of Active Duty Service members. It found that based on self-reported height and weight measurements used to calculate BMI, 54.2 percent of males across all ages were classified as overweight (BMI between 25 and 30) and 34.4 percent of females across all ages were overweight. However, the use of BMI as an estimate of body fat may result in misclassifying some Service members as overweight because of excess lean mass. The DHB did not find significant evidence that overweight poses risks to fitness to serve, although some studies suggest increased risk of musculoskeletal injuries and decreased heat tolerance.

Obesity is a greater concern. The 2011 HRB survey found that 12.4 percent of all respondents reported a BMI of greater than 30 (6.4 percent for women and 13.5 percent for men). By contrast, in 1995, fewer than 5 percent of Active Duty Service members were obese. Obesity poses serious long-term health concerns and puts obese personnel at greater risk of acute events and injury as well as jeopardizing the unit and the mission.

It was difficult for the DHB to determine with substantial certainty what portion of military personnel are overweight or obese, although various surveys tend to approximate each other. Data collection on weight varies across DoD population surveys, as do the measures used to indicate overweight and obesity. A more systematic, timely, and uniform methodology would enhance analysis of the adequacy of the fitness of the force. In response to this need, DoD required the Services to establish an automated data registry. The Military Services Fitness Database was subsequently developed and successfully tested; however, the program was not implemented.

> **Recommendation 5: DoD should implement an automated data registry Department-wide, which would document baseline statistics and track physical fitness, weight for height, and body fat percentages at the individual level over time. Although accession and retention standards differ across the Services, the methods for collecting and recording such data should be uniform.**

In addition to body fat/weight assessments, each Service deploys its own form of physical readiness test. Individuals who do not meet the standards can be involuntarily enrolled in a reconditioning program or discharged from service. Although the fitness requirements for service reasonably can vary among the Services based on mission, strategies for remediation could be standardized based on widely accepted evidence regarding effectiveness.

Recommendation 6: Although some customization of retention and physical fitness standards is necessary, the Services should, where possible, standardize remediation programs to reduce costs to the Department and ensure that only evidence-based interventions are implemented. Evaluation metrics should be developed prior to the initiation of any program.

It is widely accepted that weight gain is associated with smoking cessation in the military and elsewhere. This may keep smokers from attempting to quit because of concern about the possible effects on their weight. Evidence shows that ex-smokers weigh more on average than both non-smokers and current smokers, and that smokers weigh less than non-smokers. Although some interventions to prevent weight gain have demonstrated short-term success, there is as yet insufficient evidence regarding programs to prevent weight gain on a long-term basis among those who quit.

Recommendation 7: DoD should consider the confounding effects of smoking cessation on weight control and maintenance efforts, and develop strategies to mitigate the negative effects on weight associated with smoking cessation efforts.

DoD already has a number of technology-based programs to assist with weight loss and management. These technologies and applications can make health-related resources more readily accessible and enable Service members to easily track their fitness and progress toward weight loss and/or maintenance. The Defense Health Board was impressed with technology-based programs aimed at fitness and health already in use by the Services and encourages their broader use and evaluation.

Recommendation 8: DoD should continue to develop and promote technology-based approaches to improved fitness, with the additional aims of enhancing standardization of metrics and facilitating the analyses of effectiveness of such approaches.

The research literature on obesity in military populations reports that the most successful treatment interventions incorporate exercise, healthy eating information, good sleep hygiene, behavioral modification, self-monitoring, relapse prevention, and structured follow-up by trained personnel.

Recommendation 9: To ensure personnel are receiving tailored and appropriate guidance regarding weight, DoD should require that all military healthcare personnel receive enhanced training, at appropriate levels, on effective counseling and support approaches to weight management in military patient populations.

Anecdotal evidence indicates that personnel often experience stigma when assigned to a weight loss remediation program. This can negatively influence their motivation to participate in these programs and their eventual ability to achieve and maintain weight loss goals. The development of Service-specific universal wellness programs applicable to all Service personnel might help mitigate this problem.

Recommendation 10: DoD should develop strategies to address the stigma often experienced by personnel assigned to weight remediation programs.

Although local, base-specific, and Service-specific programs and policies across DoD adequately address overweight, obesity, and failure to meet physical fitness standards, most have not been systematically evaluated in a standardized and independent manner. The Healthy Base Initiative, a demonstration project that is assessing 13 select installations, aims to create environments that enable sustainment of healthy lifestyles, using a multi-pronged approach that promotes healthy nutrition, physical activity, and tobacco-free living. This initiative provides an opportunity to develop a program that is based on lessons learned from existing programs while advancing knowledge of effectiveness based on prospectively developed, well-designed metrics.

Recommendation 11: Before launching new military fitness and nutrition initiatives and campaigns, DoD should assess the effectiveness of existing efforts. Future campaigns should be evidence-based with clear metrics prospectively developed for assessing effectiveness.

Numerous assessments of strategies for preventing overweight and obesity and maintaining healthy weight have endorsed system-based, multi-pronged, multi-leveled approaches. Effective military weight/fat loss programs should mirror approaches found to work in civilian populations, recognizing the unique challenges and opportunities in military populations.

Recommendation 12: To ensure that Service members successfully achieve *and sustain* a healthy weight, DoD leadership at all levels should aggressively and persistently pursue a multi-dimensional, long-term approach that reflects the Services' retention standards and is consistent with the systems-approach strategies outlined by the Institute of Medicine in 2012 and the National Prevention Strategy of the U.S. Surgeon General. This requires that the Department take the following actions.

a) **Emphasize a focus on a lifetime course of health for military personnel, addressing all of the variables that influence healthy weight.**
b) **Provide 24-hour access to healthy foods, physical fitness programs, and support for military personnel.**
c) **Set nutritional standards for food offered through DoD dining facilities and by on-base contract vendors.**
d) **Facilitate access to healthcare providers appropriately trained in health and wellness management.**

Current data indicate that high rates of overweight and obesity are found in Veteran populations. Weight gain is greatest from the time of discharge from service and in the three years before discharge. Many factors contribute to this phenomenon, including lower levels of energy expenditure without a compensatory decrease in food intake, lack of incentives to manage and control weight, the change in the food environments, and stress or disability related to Service

experiences. Discharge from military service creates a window of risk as well as an opportunity to prevent unhealthy weight gain in Veterans.

> **Recommendation 13: DoD's discharge/separation process should include a discussion about the potential for weight gain and programs and services available to prevent its occurrence. In particular, personnel diagnosed with PTSD or mental illness should receive appropriate counseling and follow-up services to prevent unhealthy weight gain.**

The costs associated with treatment of obesity-related illnesses are considerable, not only in terms of capital but also in human costs that affect quality of life and life expectancy. The transition of care between the DoD and Department of Veterans Affairs health systems offers both challenges and opportunities to create a seamless passage into healthy retirement.

Findings and Recommendations: Weight Management Among DoD Dependents and Retirees

DHB was asked to review and suggest optimal strategies for addressing overweight and obesity in DoD dependents and retirees. Because of the diversity of this population, it mirrors the general population in many ways. Where it is unique is in its exposure to the unique stressors of deployment, its use of the Military Health System, its potential access to military facilities (e.g., food sources, fitness centers), and its greater mobility relative to the general population. Dependents may seek healthcare at a military treatment facility or in the civilian sector. Retirees might be receiving care through TRICARE or through Veterans' benefits. Yet all are exposed to the environmental, social, and cultural influences that may promote or discourage the maintenance of a healthy weight.

Recent efforts focused on the growing rates of overweight and obesity in the military community include numerous base-specific campaigns as well as the Healthy Base Initiative. However, the Healthy Base Initiative is a time-limited demonstration project. Thus, it is important to adequately resource and evaluate the effort to determine its effectiveness and potential for expansion of those elements that prove to be successful.

Base-specific as well as DoD-wide programs need to be evidence-based and periodically assessed for effectiveness. The DHB recognizes the challenge of offering programs to such a complex population, one that varies by status, age, demography, Service, location, and provider environment. With so many moving parts, it is critical to maintain a sustained focus on these issues at the Department level, which has the vantage point to view the system in its entirety.

Recommendation 14: DoD should consistently embrace a systems approach in addressing overweight and obesity in its beneficiary and retiree populations, consistent with the strategies outlined by the Institute of Medicine in 2012 and the National Prevention Strategy of the U.S. Surgeon General. This requires that the Department take the following actions.

a) **Emphasize a focus on a lifetime course of health for dependents and retirees, addressing all of the variables that influence healthy weight.**
b) **Provide 24-hour access to healthy foods, physical fitness programs, and support for military families living on or near military facilities.**
c) **Facilitate access to healthcare providers appropriately trained in health and wellness management.**
d) **Promote seamless coordination of care as retirees transition from the DoD health system to the VA health systems, with a focus on prevention.**
e) **Develop and sustain Department-level quality assessment and improvement activities that address large-scale population-based programs focused on health and wellness, particularly weight management.**
f) **Identify and prioritize interventions for those populations at greatest risk for unhealthy weight, for example, young military families lacking sufficient access to healthy foods or affordable and accessible weight management programs.**
g) **Set nutritional standards for food offered through DoD dining facilities and by on-base contract vendors.**
h) **Ensure that the physical environment of military installations supports the principles of a healthy lifestyle, such as bicycle paths and walkways.**

Using a systems approach, HBI is a good example of an initiative that addresses the key contributors to obesity, and seeks to create an environment that encourages healthy and sustainable lifestyles focused on prevention. The HBI objectives are to optimize health and performance, improve readiness, reduce health care costs, and provide DoD with a framework for best practices that support improvement of the health of the military community.

Findings and Recommendations: Children of Active Duty and Retiree Military Personnel

Youth with a parent or parents who served in the military are twice as likely to consider military service as are children of those with no record of military service. As this cohort is likely to be cared for through the Military Health System and be the recipient of installation-based services, such as childcare and child development centers, it is important that efforts be made to ensure healthy weight for these children not only for reasons of health but also to help support force readiness in the future.

The Department is to be commended for efforts currently under way to address childhood obesity through the efforts of the Childhood Obesity Working Group, work tasked to the Clearinghouse for Military Family Readiness, and the Healthy Base Initiative. These activities will contribute to an increased focus on the health needs of children of Active Duty and retired military personnel receiving care and services through the military health system. However,

efforts should go beyond the clinic and reach children in their communities on and around military installations.

Recommendation 15: In its ongoing efforts to improve the health of children and youth in the military community, DoD should, whenever possible, adopt best practices from childhood obesity programs developed and tested in the civilian population, and undertake rigorous evaluation of these best practices in military populations. In addition, DoD should review and develop opportunities to provide children of dependents opportunities for exposure to and education in healthy lifestyles, with a focus on nutrition and physical fitness.

Considering the implications that childhood obesity has on health as adults and the likelihood that military families will be a major source of future Service members, a focus on childhood obesity is critically important to current health care expenditures and to the future of our nation's security.

I. Introduction

> "America has a growing problem…We have an issue of increasing obesity within the civilian population, [and] a history of poor nutritional choices, both in the civilian and military populations, that's affecting readiness."
>
> Dr. Jonathan Woodson, Assistant Secretary of Defense (Health Affairs)[2]

America's obesity epidemic is well documented and receives considerable attention because of its impact on health, fitness, and healthcare costs. The prevalence of obesity in the United States has been on the rise over the last two decades; approximately 1 in 3 U.S. adults is obese.[3] Superimposed on the high prevalence of obesity in the United States, another one-third of Americans over age 20 are overweight (and not obese) (see the next topic of this section, "Defining Overweight and Obesity," for an explanation of terms).[4] Unlike obesity, rates of overweight have held steady for several years and the health consequences are not as well defined. Consistent with national trends, rates of overweight and obesity also have increased in the U.S. military population over time, although rates of overweight have leveled off in recent years in the military population as in the general population.

High rates of excessive weight and body fat have implications for national security if our Armed Forces are unable to recruit and retain a fit force and maintain fitness throughout military service. In addition, the Department of Defense (DoD), as the largest public healthcare provider in the United States, must address the challenges that obesity poses to the military healthcare system, which not only provides care to Service members, but also to beneficiaries and retirees. The rising rates of excessive weight and body fat have serious implications for DoD in four significant ways.

First, excessive weight and body fat disqualify some otherwise qualified individuals from military Service, preventing them from serving their country in a military capacity. General population trends are of concern because DoD relies on an all-volunteer force, thereby drawing on the U.S. population to meet mission requirements.

Second, excessive weight and body fat among the Active Duty, National Guard, and Reserve populations reduces overall force fitness and readiness. Research has shown that higher body mass index (BMI; see description below) can be associated with "decreased fitness and increased

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[2] Sanchez A. New campaign aims to improve troops, families' health. News release. American Forces Press Service. U.S. Department of Defense. February 12, 2012. http://www.defense.gov/news/newsarticle.aspx?id=67129. Accessed July 10, 2013.

[3] Ogden CL, Carroll MD, Kit BK, et al. Prevalence of obesity in the United States, 2009–2010. National Center for Health Statistics Data Brief No. 82. January 2012. http://www.cdc.gov/nchs/data/databriefs/db82.pdf. Accessed July 10, 2013.

[4] Fryar CD, Carroll MD, Ogden CL. Prevalence of obesity among children and adolescents: United States trends 1963-1965 through 2009-2010. Centers for Disease Control and Prevention National Center for Health Statistics Health E-Stat. September 2012. http://www.cdc.gov/nchs/data/hestat/obesity_child_09_10/obesity_child_09_10.pdf Accessed July 10, 2013.

risk of pain, injury, disability, and premature retirement or discharge in military personnel." [5] Excessive weight and body fat have been associated with decreased military operational effectiveness as well as acute and chronic adverse health effects.[6]

Third, data from 2007 show that that the Department spends nearly $1.1 billion annually treating obesity-related illness for Service members and their families.[7] Considering that the number of enrollees in TRICARE Prime and the prevalence of obesity have both increased steadily over time since 2007, the costs to DoD are likely even higher today.[8] Rates of excessive weight and body fat in the retiree population also are of concern. Recognizing this problem, the Department seeks feasible strategies to address this problem and reduce potential costs.

Finally, children of parents who serve are more likely to volunteer for Service themselves. The parents of these children are role models for their offspring, and their habits will influence the lifelong habits of their children.[9] Furthermore, as this cohort is likely to be cared for through the Military Health System, it is important that efforts be made to ensure healthy weight not only for reasons of health but also to help support force readiness in the future.

For these reasons, it is imperative that efforts be made to understand the implications of these trends for the military specifically, and for the Nation's health more generally.

Defining Overweight and Obesity

According to the Centers for Disease Control and Prevention (CDC), "Overweight and obesity are both labels for ranges of weight that are greater than what is generally considered healthy for a given height. The terms also identify ranges of weight that have been shown to increase the likelihood of certain diseases and other health problems."[10]

It can be challenging to compare data over time, as definitions and metrics have periodically changed. The most commonly used metric has been BMI. BMI is calculated as weight (pounds)/height (inches)^2 x 703 or, more commonly, kilograms/meters (kg/m)^2. Given that weight increases with height, BMI establishes healthy weight for height.

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[5] Accession Medical Standards Analysis and Research Activity (AMSARA). *Annual Report 2012*. http://www.amsara.amedd.army.mil/Documents/AMSARA_AR/AMSARA%20AR%202012_final.pdf. Accessed July 10, 2013; p.12.

[6] Diagnoses of overweight/obesity, Active Component, U.S. Armed Forces, 1998-2008. *Medical Surveillance Monthly Report. 2009;16(01)2-7.*

[7] Dall TM, Zhang Y, Chen Y J, et al. Cost associated with being overweight and with obesity, high alcohol consumption, and tobacco use within the Military Health System's TRICARE Prime-Enrolled population. *Science of Health Promotion*. 2007;22(2):120-139.

[8] DoD. *Evaluation of the TRICARE Program: Access, Cost, and Quality. Fiscal Year 2012 Report to Congress*. http://tricare.mil/tma/congressionalinformation/downloads/TRICARE%20Evaluation%20Report%20-%20FY12.pdf. Accessed August 8, 2013

[9] Vander Ploeg KA, Maximova K, Kuhle S, et al. The importance of parental beliefs and support for physical activity and body weights of children: A population-based analysis. *Can J Public Health*. 2012 Jun;103(4):e277-281.

[10] CDC. Defining overweight and obesity. http://www.cdc.gov/obesity/adult/defining.html. Accessed July 10, 2013.

The definitions of overweight and obesity have evolved over time, as have the tools and metrics used to determine an individual's status. In 1985, the National Institutes of Health (NIH) held a consensus development conference regarding the health implications of obesity. It defined obesity as an "excess of body fat frequently resulting in a significant impairment of health" and recommended treatment for obesity when BMI is greater than 27.8 for men and 27.3 or greater for women.[11] These BMI values represented the lower cutoff points for overweight, as determined at the time by the National Center for Health Statistics (National Health and Nutrition Examination Survey, or NHANES) and were close to the values of 27.2 (men) and 26.9 (women) that the NIH panel had determined to be 20 percent above desirable weight, based on the Metropolitan Life Insurance Company tables. This threshold was determined to be associated with significant excess mortality and morbidity, which emphasized the need for action. The panel noted that there had been a slight increase in the desirable weights between the 1959 version of the tables and the 1983 revision, which was not well understood. The data in the tables reflected the mortality experiences of policyholders with a cutoff date of 11 years prior to publication; as such, these cutoffs were established based on deaths of policyholders no more recent than 1972.

The consensus statement concluded:

> "Data from NHANES II (1976 through 1980) were analyzed by comparing several parameters for the subjects at or above, or below, the 85th percentile of the reference population.[12] At or above this cutoff point, males have a BMI greater than or equal to 27.8 and females have a BMI greater than or equal to 27.3. This analysis showed a strong association between the prevalence of obesity and CVD [cardiovascular disease] risk factors. Based on these criteria, the prevalence of hypertension (blood pressure greater than 160/95) is 2.9 times higher for the overweight than for the nonoverweight. The prevalence is 5.6 times higher for the young (20 through 44 years old) overweight than for the nonoverweight subjects in this age group. The prevalence is twice as high for the obese older (45 through 74 years old) group as it is for the nonoverweight subjects of the same age. The prevalence of hypercholesterolemia (blood cholesterol over 250 mg/dl) in the young overweight age group is 2.1 times that of the nonoverweight group; overweight and nonoverweight subjects show similar prevalences for hypercholesterolemia after age 45."[13]

[11] Kuczmarski RJ, and KM Flegal. Criteria for definition of overweight in transition: Background and recommendations for the United States. *Am J Clin Nutr*. 2000;72:1074-1081.
[12] The reference population included noninstitutionalized, nonpregnant U.S. residents, ages 20 to 29, 1976-1980.
[13] NIH. Consensus Development Conference Statement. Health Implications of Obesity. February 1985. http://consensus.nih.gov/1985/1985Obesity049html.htm. Accessed July 10, 2013.

In 1990, *Healthy People 2000* considered overweight to be a BMI of ≥ 27.8 for men and ≥ 27.3 for women.[14] In 1997, the World Health Organization (WHO) defined "pre-obesity" or "overweight" as a BMI of 25 and greater and obesity as a BMI of 30 or greater.[15] WHO noted that BMI offers the most useful population-level measure of overweight and obesity, as it is equally applicable to both sexes and for all ages of adults; however, it may not correspond to the same degree of fatness in different individuals.[16] In 1998, another NIH panel recommended use of the WHO standard—overweight is indicated by a BMI between 25 and 30, and obesity by a BMI of ≥ 30.[17]

Thus, by most current standards, obesity is indicated by a BMI ≥ 30, and overweight by a BMI of ≥ 25 < 30. Normal weight is reflected by a BMI between 18.5 and 24.9. Underweight is reflected by a BMI less than 18.5. Obesity in children is defined as a BMI greater than or equal to the age- and sex-specific 95th percentiles of CDC growth charts.[18]

DoD uses a definition of overweight that differs from the accepted standard. According to DoD Instruction (DoDI) 1308.3, "DoD Physical Fitness and Body Fat Programs Procedures," overweight is defined as exceeding the maximum limit indicated in the Service height-weight screening table. The DoDI notes that overweight Service members may still comply with standards by meeting the body fat standards or by having an above average lean mass, which the DoDI notes to be a desirable characteristic for individual military readiness. The upper limit of acceptability in the DoD screening table is a BMI of 27.5.

However, the Services each have their own screening tables (requirements vary by gender and age), and in some cases the upper limits fall significantly below 27.5, the DoD absolute maximum. The Services are not permitted to set a more stringent screening requirement than a BMI of less than 25. The DoD rules stem from body fat limitations that were converted into BMI equivalents.

At a joint meeting of the Army, Navy, and Marine Corps in 1994, the Services determined that they would use the Metropolitan Life Insurance tables. The Navy had been using these as the basis for their body fat standards, but was applying the criteria to a then-current body composition data set to extrapolate percent fat equivalents.[19] The Services determined at the

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[14] In September 1990, the Department of Health and Human Services released *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*, a strategy for improving the health of Americans by the end of the century. The objectives are updated every 10 years. http://www.cdc.gov/nchs/healthy_people/hp2000.htm. Accessed September 9, 2013.

[15] Kuczmarski and Flegal, op cit.

[16] WHO. Obesity and overweight. Fact sheet N°311. Updated March 2013. http://www.who.int/mediacentre/factsheets/fs311/en/. Accessed July 10, 2103.

[17] NIH. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. NIH Publication No. 98-4083. September 1998. http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed July 10, 2013.

[18] Ogden et al., January 2012, op cit.

[19] Hodgdon JA. *A History of the U.S. Navy Physical Readiness Program from 1976 TO 1999*. Technical Document Number 99-6F, supported by the Office of Naval Research, Arlington, VA, and the Navy Personnel Command,

foregoing meeting that a more appropriate table should be developed that reflected 120 percent of the Metropolitan Life table values. However, the table ultimately provided to DoD did not contain the midpoint values for the medium-frame individual as was intended. Rather, these values were calculated from a table published by Andres, and represented 120 percent of the midpoint weight across all frame sizes for each height in the 1983 Metropolitan Life tables, adjusted for added height from shoes and weight from clothing. To this day, the DoDI has the same body fat requirement. Service standards are not allowed to be more stringent than 18 percent body fat for men and 26 percent for women, and not more liberal than 26 percent for men and 36 percent for women. However, body fat is not measured unless a Service member exceeds the height-weight standard. In this case, body composition is initially determined by circumference measurements from which body fat is then calculated.[20]

Health Effects of Overweight and Obesity

Evidence has been building over time that individuals who are overweight or obese are at greater risk for many diseases, although the data are more compelling regarding obesity. The health effects of overweight are not as pronounced. For example, a 2013 review and meta-analysis of BMI categories in studies involving more than 2.88 million individuals found that mortality was significantly lower among those who were overweight but not obese ($25 \leq BMI < 30$) when compared with normal weight ($BMI < 25$) individuals.[21] These results are broadly consistent with findings from two previous meta-analyses that used standard categories.[22, 23] The same meta-analysis also did not find excess mortality associated with grade 1 obesity ($30 \leq BMI < 35$), consistent with observations of lower mortality among overweight and moderately obese patients.[24, 25, 26, 27]

Heymsfield and Cefalu suggested that several factors could explain the foregoing findings.[28] First, physicians are more aggressive in managing risk factors in their overweight and obese

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Millington, TN, under research work unit 63706N M0096.002-6716.
http://www.ihpra.org/navyphysical%20readiness.pdf. Accessed July 10, 2013.

[20] Ibid.

[21] Flegal KM, Kit BK, Orpana H, et al. Association of all-cause mortality with overweight and obesity using standard body mass index categories: A systematic review and meta-analysis. *JAMA.* 2013;309(1):71-82. doi:10.1001/jama.2012.113905.

[22] McGee DL. Body mass index and mortality: a meta-analysis based on person-level data from twenty-six observational studies. *Ann Epidemiol*. 2005 Feb;15(2):87-97.

[23] Janssen I, Mark AE. Elevated body mass index and mortality risk in the elderly. *Obes Rev*. 2007 Jan;8(1):41-59.

[24] Batsis JA, Romero-Corral A, Collazo-Clavell ML, et al. Effect of weight loss on predicted cardiovascular risk: change in cardiac risk after bariatric surgery. *Obesity.* 2007 Mar;15(3):772-784.

[25] Carnethon MR, De Chavez PJ, Biggs ML, et al. Association of weight status with mortality in adults with incident diabetes. *JAMA*. 2012 Aug 8;308(6):581-90. doi: 10.1001/jama.2012.9282.

[26] Doehner W, Clark A, Anker SD. The obesity paradox: weighing the benefit. *Eur Heart J.* 2010 Jan;31(2):146-148. doi: 10.1093/eurheartj/ehp339. Epub 2009 Sep 5.

[27] Lainscak M, von Haehling S, Doehner W, Anker SD. The obesity paradox in chronic disease: facts and numbers. *J Cachexia Sarcopenia Muscle*. 2012 Mar;3(1):1-4. doi: 10.1007/s13539-012-0059-5. Epub 2012 Mar 14.

[28] Heymsfield SB, and WT Cefalu. Does body mass index adequately convey a patient's mortality risk? *JAMA*. 2013 Jan 2;309(1):87-88. doi: 10.1001/jama.2012.185445.

patients, and new drugs and interventions may prolong survival, particularly among the obese. In addition, excess adipose tissue may be protective later in life in terms of falls and fractures and as reserves during acute catabolic illnesses. In addition, Willet, Hu and Thun[29] point to two studies[30, 31] that pooled data from cohort studies, and after addressing perceived biases, found increased mortality in overweight and all obese categories. Multiple studies clearly indicate that morbidity needs to be considered as well as mortality and individual risk must be appropriately assessed.

Morbidity associated with a BMI greater than 30 has been well studied. In 1998, the National Heart, Lung, and Blood Institute (NHLBI) compiled evidence in developing its *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*, concluding "Above a BMI of 30 kg/m2, morbidity for a number of health conditions increases as BMI increases. Higher morbidity in association with overweight and obesity has been observed for hypertension, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, other respiratory problems, and some types of cancer (endometrial, breast, prostate, and colon)."[32, 33]

The specific risks for those having a BMI in the overweight (but not obese) range are more controversial, with evidence suggesting that risks are heightened, as documented by Willett et al.,[34] and evidence on the other end of the spectrum suggesting that minimal excess weight may actually have a protective effect, as demonstrated by the reduced hazard ratios of those with an overweight BMI as documented by Flegal et al.[35]

Several studies have documented increasing risks of Type 2 diabetes, hypertension, and coronary heart disease as BMI increases, even in the overweight range.[36, 37] A 2003 report by the Agency for Healthcare Research and Quality concluded, "Risk associated with specific morbidity tends to increase more linearly with BMI than the risk associated with total mortality. This trend has

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[29] Willett WC, Hu FB, Thun M. Overweight, obesity, and all-cause mortality. *JAMA*. 2013 Apr 24;309(16):1681. doi: 10.1001/jama.2013.3075.

[30] Berrington de Gonzalez A, Hartge P, Cerhan JR, et al. Body-mass index and mortality among 1.46 million white adults. *N Engl J Med*. 2010 Dec 2;363(23):2211-2219. doi: 10.1056/NEJMoa1000367.

[31] Prospective Studies Collaboration. Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet*. 2009 Mar 28;373(9669):1083-96. doi: 10.1016/S0140-6736(09)60318-4. Epub 2009 Mar 18.

[32] NIH, 1998, op cit., p. 12.

[33] *See also, for example*, Hoffman J, and JA Salerno. *The Weight of the Nation*. New York, New York: St Martin's Press: 2013; Calle EE, Rodriguez C, Walker-Thurmond K, et al.. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med*. 2003 Apr 24;348(17):1625-1638; Dores H, de Araújo Gonçalves P, Carvalho MS, et al. Body mass index as a predictor of the presence but not the severity of coronary artery disease evaluated by cardiac computed tomography. *Eur J Prev Cardiol*. 2013 Jun 17. [Epub ahead of print].

[34] Willett W, Dietz W, Colditz G. Guidelines for healthy weight. *N Eng J Med*. 1999;341:427-434.

[35] Flegal, op cit.

[36] Willet, op cit.

[37] Friedl KE. Body composition and military performance—many things to many people. *J. Strength and Conditioning Res*. 2012;26(7):S87-S100.

been demonstrated most frequently for cardiovascular disorders."[38] BMIs near the threshold of 27 to 28 have been used in making clinical decisions about the use of pharmacotherapy when comorbid with other conditions, such as hypertension, dyslipidemia, coronary heart disease, Type 2 diabetes, or sleep apnea.[39, 40] Even mildly elevated BMI has been noted to be a risk factor for musculoskeletal injuries such as low back pain and limb injuries.[41, 42] As discussed later in this report, considering the propensity for other injuries among overweight individuals such as heat stroke, the implications of being overweight should be considered differently among Active Duty military personnel.[43, 44]

Obese persons have a much higher risk of chronic health conditions than overweight or healthy weight individuals, including hypertension, adverse lipid concentrations, and type 2 diabetes.[45] Furthermore, nearly 10 percent of total medical expenditures in the United States—approximately $147 billion in 2006—can be attributed to obesity.[46, 47]

BMI as a Screening Tool

BMI is a useful screening tool for populations, but it is an imperfect predictor or diagnostic of health risk in individuals. Although BMI correlates with the amount of body fat, it does not directly measure body fat. As a result, some people who are muscular may have a BMI that identifies them as overweight even though they do not have excess body fat.[48] Other data suggest that body fat percentage and distribution of body fat may be a more critical indicator of fitness in overweight individuals than just BMI.[49]

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[38] Agency for Healthcare Research and Quality. *Screening and Interventions for Overweight and Obesity in Adults*. 2003. http://www.ahrq.gov/downloads/pub/prevent/pdfser/obesser.pdf. Accessed July 11, 2103. Page 3.
[39] National Task Force on the Prevention and Treatment of Obesity. Long-term pharmacotherapy in the management of obesity. *JAMA.* 1996;276:1907-1915.
[40] U.S. Department of Agriculture. Dietary Guidelines for Americans. 1995. http://www.cnpp.usda.gov/DGAs1995Guidelines.htm. Accessed July 11, 2013.
[41] Hendrix WH, Hughes RL. Relationship of trait, Type A behavior, and physical fitness variables to cardiovascular reactivity and coronary heart disease risk potential. *Am J Health Promot.* 1997;11(4):264-271.
[42] Reynolds K, Cosio-Lima L, Creedon J, et al. Injury occurrence and risk factors in construction engineers and combat artillery soldiers. *Mil Med*. 2002;167(12):971-977.
[43] Cowan D, Bedno S, Urban N, et al. Musculoskeletal injuries among overweight army trainees: Incidence and health care utilization. *Occ. Med*. 2011;61(4):247-252.
[44] Bedno SA, Yuanzhang L, Han W, et al. Exertional heat illness among overweight U.S. Army recruits in basic training. *Aviat. Space Environ. Med*. 2010;81(2):107-111.
[45] Ogden et al., January 2012, op cit.
[46] Ogden C. Epidemiologist and Branch Chief, National Health and Nutrition Examination Survey (NHANES) CDC/National Center for Health Statistics. "Obesity in the US: Descriptive Epidemiology." Presentation to the Defense Health Board. July 12, 2012.
[47] Finkelstein EA, Trogdon JG, Cohen JW, et al. Annual medical spending attributable to obesity: Payer and service-specific estimates. *Health Affairs*. 2009;28(5):w822-w831.
[48] Dietz B. Former Director of the Division of Nutrition, Physical Activity and Obesity, CDC. "Best Practices Interventions for Weight Maintenance." Presentation to the Defense Health Board. November 16, 2012.
[49] Friedl KE. Can you be large and not obese? The distinction between body weight, body fat, and abdominal fat in occupational standards. *Diabetes Technology & Therapeutics*. 2004;6(5):732-749.

Even assessment of overall fatness or adiposity may be less meaningful as predictors than the distribution of body fat, particularly to the abdomen. Several studies suggest that waist circumference is an important marker of fitness and may play a role in disease pathology. For example, extra weight around the middle and upper parts of the body (central obesity) is associated with metabolic syndrome, a group of risk factors that occur together and increase the risk for coronary artery disease, stroke, and type 2 diabetes.[50]

NIH guidelines state that waist circumference provides an independent prediction of risk over and above that of BMI and is particularly useful in those who are categorized as normal or overweight on the BMI scale. At BMIs greater than or equal to 35, waist circumference has little added predictive power of disease risk beyond that of BMI.[51]

It is important to consider the accuracy of BMI reports when classifying prevalence of overweight and obesity. Self-reported values of height and weight could lead to misclassification errors. Some research has shown that both men and women misreport height and weight.[52, 53, 54] Others have observed that self-reported heights and weights are reasonably accurate and acceptable for epidemiologic surveys.[55, 56]

In sum, although BMI is an important measure for assessing population trends and for use as a screening tool, it appears to be less accurate as a standalone diagnostic measure. In particular, there are problems in using BMI as a surrogate for body fat in individuals with high muscle mass (such as men applying for military service or highly trained athletes) or in women, who tend to have higher body fat percentages associated with lower BMIs than do men.[57] These issues are addressed further in Section III of this report.

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[50] Alberti KG, Eckel RH, Grundy SM, et al. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. *Circulation*. 2009 Oct 20;120(16):1640-1645. doi: 10.1161/CIRCULATIONAHA.109.192644. Epub 2009 Oct 5.

[51] NHLBI. Guidelines on Overweight and Obesity. http://www.nhlbi.nih.gov/guidelines/obesity/e_txtbk/txgd/4142.htm. Accessed July 11, 2013.

[52] Rowland ML. Self-reported weight and height. *Am J Clin Nutr*. 1990 Dec;52(6):1125-1133.

[53] Merrill RM, Richardson JS. Validity of self-reported height, weight, and body mass index: Findings from the National Health and Nutrition Examination Survey, 2001-2006. *Prev Chronic Dis* 2009;6(4):A121. http://www.cdc.gov/pcd/issues/2009/oct/08_0229.htm. Accessed July 11, 2013.

[54] Bonn SE, Trolle Lagerros Y, Bälter K. How valid are Web-based self-reports of weight? *J Med Internet Res*. 2013 Apr 9;15(4):e52. doi: 10.2196/jmir.2393.

[55] Stommel M, and CA Schoenborn. Accuracy and usefulness of BMI measures based on self-reported weight and height: Findings from the NHANES & NHIS 2001-2006. *BMC Public Health*. 2009;9:421. Published online 2009 November 19. doi:10.1186/1471-2458-9-421 PMCID:PMC2784464.

[56] Villanueva EV. The validity of self-reported weight in US adults: a population-based cross-sectional study. *BMC Public Health*. 2001;1(11).

[57] Packnett ER, Niebuhr DW, Bedno SA, et al. Body mass index, medical qualification status, and discharge during the first year of US Army service. *Am J Clin Nutr*. 2011 Mar;93(3):608-614. doi: 10.3945/ajcn.110.007070. Epub 2011 Jan 19.

Other methods of estimating body fat and body fat distribution include measurements of skinfold thickness; calculation of waist-to-hip circumference ratios; measurements of hip, waist, and neck circumferences; and technological applications such as ultrasound, computed tomography, and magnetic resonance imaging. Dual-energy X-ray absorptiometry (DXA), typically used to measure bone density, also has been used for measuring total body fat.

Rates of Obesity and Overweight in the U.S. Population

Obesity: CDC estimates that in 2009-2010, more than 35 percent of U.S. adults were obese.[58] Adults aged 60 and over were more likely to be obese than younger adults. However, the prevalence of obesity among young adults more than doubled between 1980 and 2008.[59] Of note, the age-adjusted percentage of men considered obese by BMI but not by percent body fat nearly tripled between 1960 and 2008 (rising from 4 to 11.2 percent).[60]

Recent analyses of NHANES data compared the weight of "baby boomers" (those born from 1946 through 1964) and found that 38.7 percent were obese compared to 29.4 percent of the previous generation (comparable age range).[61]

Men and boys have seen an increase in obesity at rates greater than women and girls in the last 12 years. While rates have remained relatively the same in non-Hispanic white women and girls, African American and Mexican American women have experienced increases in obesity rates over the past decade.[62]

There are regional differences in obesity rates, ranging from a high of 34.9 percent in Mississippi to a low of 20.7 percent in Colorado in 2011. Thirty-nine states have an obesity rate of at least 25 percent.[63] Twenty-six of the 30 states with the highest obesity rates are in the Midwest and South.[64] Although rates have increased across all regions, the most dramatic increases have occurred in the Midwest and South since 1991.[65]

Approximately 17 percent of children and youth ages 6 to19 were obese in 2011, with a higher prevalence among boys than girls.[66] Data from the 2012 Youth Risk Behavior Surveillance System (YRBSS), which relies on self-reported information, show that 13 percent of high school

[58] Ogden, January 2012, op cit.
[59] CDC. Obesity: Halting the Epidemic by Making Health Easier. At a Glance 2011. http://www.cdc.gov/chronicdisease/resources/publications/aag/obesity.htm. Accessed July 11, 2013.
[60] Cawley J, and JC Maclean. Unfit for Service: The implications of rising obesity for US military recruitment. *Health Economics*. 2011;DOI: 10.1002/hec.1794.
[61] King DE, Matheson E, Chirina S, et al. The status of baby boomers' health in the United States: The healthiest generation? *JAMA Intern Med*. 2013 Mar 11;173(5):385-386. doi: 10.1001/jamainternmed.2013.2006.
[62] Ogden, July 2012, op cit.
[63] CDC. Data and Statistics. http://www.cdc.gov/obesity/data/. Accessed July 12, 2013.
[64] Trust for America's Health. *Issue Report: F as in Fat: How Obesity Threatens America's Future*. Robert Wood Johnson Foundation. September 2012.
[65] Ibid.
[66] Ogden et al., January 2012, op cit.

students are obese, with regional differences that range from 7.3 percent in Colorado to 17 percent in Alabama.[67]

Although rates appear to be plateauing, with no change in obesity prevalence from 2007/2008 to 2009/2010,[68] even the most conservative projections suggest that, absent interventions to reverse or slow current trends, 42 percent of adults could be obese by 2030.[69]

Overweight: In addition to a high prevalence of obesity in the United States, one-third of Americans over age 20 are overweight (and not obese).[70] After rising for several years, rates of overweight started to level off between 2008 and 2010. YRBSS data show that 15.2 percent of high school students reported being overweight in 2011, with regional differences ranging from 10.7 percent in Colorado to 19.5 percent in Louisiana.[71]

Charge to the Defense Health Board

On April 20, 2012, the Acting Under Secretary of Defense for Personnel and Readiness (USD(P&R)) endorsed a request by the then Deputy Surgeon General of the Air Force (now the Surgeon General) that the Defense Health Board (DHB) examine the rising rates of obesity and overweight in America and the implications for DoD, and recommend strategies to address this growing problem (see Appendix A). This examination focuses on four sets of issues: 1) the effects of national trends in overweight and obesity on recruitment and retention of military personnel; 2) best practices for maintaining healthy weight in Service members; 3) optimal strategies for addressing overweight and obesity in DoD dependents and retirees; and 4) strategies and best practices for ensuring that children of military personnel specifically, and the overall population more generally, achieve healthy weight.

In response to USD(P&R)'s April 2012 request, the Board convened a subset of its members to review the issues. The members developed Terms of Reference (see Appendix B) to define the scope of the investigation and a set of Guiding Principles to steer their review (see Box 1A). Members met in person or by telephone to receive briefings from and consultations with the Department, Service recruiting commands, and recognized experts in adult and childhood obesity and weight management from CDC, NIH, the Institute of Medicine (IOM), and academia. Appendix B contains a complete list of briefings received at each meeting. In addition, members reviewed the literature concerning these issues and best practices for addressing them.

[67] Trust for America's Health, op cit.
[68] Ogden, July 2012, op cit.; Ogden et al., January 2012, op cit.
[69] Trogdon, J. Obesity and Severe Obesity Forecasts Through 2030. Weight of the Nation 2012 Conference: Moving Forward, Reversing the Trend; May 7-9, 2012; Washington, DC. http://www.adph.org/ALPHTN/assets/TrogdonHandouts.pdf. Accessed July 17, 2013.
[70] Fryar et al., op cit.
[71] Trust for America's Health, op cit.

Box 1A: Guiding Principles

The subset of Defense Health Board members responsible for conducting this assessment felt that it was especially important at the outset of the review to establish Guiding Principles to lay the foundation for and underpin their review. The principles reflect the Board's core beliefs regarding the role of the Department in considering and developing strategies in response to the Board's recommendations.

Overarching Principle: DoD has an obligation to be a leader in addressing the obesity epidemic afflicting our Nation, and to set a benchmark for best practices in prevention and treatment. As the ensurer of our Nation's safety and security, and as the largest employer in the United States, DoD has the dual obligation to ensure a ready and fit-to-fight Force, and to help promote the health of citizens across the Nation.

Guiding Principles: These principles anticipate that the strategies and solutions recommended by the Board will:

1) Be based on the best available, highest quality evidence;
2) Be measurable and outcomes-based, while ensuring that no conclusions are based on a single measure;
3) Consider cost implications, feasibility and return on investment for the Department;
4) Identify the various obesity-related risks for different DoD sub-populations and strategies for targeting these particular groups, where possible, such as family members and retirees;
5) Reflect both known and emerging health policy landscapes and the potential impacts of these changes on future policy development;
6) Take into consideration current DoD initiatives, undertakings, and recommendations regarding the obesity problem; and,
7) Embrace a comprehensive, systems-based examination of the relevant issues, acknowledging the importance of implementation science in tracking effectiveness of interventions.

About This Report

This report addresses the four sets of issues posed in the Terms of Reference. Section II focuses on issues facing DoD as it seeks to recruit and retain Active Duty, Guard, and Reserve military personnel from the general public, now and in the future.
Section III assesses the status of excess weight and body fat in current military personnel, best practices in attaining and maintaining appropriate weight, and actions DoD might take with regard to personnel who fail to meet weight standards.

Section IV provides available data on rates of excess weight and body fat among DoD beneficiaries and retirees. It also estimates the long-term costs of excess weight and body fat should current trends continue in these populations and best practices and methods for addressing and managing weight and fitness.

Section V focuses on whether the children of military personnel are more likely to join the military and, if so, whether DoD can adopt best practices for weight control among children and youth who might want to serve their country in the future.

II. Recruiting and Retaining a Fit Force

Background/History

The Armed Forces have long required that potential recruits meet certain physical fitness standards before being admitted into one of the Services. Accession standards determine fitness for military service following a formalized screening process. The purpose of physical fitness standards for military service has always been to recruit Service members who are able to meet the physical demands of serving.

Although the U.S. military's current physical accession standards have evolved to become far more specific over the last 30 years and to address the increasing incidence of overweight applicants, the concept of having such standards are longstanding, with weight and height (not height-weight) standards establishing suitability for service dating back to the 19th century.

The first regulations regarding the physical condition of recruits were issued in 1814, allowing into the Army "free able-bodied men between the ages of 18 and 35 who were active and free from disease," and relied on physicians to subjectively determine whether applicants were healthy enough to serve.[72, 73] Early standards during the 19th century required that U.S. soldiers be a minimum of 66 inches tall, which has since been significantly reduced.[74] Weight was not assessed as often as height during the Civil War, and when it was used, it was more frequently to evaluate an applicant for underweight rather than overweight.[75] In fact, until the Korean Conflict, standards were primarily used to eliminate underweight candidates.

Minimum weight and chest circumference for height were defined in 1917. Being underweight according to the tables was grounds for rejection; however, obese applicants were eliminated only if the examining physician determined an obvious morbidity or if they exceeded the limit for Cavalry service.[76]

In 1960, formal accession standards established minimum and maximum weights for height. The limits for weight were quite liberal; upper limits for men were approximately 140 percent of the average weights tabulated by the U.S. Army Office of the Surgeon General.[77, 78] Later, these standards expanded from simple entry criteria to requirements that must be maintained

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[72] Siegal DL. *An Evaluation of the Performance of the Medical Examination for Entrance into the Armed Forces*. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College; 1971.
[73] Mahmoud RA, Clarke KL, May L. Evolution of military recruit accessions standards. In: Kelley PW, ed. *Military Preventive Medicine: Mobilization and Deployment*. Washington, DC: Borden Institute, Office of The Surgeon General, U.S. Department of the Army; 2003; Chapter 7. https://ke.army.mil/bordeninstitute/published_volumes/mpmVol1/PM1ch7.pdf. Accessed July 14, 2013.
[74] IOM. *Body Composition and Physical Performance: Applications for the Military Services*. Washington, DC: National Academies Press, 1992.
[75] Ibid.
[76] Ibid.
[77] Ibid.
[78] Mahmoud et al., op cit.

throughout one's military career. In addition, in 1991, body fat became a secondary measure available to screeners, and is now a required part of the screening process if an applicant does not meet the required weight minimum or maximum for his or her height.[79] To this day, body weight and body fat standards are the only physical standards used by all Services as a surrogate measure of physical fitness and combat readiness to disqualify applicants for unsuitability.[80, 81]

Once a Service accepts an applicant, DoD Directive 1308.1 requires that the Service member "maintain physical readiness through appropriate health, nutrition and fitness habits."[82] Further, the Directive requires that "individual Service members must possess the cardio-respiratory endurance, muscular strength and muscular endurance, together with desirable levels of body composition to successfully perform in accordance with their Service-specific mission and military specialty."[83]

Current Recruitment Policies and Standards

The Defense Health Board (DHB) reviewed the adequacy and appropriateness of current recruitment policies and standards with regard to weight and considered the implications of current trends on future Force requirements.

The Accession Policy Directorate within the Office of Military and Personnel Policy under the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD(P&R)) has operational control of the United States Military Entrance Processing Command (USMEPCOM), which processes all enlisted applicants for the military, as well as the majority of officer candidates except those offered a direct commission, applicants for Service Academies, and most Reserve Officers' Training Corps (ROTC) scholarship holders. The Army is the Executive Agent for USMEPCOM. The DoD Medical Evaluation Review Board (DODMERB) conducts the medical entrance processing for entry into the Service Academies[84] and ROTC. The Air Force is the Executive Agent for DODMERB.[85]

DoD Instruction (DoDI) 1304.26, "Qualification Standards for Enlistment, Appointment or Induction," outlines the overarching DoD standards that must be met to join the Services, including age, citizenship, education, aptitude, physical fitness, dependency status and moral character requirements.[86] USMEPCOM is responsible for determining whether an applicant is

[79] IOM, 1992, op cit.
[80] Ibid.
[81] Mahmoud et al., op cit.
[82] DoD Directive. *DoD Physical Fitness and Body Fat Program*. June 30, 2004. http://www.dtic.mil/whs/directives/corres/pdf/130801p.pdf. Accessed July 14, 2014. Page 2.
[83] Ibid.
[84] The Service Academies include: U.S. Military Academy at West Point (Army), U.S. Naval Academy, U.S. Air Force Academy, U.S. Coast Guard Academy, U.S. Merchant Marine Academy
[85] Ponder K, Assistant Director, Reserve and Medical Manpower, OUSD(P&R), Military & Personnel Policy, Accession Policy Directorate. "Accession Policy Overview." Presentation to the Defense Health Board. September 17, 2012.
[86] DoD Instruction 1304.26. *Qualification Standards for Enlistment, Appointment, and Induction*. September 20, 2005. http://www.dtic.mil/whs/directives/corres/pdf/130426p.pdf. Accessed July 14, 2013.

qualified to serve based on these requirements and established medical standards for those applicants being processed through USMEPCOM. Service Academy and ROTC applicants must meet the medical standards for accession established by DODMERB.

Medical standards are defined in DoDI 6103.03, "Medical Standards for Appointment, Enlistment or Induction in the Military Services" (implemented April 28, 2010 and updated September 13, 2011).[87] If USMEPCOM or DODMERB makes a disqualification determination, the Service to which the individual is applying determines whether it will grant a waiver to the requirement. Failure to meet height-weight standards is considered only a temporary disqualification.[88]

The Medical and Personnel Executive Steering Committee (MEDPERS) convenes quarterly and provides policy oversight and guidance for the accession medical and physical standards setting process through the Accession Medical Standards Working Group (AMSWG). AMSWG is responsible for regularly reviewing and updating DoDI 6130.03 as well as reviewing any other accession-related medical issues.

Aside from indicating that certain prior obesity-related surgery procedures are disqualifiers of eligibility to serve, there are no medical disqualifications related to height-weight or BMI contained within DoDI 6130.03. A separate DoDI, 1308.3, "DoD Physical Fitness and Body Fat Programs Procedures," outlines the maximum and minimum screening weights based on selected body mass index (BMI) standards for eligibility to serve in any of the Services (specifically, a minimum BMI of 19 and maximum BMI of 27.5 regardless of age).[89] In general, the Services have adopted more stringent requirements than the DoD standard.

DoDI 1308.3 also outlines minimum and maximum body fat measurements. Within these limits, each of the Services may establish more strict requirements. Each Service has outlined its own gender-specific height-weight requirements, which are typically more stringent than the DoD parameters, and are generally graded by age. These requirements are designed to prevent accession of those with excess body fat into the military.[90] Of note, the BMI standards are higher for women than for men, both at accession and for retention. However, allowable body fat percentages are higher for women than for men because of biological differences between the sexes in what constitutes a normal percentage.

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[87] DoD Instruction 6103.03. *Medical Standards for Appointment, Enlistment, or Induction in the Military Services*. April 28, 2010. http://www.dtic.mil/whs/directives/corres/pdf/613003p.pdf. Accessed July 14, 2013.

[88] This is in contrast to other medical disqualifications, which are considered irreversible and permanent, disallowing the Service member from reapplying to that Service.

[89] DoD Instruction 1308.3. *DoD Physical Fitness and Body Fat Programs Procedures*. November 5, 2002. http://www.dtic.mil/whs/directives/corres/pdf/130803p.pdf. Accessed July 14, 2013.

[90] DoD defines excess body fat, on average, as higher than 36 percent of total body composition for females and 26 percent for males. The Services each have their own standards that must fall within the DoD-prescribed range unless the Assistant Secretary of Defense (Force Management Policy, in accordance with DoDI 1308.3) grants an exception to policy.

Table 2.1. Maximum Percent Body Fat for Accession by Service and Age

	Percent Body Fat		
	Male	Female	Age Group
DoD Minimum	18	26	All
DoD Maximum	26	36	All
Navy	22	33	< 40
	23	34	> 40
USMC	18	26	17-26
	19	27	27-39
	20	28	40-45
	21	29	>46
USAF	20	28	< 30
	24	32	> 30
USA	26	32	17-20
	26	32	21-27
	28	34	28-39
	30	36	>40

If a recruit does not meet the accession height-weight and body fat standards for the Service to which he or she is applying, the recruit is temporarily disqualified and will not be permitted to access. Current regulations require applicants to wait four days for every pound of weight to be lost before returning to MEPS for another assessment.[96] If the applicant loses the required weight, it is not necessary to re-evaluate body fat.

An applicant may seek a waiver; however, across the Services, waivers are infrequently permitted for failure to meet these standards (see Table 2.2). Despite the fact that measurement is performed at MEPS, the official determination of ineligibility is made by the individual Services. The Services must ensure compliance with the DoD waiver requirements articulated in DoDI 1304.26.[97]

[96] U.S. Military Entrance Processing Command Regulation 40-1. October 1, 2009. http://www.mepcom.army.mil/publications/pdf/regs/r-0040-001.pdf. Accessed July 14, 2013.
[97] Directive-Type Memorandum (DTM) 08-018 – "Enlistment Waivers." June 27, 2008, Incorporating Change 3, March 20, 2013. http://www.dtic.mil/whs/directives/corres/pdf/DTM-08-018.pdf. Accessed July 14, 2013.

Table 2.2. Proportion of Accessions Granted Weight Waivers

	Percent of Total Accessions Granted a Weight Waiver
Air Force	2.9*
Marine Corps	1.2**
Army	NA***
Navy	3.6****

* Current as of September 17, 2012
** Total FY 2011 shippers
***Not available as the Army does not track this information.
**** Total FY08-FY10 accessions (standards relaxed for the Navy's Body Composition Assessment Pilot Study to assess attrition rates among sailors with body fat exceeding the standards; the study is further described below)

Although body weight (for height) and body fat are used as surrogate measures of fitness for duty, the Marine Corps is the only Service that requires any form of physical fitness test to access. Marine Corps accessions must pass the Marine Corps' Initial Strength Test which consists of pull ups (males)/flexed arm hang (females), sit ups, and a 1.5 mile (males)/1 mile run (females).

For the Army, Air Force, and Navy, applicants become accessions once they meet all medical screening requirements. Upon accession, applicants become recruits, eligible for "shipping" to basic training for the Services to which they were recruited. All Services require recruits to meet specified physical fitness standards upon completion of basic training and prior to being commissioned or enlisted; however, there is variation in the fitness requirements and tests among the Services and by age and gender. Furthermore, attrition at this point is considered a retention issue, rather than a recruitment issue.

The Army and Navy have experimented with relaxing the standards by granting weight waivers to recruits who would otherwise be disqualified because of failure to meet the height-weight and body fat standards. In 2005, the Army allowed six MEPS locations to enlist Army applicants who did not meet applicable height-weight and body fat percentage standards but who passed a test known as the Assessment of Recruit Motivation and Strength (ARMS) test. The program was expanded to all MEPS in 2006.

The available evidence from that experimental program indicate that overweight and excess body fat applicants who passed ARMS were no more likely to separate 18 months out than were applicants who met weight and body fat standards.[98, 99] However, other research by Bedno et. al.

[98] Loughran DS, and BR Orvis. *The Effect of the Assessment of Recruit Motivation and Strength (ARMS) Program on Army Accessions and Attrition*. Technical Report prepared for the U.S. Army. RAND Arroyo Center: RAND Corporation; 2011.
[99] Gubata M. Attrition among 2001-2011 Army accessions during the first three years of Active Duty service. *AMSARA Annual Report 2012*.

found a statistically significant higher incidence of heat illness among ARMS recruits[100] and a slightly higher but not statistically significant 15-month attrition rate than those who met the standard.[101] The RAND analysis found that the cost of ARMS per additional accession was $163 in Fiscal Year 2007, which "compared favorably with the estimated per-accession cost of other Army recruiting initiatives."[102] The RAND analysts added that this conclusion had to be considered with several caveats. First, it is not certain whether the broader implementation of ARMS was as successful as it was reported to be at the six initial study sites.

> "Second, it remains to be seen whether ARMS accessions in the longer run will turn out to be as productive on average as within-standards accessions. Although our tabulations suggest that ARMS accessions are, if anything, somewhat less likely than non-ARMS accessions to separate for medical reasons, it may be that they are more prone to injuries (e.g., heat illness, musculoskeletal injury) that do not result in separation but that make these accessions less productive. Moreover, it is important to acknowledge that ARMS appears to increase the number of overweight but within–body fat accessions. These individuals would not be subject to the ARMS test, and our evidence suggests that they are somewhat less likely than within-weight recruits to complete initial training."[103]

Because recruiting demands were less intense by 2009, the Army suspended the use of ARMS as an accessioning tool.

Similarly, the Navy Body Composition Assessment (BCA) Pilot did not find a difference in attrition after six months between its pilot group (allowed up to three percent excess body fat above the standard) and its control group.[104, 105, 106] These studies, which caused the Navy and Army to temporarily allow more waivers, contributed to slightly higher rates of waivers granted

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http://www.amsara.amedd.army.mil/Documents/AMSARA_AR/AMSARA%20AR%202012_final.pdf. Accessed July 14, 2013; p.12.

[100] Men with excess body fat had an increased incidence of heat illness with a rate ratio of 7.25 (95 percent confidence interval (CI): 4.17, 12.61). Bedno SA, LI Y, Han W, et al. Exertional heat illness among overweight U.S. Army recruits in basic training. *Aviation Space and Env Med.* 2010;81(2):107-113.

[101] Bedno et al. found an attrition rate of 25.4 percent versus 10.0 percent, $p < 0.001$; however, weight-control failure alone accounted for only .5 percent of the total discharges. Often weight-control failure was combined with physical conditions diagnosed since military entry or conditions existing before entry. Bedno SA, Lang CE, Daniell WE. Association of weight at enlistment with enrollment in the Army Weight Control Program and subsequent attrition in the Assessment of Recruit Motivation and Strength Study. *Military Medicine* 2010;175(3):188-193.

[102] Loughran and Orvis, op cit; p. xviii.

[103] Ibid.

[104] Gubata M, Chief, Accession Medical Standards Analysis and Research Activity, Preventive Medicine Branch, CMIDR, Walter Reed Army Institute of Research. "DoD-wide Data from the Accession Medical Standards Analysis and Research Activity." Presentation to the Defense Health Board, September 17, 2012.

[105] Packnett ER, Niebuhr DW, Bedno SA, et al. Body mass index, medical qualification status, and discharge during the first year of US Army service. *Am J Clin Nutr* doi: 10.3945/acjn.110.007070.

[106] Memorandum from Jennie Wenger, Center for Naval Analysis and Solutions to Stephen Watson, Navy Selection and Classification Office. Follow-up report on the Performance of Sailors in the Body Composition Analysis Pilot Program. December 19, 2011. CME D0026405.A1.

for failure to meet the weight and body composition requirements, thereby increasing accessions.[107]

The results of these pilot programs demonstrate that ARMS can be used to assess overweight individuals who might not otherwise meet accessioning standards in times when there is a need for rapid increase in accessions, recognizing that such individuals might be at greater risk for injury or heat stroke.[108] Related to this, in 2006, the National Research Council (NRC) issued the report, *Assessing Fitness for Military Enlistment: Physical, Medical, and Mental Health Standards*, which stated that height-weight standards are less predictive of attrition than fitness.[109] NRC recommended against using BMI as a proxy measure for fitness in the military population and suggested that DoD develop a pre-basic training fitness standard for enlistment, similar to those used by some foreign militaries and some civilian occupations, such as law enforcement.

Fitness of Current Applicants and Recruits

The ability to attract and recruit a fit force from the U.S. population has been a leading concern of several recent reviews.[110] Reflecting overweight and obesity trends in the U.S. population, the proportion of applicants and accessions to the Services who are overweight or obese has been increasing over time (although there is evidence of decline in these rates in 2010). A meta-analysis of National Health Examination Survey (NHES) and National Health and Nutrition Examination Survey (NHANES) data over time found that, for the Army, the percentage of age-eligible (17 to 42 years) male civilians who exceed the Army's weight and body fat limits rose from 5.6 percent in the 1959-1962 period to 11.7 percent in the 2007-2008 period.[111] During the same time periods, the percentage of women exceeding the limits rose from 11.5 percent to 34.7 percent.

[107] Poling T, Principal Research Scientist, Joint Advertising, Market Research and Studies (JAMRS). "Joint Advertising Market Research and Studies Accessions Data." Presentation to the Defense Health Board, September 17, 2012.
[108] Bedno SA, LI Y, Han W, et al., op cit.
[109] NRC. *Assessing Fitness for Military Enlistment: Physical, Medical, and Mental Health Standards*. Washington, D.C.: National Academies Press; 2006.
[110] See, for example, "Mission Readiness: Military Leaders for Kids" series. *Too Fat to Fight*. 2010. http://www.missionreadiness.org/2010/too-fat-to-fight/. Accessed July 14, 2103. *Still Too Fat to Fight*. 2012. http://www.missionreadiness.org/2012/still-too-fat-to-fight/. Accessed July 14, 2013.
[111] Cawley J, and JC Maclean. Unfit for Service: The implications of rising obesity for US military recruitment. *Health Economics*. 2011;DOI: 10.1002/hec.1794.

According to the Accessions Medical Standards Analysis and Research Activity (AMSARA):

> "The most frequent disqualifying condition in 2010 was exceeding the weight/body fat limits, a temporary disqualification which can be remedied.[112] Despite remaining the most common disqualifying condition, exceeding the weight/body fat limits accounted for a notably smaller proportion of disqualifications in 2010 applicants (12.5 percent) as compared to applicants in the previous five years (22.6 percent). The prevalence of disqualifications for obesity/overweight (exceeding weight/body fat limits)[113] is significantly lower in 2010 (2,097 per 100,000 applicants) as compared to applicants in the previous five years (4,640 per 100,000 applicants)." [114]

Between 2003 and 2011, 36 percent of male and 30 percent of female applicants were overweight. Nearly 9 percent of males and 1.6 percent of females were obese. The numbers are similar for accessions.[115] However, a majority of military applicants and accessions have a normal BMI (18.5-24.9). Specifically, 50 percent of male and 60 percent of female applicants and accessions self-reported a normal weight.[116] In 2011, disorders of refraction and accommodation exceeded failure to meet weight and body fat standards as the most common reason for medical disqualification. This was the first year since 1995 that body weight was not the most common reason for medical disqualification.[117]

Several recent studies have assessed the possible effects of these trends on accessions.

- Data from the Department's Joint Advertising Market Research and Studies' (JAMRS) Qualified Military Available (QMA) Database indicate that only 26 percent of today's youth (ages 17-24) are qualified[118] to serve without obtaining a waiver should they choose to serve. As of June 2011, approximately one quarter of all youth would be disqualified to serve based on height-weight standards, using the DoD maximum permitted BMI of 27.5.[119] Although the data are not available, obviously a greater number would be disqualified to serve should the standard be changed to a maximum BMI of 25.

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[112] In Fiscal Year 2012, body weight was not the most common reason for medical disqualification. This was the first year since 1995 in which this was the case. AMSARA *Annual Report 2012;p.1*. http://www.amsara.amedd.army.mil/Documents/AMSARA_AR/AMSARA%20AR%202012_final.pdf. Accessed July 14, 2013.

[113] AMSARA uses the WHO-accepted definition of a BMI greater than or equal to 25 for overweight in its studies; however, in the context of these data, overweight refers to exceeding the Service height-weight standards.

[114] AMSARA. *Annual Report 2011*. http://www.amsara.amedd.army.mil/Documents/AMSARA_AR/AMSARA_AR_2011.PDF. Accessed July 14, 2014; p. 31.

[115] Gubata, op cit.

[116] Ibid.

[117] AMSARA 2012, op cit.

[118] Qualified refers to those youth who are mentally, morally, and medically qualified for service based on DoD education, disciplinary, and medical standards.

[119] Poling, op cit.

- AMSARA review of Army enlistees from 2001-2011 found that among men, 35.2 percent were overweight ($25 \leq BMI < 30$), 14.6 percent were obese ($BMI \geq 30$), and 1.7 percent were underweight ($BMI < 18.5$). Among women, 32.8 percent were overweight, 2.3 percent were obese, and 3.1 percent were underweight.[120]

- The Center for Naval Analyses estimates that roughly 30 percent of U.S. adolescents (approximately 9 million) are likely to be ineligible to enlist because of excessive body fat.[121] According to the Navy Recruiting Command, recruiters estimate that approximately 1 in 8 (12.5 percent) of potential applicants visiting Navy recruiting centers are not processed because they do not meet accession height-weight standards, although they are still meeting current goals.[122]

Ethnic/racial disparities in obesity and overweight prevalence persist in the general population and in the population of weight-qualified youth. Within the general population, Hispanics and black males and females have a higher prevalence of obesity than whites.[123] Cawley and MacClean's modeling of NHANES data found that black men and women and Hispanic women are more likely to exceed the Army standards than others.[124] It is not surprising then that data from JAMRS indicate that Hispanics and black youth were significantly more likely to be disqualified for Service because of a failure to meet the height-weight standards. (See Figure 2.2.)

[120] AMSARA 2012, op cit.
[121] Nobrega N, Chief of Staff, Navy Recruiting Command. "Accession Briefing." Presentation to the Defense Health Board, September 17, 2012.
[122] Ibid.
[123] Ogden C, Epidemiologist and Branch Chief, NHANES CDC/National Center for Health Statistics. "NHANES Military Data." Presentation to the Defense Health Board, November 16, 2012.
[124] Cawley and MacClean, op cit.

the drawdown of the war, it appears unlikely that any of the Service components will experience difficulty recruiting in the near term. The proportion of applicants receiving any medical disqualification for service at MEPS has decreased overall in recent years,[128] suggesting that there is a "healthy recruit" effect. In other words, although overall health may not be improving at the population level within the United States, those applying for military service are among the healthiest. It could also be because recruiting centers are able to be more selective among those they are sending to MEPS, which may in turn be because the applicant pool they are seeing is healthier and more qualified.

However, complacency is not in order, as several factors are contributing to the current recruiting successes. Future planning requires close surveillance of current trends in overweight and obesity, demographic disparities in rates, and how these disparities align with regional recruitment rates nationwide. As noted above, states with high rates of accessions are also those facing the greatest increases in rates of obesity.

Although the average BMI of applicants appears to be plateauing in recent years,[129] continued vigilance is needed given the increasing prevalence of obesity over the last 20 years and projections for further increases over the next several decades.[130] Although these predictions are more optimistic than previous linear trend estimates, which suggested up to a 51-percent prevalence rate in 2030, the potential implications for recruitment for the military could be significant should the need to grow the force rise due to a national security emergency or threat of war. Based on projections of the impact of obesity on future needs, Cawley and MacClean warn, "one should not be misled by the size of the current military into underestimating the possible future implications for national security of large numbers of military-age civilians being ineligible for military service."[131] They add, should national security requirements mandate a return to conscription, projections for an adequate number of eligible personnel become even more troublesome.

In addition, ethnic disparities among the overweight/obese will affect the pool of qualified applicants, and this deserves attention as well. Although women constitute a minority in the Services, increases in the percentage of women who fail to meet the standards could disparately affect the Services.

In the long term, recruiting could be affected by a variety of factors in addition to weight, such as:

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[128] Gubata, op cit.
[129] Ogden CL, Carroll MD, Kit BK, et al. Prevalence of obesity in the United States, 2009–2010. National Center for Health Statistics Data Brief No. 82. January 2012. http://www.cdc.gov/nchs/data/databriefs/db82.pdf. Accessed July 10, 2013.
[130] Trogdon, J. Obesity and Severe Obesity Forecasts Through 2030. Weight of the Nation 2012 Conference: Moving Forward, Reversing the Trend; May 7-9, 2012; Washington, DC. http://www.adph.org/ALPHTN/assets/TrogdonHandouts.pdf. Accessed July 17, 2013.
[131] Cawley and MacClean, op cit, page 3.

- Changes in the economy that lead to significant reductions in unemployment. Accessions of high-quality recruits increase when the unemployment rate among teenagers increases;[132]
- Demographic trends that result in a preponderance of subpopulations sustaining persistently higher rates of obesity;
- Prevailing political and national security issues that might make potential future applicants more or less interested in serving;
- Increase in income inequities that motivate some groups more than others to pursue military careers;
- Decrease in access to quality medical care, which could render some populations ineligible for service for medical and fitness reasons; and
- Increases in access to recreational drugs and drug use, which would disqualify more applicants from service.

In addition to eligibility to serve, the Department must face the reality that many who are eligible are simply not interested in serving.[133, 134] Currently, only 31 percent of youth aged 17 to 24 may be qualified to serve (based on medical, conduct, dependent and education requirements) (see Figures 2.4 and 2.5). Future changes in college enrollments as well as changes in the youth population may also affect recruitment efforts. Of youth aged 17 to 24, only 1.2 percent meet basic eligibility standards (including a BMI under 27.5), are high academic achievers, and are interested in military service (see Figures 2.4 and 2.5).[135]

These data demonstrate that it will be critical for the Department to continue to monitor these interrelated factors to determine the optimal solutions for ensuring a recruit market that is fit to fight, available to serve, and interested in serving.

[132] Gubata, op cit.
[133] Poling, September 2012, op cit.
[134] Fairley TP, Principal Research Scientist, JAMRS. "Joint Advertising Market Research and Studies Eligibility and Propensity Data." Presentation to the Defense Health Board, November 16, 2012.
[135] Poling, September 2012; op cit.

goals could be more difficult, requiring that steps be taken to ensure that those who want to serve are able to meet fitness standards. Several factors are contributing to the current recruiting successes, including the availability of new recruits, and high public regard for those who serve.[139] However, future planning requires systematic and regular review of trends in excess weight and body fat, scientific developments, and demographic changes in rates and how they align with regional and national recruitment rates.

> **Recommendation 1**: **There is currently no need to ease accession standards regarding overweight and obesity to meet recruitment targets. However, given the trends in the prevalence of overweight and obesity in the Nation, accession standards should be reassessed every three years to ensure that the ongoing objective of recruiting a fit force is met.**

Further, if the BMI ceiling were eased beyond the current 27.5 maximum into the higher overweight and obese range, six-month attrition rates may increase, leading to unrecoverable costs to the military Services. Although the Board initially questioned why the ceiling BMI (27.5) is so high and falls into the range classified as overweight by others (e.g., World Health Organization, National Institutes of Health), further investigation led the members to conclude that this seems reasonable given that many applicants may simply have a higher muscle mass at a BMI between 25 and 27.5, and may not in fact have excess fat. In addition, results from the ARMS study and the BCA pilot found that individuals in these weight ranges can be assessed for fitness and accessed with relatively good success. Moreover, attrition and discharge data do not reveal abnormal rates among those deemed overweight, although there are long-term morbidity concerns in this population.

However, lack of data regarding those who are turned away from recruitment centers because of overweight and obesity indicators creates challenges in assessing the actual recruitment losses related to these factors.

> **Recommendation 2**: **The Services should require recruitment centers to collect data regarding the total number of interested citizens applying and the proportion turned away because of an initial determination of unlikelihood to meet height-weight and/or body fat standards.**

Recruiters should maintain a low threshold for determining whether potential recruits meet height and weight standards, and conduct measurements of body fat on a selective basis among recruits. These measurement efforts should not be labor-intensive for the recruiters and should not detract from the overall goal of engaging youth. A study could be conducted as a pilot to determine the rate of denials based on BMI and/or body fat at selected centers in those states with the highest historical accession levels and obesity rates.

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[139] Greenberg Quinlan Rosner Research and Public Opinion Strategies Survey, June 2012. http://missioncontinues.org/docs/default-document-library/a_new_generation_of_leaders.pdf?sfvrsn=0. Accessed July 11, 2013.

Recommendation 3: DoD should launch a pilot project in selected Service recruitment centers to assess the feasibility of training recruiters to calculate BMI and collect circumference taping measurements (in accordance with the instructions noted in DoDI 1308.3) for potential recruits who appear to be overweight but who may have normal levels of body fat.

Data indicate that higher attrition rates are observed among obese recruits. Considering the cost of attrition among accessions, the results of accessioning more individuals through this pilot project who are overweight according to BMI but meet the standards for body fat percentage should be evaluated against attrition rates.

As may be the case among different civilian professions, certain military jobs or specialty areas may require more stringent fitness or body composition standards (e.g., Special Forces) based on differing physical demands. The Board accepts this requirement, but does not advocate for easing requirements for any specialist categories. A key tenet of military service is the need for readiness for any call to duty or action at all times. Specifically, any individual could be called up for deployment in a national security emergency or threat of war. As such, it is incumbent upon the Services to ensure that even though a job may not typically require a certain level of fitness, Service members must be able to operate in any environment or circumstance and not be limited by physical constraints.

Recommendation 4: **The current accession standards of height-weight and/or body fat should be maintained as a minimal requirement for all positions in the military in the interest of ensuring the availability of an agile and responsive fighting force. The Services should be encouraged to impose stricter standards as needed based on meeting the needs of their missions.**

III. Attaining and Maintaining Fitness Among Service Members

Introduction

Military service assumes a minimum level of physical strength and endurance. As such, regular fitness testing and physical exercise are key components of the training regimens of most military units, and most Service members must comply with Service-specific height-weight standards throughout their careers to remain in the military. In addition to the risks to health of overweight and obesity, as discussed in Section I of this report, obese or poorly fit individuals can be a hazard to themselves as well as to their units.

The *Healthy People 2010* objectives released in 2000 included the goal of increasing the proportion of adults with healthy weight, as defined by a body mass index (BMI; see Section I for a discussion of terms) greater than or equal to 18.5 and less than 25, to at least 60 percent.[140] DoD adopted this recommendation for its own personnel and is able to monitor progress through the DoD Survey of Health Related Behaviors (HRB) among military personnel.[141] The subsequent *Healthy People 2020* objectives set a target of 33.9 percent of adults achieving healthy weight.[142] The most recent data from the 2011 HRB Survey reveal that 34.7 percent of military personnel age 20 years or older met the 2020 healthy weight objective; higher than the 30.8 percent in the civilian population.[143]

As described in the previous section of this report, excessive weight and body fat has commonly been the leading medical reason applicants are disqualified for military service.[144] In 2012 alone, more than 6,100 soldiers, sailors, airmen and marines were discharged because of failure to meet their Service physical fitness standards.[145] According to the 2008 HRB survey, approximately 15 percent of men across the Services and 20 percent of women had difficulty meeting Service weight and/or body fat standards.[146]

Beyond the challenges these trends pose to military recruitment and retention, as described in Section II, overweight and obesity have implications for the health of the force and its mission readiness. Dr. Karl Friedl, former director of the U.S. Army's Telemedicine and Advanced

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[140] U.S. Department of Health and Human Services (HHS). *Healthy People 2010*. 2nd ed. [with Understanding and Improving Health (vol. 1) and Objectives for Improving Health (vol. 2)]. Washington, D.C.: U.S. Government Printing Office, November 2000.
[141] TRICARE Management Activity (TMA). Survey of Health Related Behaviors (HRB). http://tricare.mil/tma/dhcape/surveys/coresurveys/surveyhealthrelatedbehaviors/SHRB.aspx. Accessed July 18, 2013.
[142] HHS. *Healthy People 2020*. Nutrition and Weight Status. http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=29. Accessed July 18, 2013.
[143] TMA HRB, op cit.
[144] Mission Readiness: Military Leaders for Kids series. *Too Fat to Fight*. 2010. http://www.missionreadiness.org/2010/too-fat-to-fight/. Accessed July 14, 2013.
[145] Bopp K (Air Force), Wallinger J (Navy), McGuire B (Marine Corps), Palkosa F (Army). "Service Briefings." Presentations to the Defense Health Board, May 23, 2013.
[146] Peterson AL. University of Texas Health Science Center at San Antonio and University of Texas at San Antonio. "Weight Management in the Military." Presentation to the Defense Health Board, January 25, 2013.

Technology Research Center, wrote about the challenge of determining the optimal standards to meet the military's goals of readiness, health, and appearance.[147] The Marine Corps, for example, has the most stringent body fat percentage requirements because the culture of that Service places a high priority on appearance.[148] Finding the balance to ensure that the standards optimize the three components of appearance, readiness and health, without being so restrictive that Services struggle to fill their ranks in a time of need (i.e., war), continues to be a challenge.[149]

This section of the report focuses on prevalence of overweight and obesity in the Active Duty military population, the implications of each condition—overweight and obesity—for force health and readiness, current DoD standards and policies for reaching and maintaining healthy weight, recommendations of other groups for maintaining a fit force, and what is known about what works in maintaining and sustaining healthy weight in military populations.

Prevalence of Overweight and Obesity in Military Populations

Consistent with national trends, rates of overweight and obesity have also increased over time within the U.S. military population.[150] However, in evaluating prevalence data across the Services, several caveats are worth considering.

First, methods of data collection vary across surveys, as do the measures used to indicate overweight and obesity (see Appendix E). In some cases, surveys rely on self-reports, while in other cases ICD-9 codes are used, sometimes in combination with BMI measures. Some surveys rely on a classification of "clinical overweight," which includes all BMI levels of 25 and greater. Thus, it is sometimes difficult to ascertain precisely what fraction of an identified group is obese versus overweight, although many studies have adjusted for these differences.

Moreover, the DoD Physical Fitness and Body Fat Programs Procedures prescribed in DoD Instruction (DoDI) 1308.3 set a threshold of a BMI of 27.5 as the cutoff between normal weight and overweight for Active Duty members, so it is not always clear whether overweight includes all those with a BMI between 25 and 30, or just those with a BMI between 27.5 and 30 (as well as what the comparator groups are).[151]

To compound the problem, ICD-9 codes might not be properly assigned, or assigned at all. A 2010 structured data query of the Military Health System (MHS) electronic medical records of 3 million individuals over the age of 18 found that of the 15 percent of individuals with a BMI greater than 30, only 16 percent had an associated ICD-9 code for obesity in their medical

[147] Friedl KE. Body composition and military performance – Many things to many people. *Journal of Strength and Conditioning Research.* 2012;26(7):S87-S100.
[148] See Marine Corps Order 6110.3. Marine Corps Body Composition And Military Appearance Program. August 8, 2008. http://www.newriver.marines.mil/Portals/17/Documents/MCO%206110.3.pdf. Accessed August 12, 2013.
[149] Friedl, 2012, op cit.
[150] TMA HRB, op cit.
[151] DoD Instruction 1308.3. *DoD Physical Fitness and Body Fat Programs Procedures*. November 5, 2002. http://www.dtic.mil/whs/directives/corres/pdf/130803p.pdf. Accessed July 16, 2013.

record.[152]

Second, several studies have demonstrated that BMI is not always a valid measure in individuals because it cannot distinguish between fat and fat-free mass.[153] Thus, individuals with excess fat but not excess weight may be classified as having a healthy BMI (i.e., false negatives). In 2008, Heinrich et al. demonstrated that reliance on waist circumference or BMI alone in a military population underestimated obesity compared to measurements of body fat percentage.[154] More specifically, using BMI and the World Health Organization accepted definitions of obesity (as described in Section II in this report), the authors found that obesity was underestimated when compared with body fat. This study measured body fat using a field method, which tends to underestimate obesity, as well, when compared to dual-energy x-ray absorptiometry (DXA), which is a means for measuring bone mineral density and is considered the gold standard for assessing body adiposity.[155] The same was found for waist circumference (WC) measurements. These findings were statistically significant ($p < .05$). The study notes that although not ideal, BMI does offer several advantages from a logistical standpoint because "it is less intrusive (it does not require subjects to remove or raise their clothing), is more comparable across studies (compared with WC, which can be measured in a number of different ways, yielding varied results), and is simpler to obtain and report (i.e., it does not require special training)."[156] The authors suggest that in the future, combining WC and BMI may improve predictability.

Many surveys rely on self-reported data, for which some have questioned accuracy. However, a validity study using National Health and Nutrition Examination Survey (NHANES) data concluded that self-reported height and weight data did not differ significantly from measured data among younger adults.[157] Others have observed that self-reported heights and weights are reasonably accurate and acceptable for epidemiologic surveys.[158, 159]

For the foregoing reasons, it is difficult to ascertain with certainty the actual rates of overweight and obesity in military populations. Thus, survey data should be considered with these limitations in mind.

Of note, the Department has mandated the development of a system to collect and manage data on the weight, height, percent body fat, and fitness of all military personnel. In November 1998, the Government Accountability Office (GAO) completed a study on gender issues related to the

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[152] Stephens, MB. Coding and obesity: Room to grow. *JABFM.* 2011;24(3):329-330.
[153] Heinrich KM, Jitnarin N, Suminski RR, et al. Obesity classification in military personnel: A comparison of body fat, waist circumference, and body mass index measurements. *Military Medicine.* 2008;173(1):67-73.
[154] Heinrich et al., 2008, op cit.
[155] Bergman RN, Stefanovski D, Buchanan TA, et al.. A better index of body adiposity. *Obesity (Silver Spring).* 2011;19(5):1083-1089.
[156] Heinrich et al., 2008, op cit., p. 72.
[157] Smith TJ, Marriott BP, Dotson L, et al. Overweight and obesity in military personnel: Sociodemographic predictors. *Obesity*. 2012;20(7):1534-1538.
[158] Villanueva EV. The validity of self-reported weight in U.S. adults: A population based cross-sectional study. *BMC Public Health.* 2001;1:11.
[159] Bowman R, DeLucia J. Accuracy of self-reported weight: A meta-analysis. *Behavior Therapy*. 1992;23:637–655.

validity and equity of fitness standards in the military.[160] The final report was critical of DoD procedures relating to its Physical Fitness and Body Fat Program, highlighting a lack of uniformity in the fitness tests used by the services and lack of consistent methodology used for screening. In 2002, in response to the GAO findings, the military services were required per DoDI 1308.3 to establish an automated data registry to provide baseline statistics and track physical fitness and body measurements.[161]

A computer application, the Military Services Fitness Databases (MSFD) was developed to store and track data related to height, weight, and percent body fat for the Army Weight Control Program and Army Physical Fitness test scores.[162] It could then be used to generate reports. Piloted from 2003 to 2005 at Womack Army Medical Center, Fort Bragg, the MSFD successfully replaced three locally developed computer systems.[163] The system not only provided for soldiers to be tracked longitudinally, but also captured demographic information in a central location. Although system administrators anecdotally felt that the program was useful, the MSFD was not implemented or continued after the pilot project ended.[164]

Available Data

The 2011 HRB Survey of Active Duty Service members, fielded every three years to 300,000 randomly selected personnel, found that based on self-reported height and weight measurements used to calculate BMI, 54.2 percent of males across all ages were classified as overweight (BMI between 25 and 30), and 34.4 percent of females across all ages were overweight.[165] Smith et al. remind users of these data that the use of BMI as an estimate of body fat may misclassify some male respondents, in particular, as overweight because of excess lean mass.[166]

In addition, the 2011 HRB Survey found that 12.4 percent of all respondents reported a BMI of greater than 30 (6.4 percent for women and 13.5 percent for men). The Army (15.8 percent) and Navy (15 percent) reported the highest rates of obesity, and the Marine Corps reported the lowest rate (5 percent). By contrast, in 1995, fewer than 5 percent of Active Duty Service members were obese.

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[160] U.S. Government Accountability Office (formerly U.S. General Accounting Office). Gender Issues: Improved Guidance and Oversight Are Needed to Ensure Validity and Equity of Fitness Standards. GAO/NSIAD-99-9. http://www.gao.gov/archive/1999/ns99009.pdf. Published November 1998. Accessed July 16, 2013.

[161] Hodgdon JA. A History of the U.S. Navy Physical Readiness Program from 1976-1999. Technical Document No. 99-6F. Human Performance Department, Naval Health Research Center. San Diego, CA.

[162] Williamson, DA, et al. Military Services Fitness Database: Development of a computerized physical fitness and weight management database for the U.S. Army. *Mil Med.* 2009 January; 174(1):1-8.

[163] Ibid.

[164] Electronic communication with Dr. Andrew Young, U.S. Army Research Institute of Environmental Medicine, May 10, 2013.

[165] TRICARE HRB, op cit. The total number of complete usable survey respondents was nearly 40,000.

[166] Smith, TJ, et al. Overweight and obesity in military personnel: Sociodemographic predictors. *Obesity.* 2012 July; 20(7):1534-1538.

The Armed Forces Health Surveillance Center (AFHSC) reviewed medical records of individuals who served in the active component any time between 1998 and 2010.[167] Records of all outpatient encounters of active component members in fixed U.S. military and some non-military (i.e., purchased care) medical facilities were searched to identify U.S. military members with diagnoses specific for "clinical overweight."[168] The AFHSC analysis found that the number and prevalence of active component members who received at least one overweight or obesity diagnosis per ICD-9 codes more than tripled during that time period. Among the surveyed population the prevalence of overweight or obesity was higher among females than males during that time period and increased with age. The lowest prevalence of clinical overweight was among Marines and the youngest ages (less than 20 years).[169] Importantly, the increases in new cases that occurred from 2003 to 2008 leveled off through 2010. After that point, a majority of the increase in clinical overweight/obese cases is attributable to Service members who continued to serve and received a recurring diagnosis of clinical overweight.

Self-reported data from the 2012 population-based Health Care Survey of DoD Beneficiaries (HCSDB) show that among TRICARE-eligible adults responding to the survey in the fourth quarter of Fiscal Year 2012, an average of 24 percent were obese based on BMI; however, this number includes Active Duty personnel, military dependents, and retirees.[170] Rates of obesity were 17 percent for Active Duty Army, 14 percent for Active Duty Air Force, and 14 percent for Active Duty Navy. These rates are significantly lower than the obesity rate in the U.S. population; more than 35 percent of U.S. adults were obese based on BMI in 2009-2010.[171]

HCSDB data also show that among adults responding to the survey, 40 percent were overweight based on BMI.[172] Rates of overweight were similar across Active Duty members of the Services: Army at 51 percent, Air Force at 50 percent, and Navy at 52 percent. These rates are higher than the general U.S. population, in which one-third of Americans over age 20 are overweight (and not obese).[173] This suggests that many of these individuals may be classified as overweight based on BMI, but have increased lean muscle mass as a result of being physically fit. In general, obese people, as measured by BMI, are likely to also be overfat, meaning they have a high percentage

[167] Armed Forces Health Surveillance Center (AFHSC). Diagnoses of overweight/obesity, Active Component, U.S. Armed Forces, 1998-2010. *Medical Surveillance Monthly Report (MSMR).* 2011;18(1):7-11MSMR, 2011, op cit.
[168] Ibid. An outpatient encounter for clinical overweight was defined as an outpatient encounter with a diagnosis of "overweight" or "obesity" (ICD-9-CM: 280.0 or 278.00-278.02) or an adult BMI above 25 kg/m2 (ICD-9-CM: V85.2-V85.4) or a pediatric BMI above the 85th percentile for persons up to 20 years of age (ICD-9-CM: V85.53, V85.54).
[169] Ibid.
[170] TRICARE Beneficiary Reports. 2012 Annual Adult Beneficiary Report. http://www.tricare.mil/survey/hcsurvey/2012/bene/fy2012/html/p9-0-11-3q.htm. Accessed on July 16, 2013.
[171] Bannick R. Q4FY12 Health Care Survey of DoD Beneficiaries (HCSDB) of November 1, 2012.
[172] Ibid..
[173] Fryar DC, Carroll MD, Ogden CL. Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960–1962 Through 2009–2010. September 2012 Health E-Stats. CDC/National Center for Health Statistics. http://www.cdc.gov/nchs/data/hestat/obesity_adult_09_10/obesity_adult_09_10.htm. Accessed on July 16, 2013.

of body mass made up of fat.[174] Someone who is overweight but not overfat is likely to have a higher percentage of lean mass, in the form of muscle, which is heavier than fat.

Implications of Overweight or Obesity for Military Readiness

Beyond the health risks of overweight and obesity shared by the general population (as described in Section I), overweight, and particularly obese, military personnel face additional challenges in environments requiring muscular and cardiorespiratory endurance.

Data regarding the effects of overweight (not obese) on military readiness generally do not reveal adverse consequences beyond musculoskeletal injuries, although several issues are worthy of ongoing attention. A major question considered by the DHB is whether the current category of "overweight," that is, a BMI between 25 and 30, and for some Services 27.5, is a reliable indicator of fitness to serve, and whether it applies equally across all Services and military occupations.

For example, Friedl, while at the U.S. Army Research Institute of Environmental Medicine wrote:

> "The truth is that soldiers who are large are ideal performers of many of the Army's common tasks, which depend largely on carrying and lifting strength. They are larger than ever before, a desirable Army trait—'large and in charge'—with appearance of fitness and formidable size serving an important psychological advantage. Improved nutrition and medical care has added an average of 30 pounds of lean mass to the soldier, compared with Civil War soldiers over a century ago. All of this revives a very interesting question of what it means to health and performance to be large but lean."[175]

Because BMI takes into account the relationship between height and weight, it is important to note that for a given height, Civil War soldiers were generally underweight. However, over time the American population has become taller and caloric intake has improved.

Abundant research confirms the direct relationships among lean mass, strength, and work capacity. Strength is predicted by the cross-sectional area of muscle, and work capacity is determined by the amount of working muscle.[176] Friedl has shown that some of the strongest soldiers might also be the fattest; however, aerobic capacity falls off with increasing fatness.[177] Fogelholm et al. found that military personnel with higher levels of body fat had impaired cardiorespiratory function and reduced muscular and motor function, which reduced their ability

[174] De Mar Biblioni M, Pons A, Tur JA. Defining body fatness in adolescents: A proposal of the Afad-A Classification. *PLoS One*. 2013; 8(2): e55849.
[175] Friedl, KE. Can you be large and not obese? The distinction between body weight, body fat, and abdominal fat in occupational standards. *Diabetes Technology & Therapeutics.* 2004;6(5):732-749, p. 733.
[176] Institute of Medicine (IOM): Committee on Military Nutrition Research. Marriott BM, Grumstrup-Scott J, eds. *Body Composition and Physical Performance: Applications for the Military Services*. Washington, D.C.: The National Academies Press;1992.
[177] Friedl, 2004, op cit.

to complete physically challenging tasks.[178] Thus, body fat percentage is an important consideration in determining fitness to serve.

Chung and Pin found that soldiers with a BMI greater than 27 are 3.5 times more likely to suffer heat intolerance (heat stroke, exhaustion, syncope, cramps, fatigue, edema) than those with lower BMIs.[179] In 2010, Bedno et al. found a significantly increased risk of heat illness and outpatient utilization among male recruits with excess body fat in basic training.[180] It was estimated that approximately 70 percent of the relative risk for heat illnesses in men with excess body fat during basic training was associated with exceeding body fat standards.[181]

Several studies have focused on exercise and heat tolerance among obese members of the military. Typically these studies, using comparison groups, are conducted in basic training populations where it is easier to gather and track data than in populations in theater. However, epidemiologic studies in civilian populations have found higher rates of strains and sprains and overall injuries with increasing BMI.[182] Friedl and others have found that, irrespective of fat composition, higher BMI is associated with greater strains on joints and risks of osteoarthritis.[183, 184, 185] A study using Millennium Cohort data found that overweight and obese participants were significantly more likely to be diagnosed with Achilles tendinitis or plantar fasciitis (using ICD-9 codes) than normal or underweight individuals, after controlling for deployment and other demographics.[186]

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[178] Fogelholm M, Malmberg J, Suni J, et al. Waist circumference and BMI are independently associated with the variation of cardiorespiratory and neuromuscular fitness in young adult men. *International Journal of Obesity (London).* 2006;30(6):962-969.

[179] Chung NK, and CH Pin. Obesity and the occurrence of heat disorders. *Military Medicine.* 1996;161(12):739-742.

[180] Bedno SA, Yuanzhang L , Weiwei H, et al. Exertional heat illness among overweight U.S. Army recruits in basic training. *Aviation, Space, and Environmental Medicine.* 2010;81(2):107-111.

[181] The incidence odds ratio among male recruits with excess body fat compared to qualified male recruits was 3.63 (95 percent CI: 1.92, 6.85). Men with excess body fat had an increased incidence of heat illness with a rate ratio of 7.25 (95 percent CI: 4.17, 12.61).

[182] Finkelstein EA, Chen H, Prabhu M, et al. The relationship between obesity and injuries among U.S. adults. *American Journal of Health Promotion.* 2007;21(5):460-468. This study was based on a sample of 42,304 adults in the 1999–2000, 2000–2001, and 2001–2002 waves of the Medical Expenditure Panel Survey. Logistic regressions were used to separately estimate the odds of sustaining any injury by mechanism or by nature for overweight ($25 \leq BMI \leq 29.9$) and three categories of obese individuals compared with those who were normal weight.

[183] Friedl KE. Size matters. *American Journal of Clinical Nutrition.* 2011;93:485-486.

[184] Lee JR, and KE Friedl. Body fat standards and individual physical readiness in a randomized Army sample: Screening weights, methods of fat assessment, and linkage to physical fitness. *Mil Med*. 2002;167:994-1000.

[185] Vogel JA, and KE Friedl. Army data: Body composition and physical capacity. In: Marriott BM, Grumstrup-Scott J, eds. *Body Composition and Physical Performance: Applications for the Military Services*. Washington, D.C.: National Academy Press, 1992:89–103.

[186] Owen BD, Wolf JM, Seelig AD et al. Risk factors for lower extremity tendinopathies in military personnel. *The Orthopaedic Journal of Sports Medicine*; 2013; doi: 10.1177/2325967113492707 (Published 12 June 2013).

Zajdowicz and McKenzie found poor exercise tolerance among obese Active Duty Naval personnel.[187] Cowan et al. compared the incidence of and outpatient utilization for training-related overuse injuries among men who exceeded body fat standards compared to those who were weight qualified.[188] Those who failed to meet the standards, and were accessioned through the Assessment of Recruit Motivation and Strength (ARMS) program (see Section II), were 47 percent more likely to experience a musculoskeletal injury and had 49 percent higher healthcare utilization. Rates of injuries to the foot and ankle, lower leg, and back were higher in the excess body fat group controlling for all other risks (hazard ratio = 1.47, 95 percent confidence interval [CI] 1.30-1.66).

Several studies have found that overweight (BMI 25-29.9) individuals, primarily women, are more likely to fail basic training.[189] Bohnker et al. found that among Navy personnel, men and women with high weight for height are more likely to fail their semi-annual Physical Readiness Test.[190] Friedl has documented weight loss in both male and female trainees who exceeded body fat standards or were overweight a year following entry, during which they were subjected to rigorous physical fitness training.[191, 192] He also found that while men can lose weight and sustain that weight loss after basic training, women are more likely to regain the weight lost during basic training.[193, 194] Further, individuals with the highest body fat percentages lose the greatest amount of weight in basic training programs.

Health Implications of Overweight and Obesity in Military Populations

The health effects of overweight and obese for all populations were summarized in Section I. Additional studies have been conducted in military populations.

Data collected as part of the Millennium Cohort Study[195] show that increased BMI is associated with numerous chronic conditions in the military population.[196] Boyko et al. demonstrated that

[187] Zajdowicz MJ, and RT McKenzie. Predictors of successful physical readiness testing under the new standard: OPNAV Instruction 6110.1F. *Military Medicine.* 2003;168(5):394-398.
[188] Cowan D, Bedno S, Urban N, et al. Musculoskeletal injuries among overweight Army trainees: *Occupational Medicine*. 2011;61(4):247-252.
[189] Poston WSC, Haddock CK, Talcott GW, et al. Are overweight and obese airmen at greater risk of discharge from the United States Air Force? *Military Medicine.* 2002;167(7):585-588.
[190] Bohnker BK, Sack DM, Wedierhold L, et al. Navy physical readiness test scores and body mass index (Spring 2002 Cycle). *Military Medicine.* 2005;170(10):851-854.
[191] Friedl, 2004, op cit.
[192] Friedl, 2012, op cit.
[193] Friedl, 2004, op cit.
[194] Friedl, 2012, op cit.
[195] The Millennium Cohort Study is an ongoing study of the health of current and former U.S. military Service members with deployment experience. Initiated in 2000, the cohort includes a population-based random sample. The initial panel (2001 to 2003, with follow up between 2004 and 2006) garnered a 71-percent response rate to follow up surveys. Subsequent panels have had lower response rates; however, both studies cited here used the initial panel. Crum-Cianflone N. Department Head, Department of Deployment Health, Naval Health Research Center. "Deployment Health Research Department, Naval Health Research Center." Presentation to the Defense Health Board. January 23, 2012.

increasing BMI (28.8 ± 3.9) was significantly associated with an increased risk of diabetes (odds ratio [OR] = 1.20, 95 percent CI = 1.17, 1.23) among former and current Service members.[197]

Also using the Millennium Cohort data, Granado et al. found overweight (OR = 1.77; 95 percent CI = 1.58, 1.98) and obese (OR = 3.09; 95 percent CI = 2.69, 3.55) participants were more likely to newly report hypertension compared with normal/underweight participants.[198] In addition, obese participants were more likely to newly report coronary heart disease (CHD) (OR = 1.39; 95 percent CI = 1.03, 1.86) and have a new CHD diagnosis code (OR = 1.71; 95 percent CI = 1.12, 2.62) compared with normal/underweight participants.

HCSDB data show that overweight Active Duty Service members are not likely to rate their health as poor or their activities as limited, compared to normal weight individuals. However obese individuals are much more likely to rate their health as fair or poor and their activities limited as compared to other populations.[199] Analysis of 2002 HRB data by Haddock et al. found that overweight individuals were 27 percent more likely to report health problems than healthy weight troops; obese troops were 108 percent more likely to report health problems.[200] Moreover, those who were obese were 33 percent more likely to have received emergency medical care. Overweight individuals did not differ from healthy weight individuals in terms of restricted activity; however, obese troops were 75 percent more likely than healthy weight personnel to report restricted activity because of poor health.

A 2009 survey conducted by the AFHSC reported that the "diagnoses most often reported during the same medical encounters at which overweight/obesity is diagnosed were 'dietary surveillance and counseling', 'general medical examination', 'essential hypertension', 'disorders of lipid metabolism', 'other and unspecified disorders of joint' and 'other and unspecified disorders of back'."[201] Further, of Service members receiving their first overweight diagnosis in 2008, 26 percent had at least one outpatient encounter for a joint disorder within the prior year, and 16 percent had at least one encounter for a back disorder in the prior year. A more recent survey reported "joint and back disorders are among the leading causes of morbidity, lost duty time, and health care costs among military members in general."[202] Although the findings demonstrate a strong association between overweight/obesity and acute and chronic adverse health effects (e.g., musculoskeletal disorders, cardiovascular diseases, cancers), clinical correlations cannot be made.

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[196] Granado NS, Smith TC, Swanson GM, et al for the Millennium Cohort Study Team. Newly reported hypertension after military combat deployment in a large population-based study. *Hypertension.* 2009;54:966-973.
[197] Boyko EJ, Jacobson IG, Smith B, et al for the Millennium Cohort Study Team. Risk of diabetes in U.S. military service members in relation to combat deployment and mental health. *Diabetes Care.* 2010;33(8):1771-1771.
[198] Granado et al., op cit.
[199] Department of Defense. "Overweight in the military. Issue Brief: Health Care Survey of DoD Beneficiaries," 2005.
[200] Haddock CK, Pyle SA, Walker SCP, et al. Smoking and body weight as markers of fitness for duty among U.S. military personnel. *Mil. Med.* 2007;172(5):527-532.
[201] AFHSC. Diagnoses of overweight/obesity, Active Component, U.S. Armed Forces, 1998-2008. *Medical Surveillance Monthly Report (MSMR).* 2009;16(1):2-7.
[202] AFHSC, 2011, op cit.

In analyzing HRB data, Kress et al. found that obese members of the Active Duty military had increased odds of depressive syndromes as compared with their normal-weight counterparts, although the direction of the association was not established.[203] The authors concluded that DoD should "emphasize prevention and regular screening for obesity and depressive symptoms to improve readiness and reduce health care costs and disease burden." [204]

Physical Readiness Assessments, Retention Standards, and Attrition Rates

> "4.1.2. Body Fat. Maintaining desirable body composition is an integral part of physical fitness, general health, and military appearance. Service members whose duties require muscular and cardio-respiratory endurance may be hampered in performing their duties when body fat exceeds 26 percent in males and 36 percent in females. The Military Services shall implement body composition programs that enhance general health, physical fitness and military appearance. Departments must ensure that actual weight loss is viewed as less important than the reduction in body fat."
>
> DoDD 1308.1, June 30, 2004[205]

Once someone is accepted into a Service, he or she undergoes a basic training program that ranges in length from 6 weeks in the Air Force to 13 weeks in the Marine Corps. The goal of basic training in the military is to increase the fitness levels of recruits to be able to meet fitness standards. Physical readiness assessments are conducted at the completion of training and then on a regular basis throughout the military career. DoDI 1308.3 outlines physical readiness requirements for all Services, but each has its own standards and requirements, especially with regard to fitness tests.[206]

All Services conduct both a body composition assessment and a physical readiness/fitness test, although the specific requirements and implementation, as well as rules for mandatory separation because of failure, vary by Service. In addition, each Service has developed its own "Maximum Allowable Weight" table that is used to screen personnel semiannually. The retention standards are the maximum weights-for-height and percent body fat that military personnel are allowed short of referral to a weight management program. The maximum allowable percentage of body fat for men ranges from 18 to 26 percent depending on service and age, while for women it ranges from 26 to 36 percent.

The regulations that accompany these tables provide objectives for each of the Services' weight standards. These consist of two components: health and fitness standards, and appearance standards. Body composition is a critical component of fitness standards. Body fat composition (percent body fat) is used as the final determinant in evaluating an applicant's acceptability when

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[203] Kress AM, Peterson MR, Hartzell MC. Association between obesity and depressive symptoms among U.S. military active duty service personnel. *Journal of Psychosomatic Research.* 2006;60:263-271.
[204] Ibid, p. 263.
[205] DoD Directive. *DoD Physical Fitness and Body Fat Program.* June 30, 2004. http://www.dtic.mil/whs/directives/corres/pdf/130801p.pdf. Accessed July 14, 2014.
[206] DoD Instruction 1308.3. *DoD Physical Fitness and Body Fat Programs Procedures*. November 5, 2002. http://www.dtic.mil/whs/directives/corres/pdf/130803p.pdf. Accessed July 16, 2013.

his or her weight exceeds that listed in the weight tables. For example, the Navy uses "within standards" or "out of standards" as cutoff points that are based on body composition analyses, including height and weight screening combined with circumference measurement. For the Navy, obesity is defined based on body fat, rather than BMI.

In addition to body fat/weight assessments, each Service deploys its own form of physical readiness test. Fitness is measured by an annual or semiannual physical fitness test, which typically involves performance of a specific number of crunches or sit-ups, pushups, pull-ups and a timed 1.5 or 2-mile run (this varies by Service, gender, and age). Individuals who do not meet the standards can be involuntarily enrolled in a reconditioning program or discharged from service. Commanding officers have the authority to administratively separate personnel who fail readiness tests although the allowable frequency and timing of the policy actions differ across the Services. Personnel can also be denied promotions, training opportunities, bonuses, transfers, awards, vacations, deployment, or leave. Waivers may be granted under certain circumstances, but regardless of the exemption, Service members are encouraged to maintain an appearance befitting military membership (see Box 3A).

The standards and policies for each Service are described below, as well as what is known about rates of attrition because of failure to meet standards.

BOX 3A: Waiver Policies

Policies take into account medical conditions that may result in a change of weight or fitness status, such as pregnancy or amputation. The Marine Corps allows medical, pregnancy and Combat Zone Deployment waivers for physical fitness assessments.[207] Within the Air Force, exemptions for the fitness assessment are available for those members who have medical illness or disabilities, are deployed or are being deployed, or are pregnant, or for other circumstances with the approval of a commander in cases of catastrophic events or terminal leave/temporary duty assignment.[208]

In the Army, alternative physical fitness tests are available for those Service members who have a permanent physical profile that may prevent them from participating in a component of the test. Soldiers with temporary physical profiles of long duration may also take alternative tests, with the approval of the commander and health care personnel. Soldiers are given three months to prepare for these alternative tests from either the date of the profile or the date recommended by health care personnel.[209] Body composition, monitored in the Army by height and weight, is associated with its own set of waivers. A soldier may request a medical exam if he or she believes that there is an underlying medical condition that is a direct cause of weight gain or inability to lose weight. Such Service members will be flagged and given 6 to 12 months to resolve their medical conditions and will temporarily be exempt from the requirement to make satisfactory progress. Certain medications (e.g., for post traumatic stress disorder) or the inability to perform aerobic activities may contribute to weight gain but are not considered sufficient justification for continued exemption from the requirement. Exemptions from the body composition program include those soldiers with major limb loss, pregnant and post-partum soldiers, new recruits within 180 days after entry, soldiers on approved continued active duty and/or continued active reserve status, and those who have undergone prolonged hospitalization for 30 or more continuous days. [210]

Though these waivers exist, policies have been established to prevent their abuse or misuse. For example, within the Navy, medical waivers are available, with commanding officers having the final authority over the waiver; however, if an individual is given three waivers within four years, review by a medical board is required. [211]

[207] McGuire B., U.S. Marine Corps' MAGTF Training Standards Division, Training and Education Command. "USMC Fitness and Weight Control Policy Brief for the Defense Health Board." Presentation to the Defense Health Board, May 23, 2013.
[208] Bopp K., Headquarters U.S. Air Force. "The Air Force Fitness Program." Presentation to the Defense Health Board, May 23, 2013.
[209] Army Regulation 350-1. *Army Training and Leader Development*. Headquarters, Department of the Army Washington, DC August 4, 2011.
[210] Ludwig C, Army Assessment Office of the Deputy Chief of Staff, G1. "AR 600-9 Weight Control Program." Presentation to the Defense Health Board, May 23, 2013.
[211] Wallinger J., Navy Personnel Command, Physical Readiness Program. "Naval Physical Readiness." Presentation to the Defense Health Board, May 23, 2013.

Air Force

The Air Force is the only Service that is exempt from DoD's Weight and Body Fat Program policy on using BMI as a standard, and uses abdominal circumference (AC) as the primary screen for adherence to body composition standards. Points are allotted for AC size, by age group, such that a smaller waist measurement taken just above the uppermost border of the iliac crest receives a higher score. The maximum waist size across age groups is 39 inches for men and 35.5 inches for women. The Air Force prefers the AC because it is a single measurement, an easily understood concept (akin to belt size), a stronger predictor of multiple health risks, easier to administer, and enables airmen to track their own progress.

The Air Force uses the "Fitness Assessment" (FA) to determine whether Airmen meet fitness requirements. Developed in 2004, the FA is a single program covering both fitness and body composition. There are four components to the FA that are scored individually, with each contributing to a certain proportion of the composite score: abdominal circumference (20 percent); push-ups (10 percent); sit-ups (10 percent); and a 1.5-mile run or 1-mile walk aerobic assessment (60 percent). To pass, the composite score must be 75 points or higher, out of a possible score of 100, and each component must receive passing scores. The FA offers incentives to Airmen to achieve higher scores by reducing the frequency of required FAs for those receiving higher scores. Airmen receiving "Excellent" scores, those ranging from 90 to100 points, are tested once per year; Airmen receiving "Satisfactory" scores, those ranging from 75 to 89.9 points, are tested twice per year; and Airmen receiving "Unsatisfactory" scores, those below 75 points, are enrolled into the Fitness Improvement Program. If an airman fails the AC portion of the test and passes all of the other components, he or she is measured using BMI taping guidance per DoDI 1308.3. If he or she meets the BMI standard, a passing score is awarded.

Airmen are exempt from the FA if they have certain medical waivers or are deployed, if the commander invalidates the FA because of illness or injury, or if the individual is pregnant. Furthermore, Airmen may be declared exempt from certain components of the assessment if they have an authorized condition, such as arthritic knees that prevents them from performing well on that portion of the assessment.

To pass the FA, airmen must pass each component individually. Depending on the pass level, airmen must complete the test either once or twice per year. Airmen who fail the FA more than four times within a two-year period may be processed for administrative separation. Figure 3.1 shows the number of separations in recent years (by calendar year) because of failure to meet the FA standards.

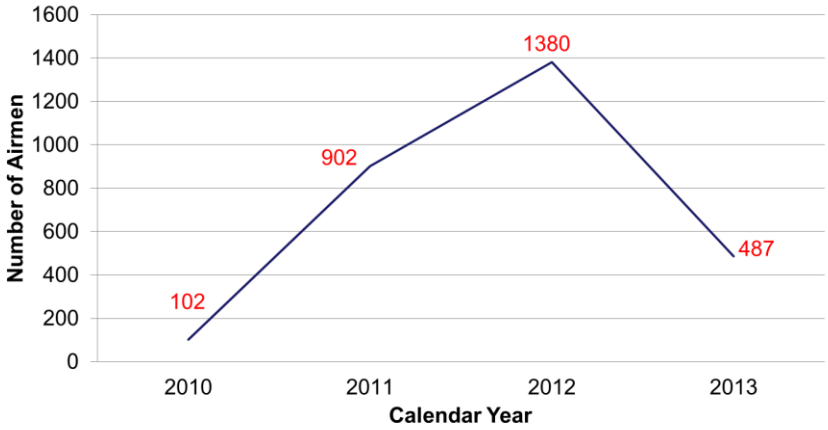

Figure 3.1: Air Force Separations for Failure to Meet FA Standards

Source: Bopp K., Headquarters U.S. Air Force. "The Air Force Fitness Program." Presentation to the Defense Health Board, May 23, 2013. The 2013 data are through April only.

The following steps are mandatory actions following an unsatisfactory score: 1) the Fitness Assessment Cell creates a case file that remains active for 24 months, 2) the unit commander conducts administrative actions (if any) and AF Form 108 is completed to document mandatory education and intervention requirements, 3) a medical provider signs the AF Form 108 if the airman is referred for medical evaluation, and 4) the airman must complete the requirements and retake the fitness assessment in 90 days. Administrative actions range from verbal counseling to a delay of promotion to reenlistment ineligibility. The commander must make a retention recommendation after four fitness assessment failures within a 24-month period. Remediation programs include the "Fitness Improvement Program" (FIP) and "Balanced Eating-Workout Effectively-Live Long" (BE WELL). FIP is a required program for all airmen with a composite fitness score of unsatisfactory. It is a unit-based or fitness center-based program that may consist of monitored exercise, documented exercise participation, and monthly follow-up appointments at a Health and Wellness Center. BE WELL targets nutritional and exercise behavior changes necessary to improve individual health and fitness. Members must be enrolled within 10 duty days of failure.[212]

In 2008, the Air Force reported that although almost 12 percent of the force was obese, 94 percent received a passing score on their fitness exam that year.[213] It was also noted that of the 39,000 airmen considered obese that year, only 156 were separated for failure to pass fitness standards.

[212] Bopp, 2013, op cit.
[213] Hoffman M. 55 percent of airmen overweight. *Air Force Times.* April 28, 2008. http://www.airforcetimes.com/news/2008/04/airforce_fat_AF_042808w/. Accessed on April 25, 2012.

Army

The Army's Body Composition Program (ABCP; formerly known as the Army Weight Control Program), is governed by Army Regulation (AR) 600-9 and is administered separately from its Physical Fitness Assessment, which is governed by AR 350-1.[214, 215]

The Army evaluates its soldiers for weight every six months, at a minimum. Soldiers undergo screenings against height-weight standards. If a soldier fails to meet the cut-off levels, he or she is "taped," or assessed for body composition. Screeners use the circumference tape method for this purpose with three points of measurement for women and two points of measurement for men. Soldiers exceeding the body fat standards for their age group and gender are enrolled into the ABCP.[216]

The Army's Physical Fitness Test (APFT) was implemented in 1980 and consists of push-ups (two minutes), sit-ups (two minutes), and a 2-mile run. Approved alternate aerobic assessments to the run are an 800-yard swim, a 6.2-mile bike ride (stationary or track), or a 2.5-mile walk. Soldiers have two hours to complete the assessment. APFT scores are annotated on DA Form 705, the "APFT Scorecard." The APFT assesses upper body, trunk, and lower body muscular endurance, and aerobic capacity. Male and female soldiers perform the same events, but the standards are adjusted for age and physiological differences. The maximum score is 300 points, and a soldier must receive at least 60 points for each component to pass. Alternate aerobic events are scored pass/fail. Active Army and active Guard/Reserve soldiers take the APFT at least twice each calendar year. Soldiers with temporary medical conditions are not required to meet standards until authorized by a physician. Other program exemptions include major limb loss (above ankle or wrist), being in an approved Active Duty/Reserve status, pregnancy and the postpartum period, prolonged hospitalization, and being within 180 days of entry into active service.[217]

If a soldier does not meet the body composition requirement (body fat standard for his or her age group and gender), he or she will be "flagged" on his or her record, be unable to be promoted or attend training courses, and be subject to separation if he or she does not achieve satisfactory progress in the ABCP. Soldiers that fail must acknowledge enrollment into ABCP in writing, complete and return a Soldier Action Plan outlining a course of action for meeting weight requirements, meet and review this plan with a dietician or health care provider within 30 days, and participate in monthly unit ABCP assessments (weigh-in and body fat test).[218]

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[214] Department of the Army, Headquarters. Army Regulation 600-9. The Army Weight Control Program. November 27, 2006.
[215] Department of the Army, Headquarters. Army Regulation 350-1. Army Physical Fitness Test.
[216] Ludwig C. Army Assessment Office of the Deputy Chief of Staff, G1. "AR 600-9 Weight Control Program." Presentation to the Defense Health Board, May 23, 2013.
[217] Palkoska F. Army Physical Readiness Division. "Army TRADOC-Army Fitness." Presentation to the Defense Health Board, May 23, 2013.
[218] Ludwig, 2013, op cit.

To complete the program, soldiers must meet body fat standards and show satisfactory monthly progress (one percent body fat loss or 3-pound weight loss). If the soldier does not show satisfactory progress, the commander may request separation from service or bar re-enlistment, involuntarily transfer the soldier to the Individual Ready Reserve, or comment on the evaluation. Recidivism is addressed in the Army policies, as well. Soldiers that exceed body fat standards within 12 months of finishing the ABCP will be separated, and those that exceed standards again within 36 months will be given 90 days to meet the standard, or be separated. Typically, subject officers will resign prior to forced separation.[219]

Recent trends in discharges of Active Duty Enlisted Soldiers because of failure to meet the Army Body Composition Program requirements are shown in Table 3.2.[220, 221]

Table 3.2. Number of Army Physical Fitness Test (APFT) and Army Body Composition Program (ABCP) Failures by Year

Fiscal Year	APFT	ABCP	Total
2000	262	1189	1451
2001	550	995	1545
2002	310	944	1254
2003	344	873	1217
2004	422	767	1189
2005	221	824	1045
2006	59	575	634
2007	63	111	174
2008	87	168	255
2009	189	245	434
2010	375	460	835
2011	497	870	1367
2012	1287	1815	3103

Navy

The Navy employs a Body Composition Assessment (BCA) per the DoDI 1308.3. Younger men may measure at a maximum of 22 percent body fat, and men over 40 years of age may have no more than 23 percent body fat. Women are allowed a maximum of 33 percent body fat, unless they are over 40 years of age, in which case they are allowed a maximum of 34 percent body fat.[222]

[219] Ibid.
[220] Ibid.
[221] Palkoska, 2013, op cit.
[222] Wallinger J. Navy Personnel Command, Physical Readiness Program. "Navy Physical Readiness." Presentation to the Defense Health Board, May 23, 2013.

The Navy's "Physical Fitness Assessment" (PFA) occurs twice annually and involves a medical screen (a Physical Activity and Risk Factor Questionnaire and a Periodic Health Assessment), a body composition assessment, and a physical readiness test involving curl-ups, push-ups, and a 1.5- mile run or alternate cardiovascular test. Sailors with medical waivers are exempt from the PFA, based on medical input and the final authority of the commander. If a sailor has three waivers within four years, his or her case will go before a medical board for determination.[223]

After one failure, an individual is counseled and ineligible for advancement (until passing), and is enrolled in the Fitness Enhancement Program (FEP), in which the Navy uses a proactive approach. Participation is at the member's or commander's discretion, but is mandatory in response to failing the physical fitness assessment. When mandatory, sailors are required to engage in physical training three times per week at a minimum, undergo counseling, participate in one nutrition and weight management program, and remain in FEP until officially passing the Physical Fitness Assessment and receiving good scores in all categories of the Physical Readiness Test. For a single failure, a sailor is enrolled in FEP, is counseled, and is ineligible for advancement. However, if the sailor experiences three failures within four years, he or she may be ineligible to re-enlist, transfer, or extend service; be processed for administrative separation (ADSEP); be subject to board review (if he or she has served in the Navy for more than six years); or be approved for a Readiness Waiver (exemption).[224]

Remediation options include: 1) ShipShape, an evidence-based, eight-week group program for Active Duty members, retirees, and family that emphasizes nutrition, activity, and psychological approaches to behavior change and includes an individually tailored weight loss plan with a maintenance phase; 2) individualized counseling following U.S. Preventive Services Task Force guidelines; 3) self-help, which means receiving the Nutrition Resource Guide and self-monitoring; and 4) commercial weight loss programs at the member's expense.[225] Recent trends in the number of separations are shown in Figures 3.2 and 3.3.[226]

[223] Wallinger, 2013, op cit.
[224] Wallinger, 2013, op cit.
[225] Ibid.
[226] Ibid.

officers achieved the recommended level of more than two days of strength training per week compared to 75 percent of enlisted personnel.[228]

Studies of Navy personnel find that increasing BMI is associated with decreased physical readiness test performance.[229] A 2008 study of Active Duty staff at a major naval medical center found that a significant proportion of obese participants (11.5 percent) failed the physical readiness test. Obese personnel were twice as likely to fail the test compared with any other BMI category.[230] The authors concluded that BMI was the single most important predictor of failing a physical readiness test.

Marine Corps

As part of their physical fitness assessment, marines must also pass a weight and body fat assessment, in conjunction with fitness standards. The Marine Corps is the only Service to require a strength test at the point of accession. Once in the Corps, marines are required to complete a physical fitness test and a combat fitness test, and be in compliance with the height-weight tables or body fat standards. The fitness tests are completed once per year, and the weight-for-height is assessed semiannually.[231]

The Marine Corps' PFA has two major components: the physical fitness test and the combat fitness test. The physical fitness test scores performance on pull-ups, crunches, and a 3-mile run. The combat fitness test includes an 800-yard run, the Ammo Lift (the number of times the marine is able to lift a 30-pound weight in two minutes), and Maneuver Under Fire (sprints involving changes in direction). Active Duty and Reserve marines must undergo the PFA. The Marine Corps grants waivers for medical, pregnancy, and combat zone deployment reasons.[232]

Failure of the physical fitness test is perceived very negatively and is annotated on the marine's record, thus affecting promotion potential and may result in discharge if it occurs twice.

Marines who fail the physical fitness assessment are counseled for unsatisfactory performance, provided an adverse Fitness Report, and given adverse Proficiency/Conduct marks. Failing this test negatively affects the member's opportunity for re-enlistment or promotion. Unlike the other Services, no strict number of failures results in discharge; however, a marine is not permitted to re-enlist if he or she cannot pass both the physical fitness test and combat fitness test (a Marine Corps-specific strength test).[233]

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[228] Ibid.
[229] Bohnker et al., 2005, op cit.
[230] Gantt CJ, Neely JA, Villafana IA, et al. Analysis of weight and associated health consequences of the active duty staff at a major naval medical center. *Mil. Med.* 2008;173(5):434-440.
[231] McGuire, 2013, op cit.
[232] Ibid.
[233] Electronic Communication from MSgt Eric M. Hickman, Career Planner, Marine Corps Recruiting Command. July 17, 2013.

The number of discharges in recent years because of failure to pass the physical fitness assessment was 92 in 2010, 186 in 2011, and 132 in 2012.[234]

Data from the Accession Medical Standards Analysis and Research Activity (AMSARA)

Although a majority of male applicants and accessions (those who have been accepted for entry into a respective Service) to the military have a normal BMI, trends over time indicate that there is an increase in obese BMI among applicants and accessions.[235] Obese applicants to the military have higher attrition rates in the first six months of service and overall when compared to those who are not obese.[236] In fact, 20 percent of attrition (premature separation) is attributable to obesity.[237]

AMSARA conducted a study of attrition among healthy weight, overweight, underweight and obese Active Duty U.S. Army enlistees and found that six-month attrition rates were higher among obese and underweight applicants than applicants who were normal weight or overweight.[238] The cost of attrition is considerable.

AMSARA conducted a study among Active Duty Army enlistees to assess the relationship between BMI measured at accession and premature separation (attrition) within the first three years of Service. Of first-time Army Active Duty enlistees from the period 2001-2011, there were 514,257 men and 106,053 women. In this cohort, among both males and females, enlistees with an underweight BMI had the highest attrition rate (29.2 percent for males, 47.5 percent for women), followed by those that were obese (males 27.8 percent, females 45.9 percent). The relative risk of attrition among men, comparing underweight, overweight, and obese enlistees to normal weight, was statistically significant for all comparisons, but involved small differences. Obese recruits had a 9-percent increased risk of attrition, and overweight recruits had a 3-percent decreased risk of attrition.

AMSARA also conducted an attributable risk and number needed to screen analysis, finding:

> "Among males, 3.6% of attrition in the first three years of service can be attributed to underweight BMI, and 2.2% can be attributed to obese BMI. Among females, 3.2% of attrition in the first three years of service can be attributed to underweight BMI, and 1.6% to obese BMI. Among men, 46 recruits would need to be screened out to identify one at increased risk of attrition due to obese BMI, and 27 recruits would need to be screened out to identify one at increased risk of attrition due to underweight BMI. Among women, 62 recruits would need to be screened out to identify one at increased risk of attrition due

[234] McGuire, 2013, op cit.
[235] Gubata M. Accession Medical Standards Analysis and Research Activity (AMSARA), Preventive Medicine Program, Walter Reed Army Institute of Research. "Accession Medical Standards Analysis and Research Activity." Source: 2012 Annual Report. Presentation to the Defense Health Board, September 17, 2012.
[236] Ibid.
[237] Ibid.
[238] Ibid.

to obese BMI, and 31 recruits would need to be screened out to identify one at increased risk of attrition due to underweight BMI".[239]

Of those medically disqualified for service, nearly 20 percent relate to "overweight, obesity or another hyperalimentation" (ICD-9 Code 278).[240, 241] Research by Packnett et al. suggest that "enlistment BMI and medical status at the time of the preenlistment physical play an important role in early discharge and may provide a valuable tool in the development of fitness, nutrition, and injury-prevention interventions in higher-risk groups."[242] Although Packnett et al. found that elevated rates of discharge were found in individuals with BMIs greater than 33, underweight individuals were more likely to be discharged.

Overall, given the small differences among risks of attrition related to normal, overweight and obese BMI groups, AMSARA concluded that elevated accession BMI does not appear to be an important predictor of attrition over the first three years of service.[243] However, as rates of overweight and obesity continue to rise in the United States, these rates may change and should be closely monitored, as the costs to recruit, access, and train new recruits are significant. AMSARA estimates that, on average, recruiting, screening, and training costs are approximately $75,000 per enlistee (not including officers). As the Department faces shrinking budgets and pressure to be leaner and more efficient, unrecoverable costs associated with early attrition of individuals because of a preventable conditions are likely to be increasingly less tolerated**.**

Additional Data on Attrition or Discharge Because of Overweight or Obesity

The Armed Forces Health Surveillance Center tracks population-based data on attrition because of health and weight factors. Time in service following failure to meet standards has been used as a proxy for time of discharge.[244] Personnel in ground-combat associated occupations (e.g., armor, infantry) faced shorter times in service following an overweight diagnosis; healthcare workers served the longest following an overweight-related diagnosis.[245]

Overall, during the 2006-2010 period, the durations of service for those with an overweight-related diagnosis were 18 months shorter for obese individuals and 9 months shorter for overweight individuals than for those not receiving such diagnoses.[246] Data also show that

[239] AMSARA. Preventive Medicine Program, Walter Reed Army Institute of Research. *Annual Report 2011*. http://www.amsara.amedd.army.mil/Documents/AMSARA_AR/AMSARA_AR_2011.PDF. Accessed July 14, 2014; p. 13.
[240] However, it is important to note that because of gaps in data collection processes, it is difficult to categorize the specific reason(s) for disqualification.
[241] Gubata, op cit.
[242] Packnett ER, Niebuhr DW, Bedno SA, et al. Body mass index, medical qualification status, and discharge during the first year of US Army service. *The American Journal of Clinical Nutrition.* 2011;93:608-614.
[243] AMSARA, op cit, p. 13.
[244] AFHSC, 2011, op cit.
[245] Ibid.
[246] Ibid.

Service members still in service three years after their initial diagnosis of overweight are just as likely to remain in service as their counterparts who never received an overweight diagnosis.[247]

Nolte et al. have pointed out that some populations with higher prevalence of overweight and obesity—non-Hispanic blacks and Hispanics in particular—are disproportionately represented in military populations and thus might be disproportionately represented in groups that fail to meet weight standards.[248] A 2011 analysis of duration of service after an overweight-related diagnosis found that Hispanic and black non-Hispanic personnel had the shortest durations of service following such a diagnosis.[249]

Research by McNulty has found that women in the Army and Marine Corps report negative career paths once they have failed a height-weight evaluation, even when body fat is within the standards.[250] In addition, McNulty's research found higher rates of eating disorders, such as anorexia nervosa and bulimia nervosa, in women in the military than would be expected based on general population data. Peterson et al. also found increased bulimic weight-loss behaviors in military populations when compared to civilian comparators.[251] Friedl speculates that one possible reason for "eventual failure of large recruits may be the failure to fall in line with army body fat standards rather than because of injury or performance failure."[252] Thus, the pressure to meet weight standards is great.

This pressure contributes to supplement use to control weight among overweight and obese military members. Based on data from the DoD Survey of Health-Related Behaviors Among Active Duty Military Personnel, Bray et al found that as many as 60 percent of Active Duty personnel have used dietary supplements.[253] An analysis of the Millennium Cohort Study found that nearly half of the subjects report use of bodybuilding, weight-loss, or energy supplements. Deployment experience, problem drinking, and reduced sleep have been identified as characteristics associated with supplement use.[254] With the most stringent fitness guidelines, marines of both genders are most likely to use supplements as compared to other Services.

In response to these findings, and given that the U.S. Food and Drug Administration has not approved these supplements for safety or efficacy, DoD has acknowledged concern about the safety of its military members who use these products. Consistent with Institute of Medicine

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[247] Ibid.
[248] Nolte R, Franckowiak SC, Crespo CJ, et al. U.S. military weight standards: What percentage of U.S. young adults meet the current standards? *The American Journal of Medicine.* 2002;113:486-490.
[249] AFHSC, 2011, op cit.
[250] McNulty, PAF. Prevalence and contributing factors of eating disorder behaviors in active duty service women in the Army, Navy, Air Force and Marines. *Mil. Med*. 2001;166(1):53-58.
[251] Peterson AL, Talcott GW, Kelleher WJ, et al. Bulimic weight-loss behaviors in military versus civilian weight-management programs. *Mil. Med.* 1995;160(12):616-620.
[252] Friedl, 2011, op cit.
[253] Bray RM, Hourani LL, Olmsted KLR, et al. 2005 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel. 2006. Prepared for Department of Defense by RTI International.
[254] Jacobson IG, Horton JL, Smith B, et al. Bodybuilding, energy, and weight-loss supplements are associated with deployment and physical activity in U.S. military personnel. *Annals of Epidemiology.* 2012;22(5):318-330.

(IOM) recommendations,[255] DoD initiated an education campaign regarding dietary supplement use in May 2013. Operation Supplement Safety aims to teach Service members, their families, and healthcare providers about safe supplement use.

The Army is aware of supplement use and attempts to schedule physical assessments on different days than weight and body fat assessments to decrease the risk to Service members who may be using supplements to assist with weight control.[256] Although supplements can contribute to a healthy lifestyle, users must be aware of possible associated risks. Dietary supplements do not undergo the same regulatory scrutiny required of prescription medications, may contain ingredients that are not benign, can have strong effects on the body, and may interact with other medications causing potentially dangerous reactions.[257] According to a Food and Drug Administration consumer alert, many weight loss supplements marketed with fraudulent messages are contaminated with ingredients that have previously been banned from the market, or contain active combinations of ingredients, such as hypertension and seizure medications that pose potential dangers to users.[258]

Remediation and Population-Based Programs to Foster a Healthier Force

Remediation policies and programs for personnel who fail to meet weight/physical fitness standards may include a healthy living workshop (e.g., nutrition, behavior change) or a fitness improvement program. In addition, each Service has an instruction for its fitness program and over the past few years has developed extensive Service-wide or base-specific fitness initiatives (see Appendix F). Anecdotally, Service members who fail to meet weight/physical fitness standards often see remediation programs as punishment. Thus, stigma is often associated with participation in these programs. Service representatives told the Board that expanding the programs and targeting general Service member and family wellness could reduce the negative perspectives many hold of participation in weight loss and fitness programs.

In addition to remediation programs, a variety of Service-based and joint programs aim to foster an overall healthier force. Joint programs include the "Go for Green" food identification system within Service dining facilities, which labels foods that should be eaten often as compared to unhealthier foods which should be eaten less often. An additional joint campaign is "Operation Supplement Safety" that is targeting the use of dietary supplements. Recent programs and initiatives such as the Healthy Base Initiative, Total Force Fitness, and Living Fit view health holistically, combining tobacco-free living, fitness, nutrition, and mental and emotional well-being. Appendix F summarizes a number of past and present initiatives.

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[255] National Research Council. *Use of Dietary Supplements by Military Personnel*. Washington, DC: The National Academies Press, 2008.
[256] Palkoska, op cit.
[257] National Institutes of Health Office of Dietary Supplements. Fact Sheet: Background Information – Dietary Supplements. http://ods.od.nih.gov/factsheets/DietarySupplements-HealthProfessional/. Accessed July 17, 2013.
[258] U.S. Food and Drug Administration. Beware of fraudulent weight-loss "dietary supplements." Consumer Health Information Fact Sheet. March 2011. http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm246742.htm. Accessed July 17, 2013.

Service Instructions typically provide guidelines for aerobic fitness, muscular fitness, flexibility, and body composition. For example, the Air Force Instruction 10-248, Physical Fitness outlines the following goals:

> "The goal of the Fitness Program (FP) is to motivate all members to participate in a year-round physical conditioning program that emphasizes total fitness, to include proper aerobic conditioning, strength/flexibility training, and healthy eating. Commanders and supervisors must incorporate fitness into the AF culture to establish an environment for members to maintain physical fitness and health to meet expeditionary mission requirements and deliver a fit and ready force. The annual fitness assessment provides commanders with a tool to assist in the determination of overall fitness of their military personnel."[259]

Military weight loss and fitness guidelines have been developed based on the recommendations of independent bodies, most notably, the Institute of Medicine's Committee on Military Nutrition Research/Subcommittee on Military Weight Management.[260] The recommendations from that group, as well as from other reviews, are described later in this chapter.

Physical activity[261] is a key focus area for all Service-recommended interventions and best practices concerning weight loss and management because of the simple reality that weight loss and maintenance is directly affected by balancing appropriate caloric intake with adequate caloric expenditure. The Services also allow, and depending on status, require, Service members to engage in physical fitness activities during duty. As a result of Service fitness requirements and physical demands associated with many Service occupations, the Active Duty, Reserve and National Guard populations are likely much more physically active than the general U.S. population.

Nutrition is also a focus of Service-specific health, wellness, and fitness programs. The 2011 HRB survey found that less than 15 percent of Active Duty Service members consume three or more servings of fruits, vegetables or whole grains each day.[262] The finding is consistent with findings in the civilian population from NHANES.[263] However, the HRB Survey uses self-report data whereas the civilian data comes from the NHANES. Some have questioned accuracy of self-reported data. However, a validity study using NHANES survey data concluded that self-

[259] Air Force Instruction 10-248. *Fitness Program.* May 24, 2005, p. 1. http://www.au.af.mil/au/awc/awcgate/af/afi10-248.pdf. Accessed August 12, 2013.
[260] IOM: Subcommittee on Military Weight Management, Committee on Military Nutrition Research, Food and Nutrition Board. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: The National Academies Press; 2003.
[261] For the purposes of this report, we define physical activity in accordance with definition used in the Physical Activity Guidelines for Americans as "bodily movement that enhances health." (2008 Physical Activity Guidelines for Americans.)
[262] U.S. Department of Defense. *2011 Health Related Behaviors Survey of Active Duty Military Personnel: Executive Summary*. 2013.
[263] Kimmons J, Gillespie C, Seymour J, et al. Fruit and vegetable intake among adolescents and adults in the United States: Percentage meeting individualized recommendations. *Medscape J Med*. 2009;11(1):26.

reported height and weight data did not differ significantly from measured data among younger adults.[264]

Good sleep hygiene is an additional important factor in maintaining healthy weight. There is increasing evidence that short sleep duration can result in metabolic changes that contribute to unhealthy weight, insulin resistance, diabetes, and cardiovascular disease.[265] A 2008 meta-analysis of epidemiologic data related to sleep showed that in cross-sectional studies from around the world there was a consistent increased risk of obesity for short-duration sleepers among both children and adults. However, causal inferences are tempered by the difficulty in controlling for other factors that could be influencing weight.[266] Nevertheless, sleep duration appears to be a modifiable risk factor for unhealthy weight and should be considered when developing strategies for reaching and maintaining healthy weight. Sleep hygiene is an ongoing and important focus of DoD study and interest because of the effects of sleep on readiness and the substantial use of stimulants or sleep aids by military personnel. A 2013 study found a high prevalence of sleep disorders and a high rate of short sleep duration among active duty military personnel. Forty percent of the subjects reported less than five hours a sleep per night.[267]

Finally, mandatory requirements imposed by the Services are significant motivators of healthy weight behavior. A study comparing health behaviors of Army Reserve personnel, Active Duty Army, and civilian employees found that for the Active Duty personnel, the hierarchical culture of the work environment leveraged healthy behaviors because of the mandatory fitness and weight control standards.[268] Active Duty populations comprise a captive population with captive moments, which illustrates that the Services have the authority to create policies through which they have significant control over the weight and fitness of their personnel.

Recommended Approaches for Obesity Prevention, Weight Loss, and Weight Maintenance

Studies exploring correlates of physical activity and overweight/obesity have been conducted in the general population (see Section IV) but do not directly reflect subpopulations with relatively high levels of physical activity, such as the military.[269] [270] (See Section IV for a discussion of evidence-based best practices in the general population, all of which have relevance to the active military population as well.)

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[264] Elgar F, Roberts C, Tudor-Smith C, et al. Validity of self-reported height and weight and predictors of bias in adolescents. *J Adolesc Health.* 2005;37(5):371–375.

[265] Tahari, S. The link between short sleep duration and obesity: We should recommend more sleep to prevent obesity. *Arch Dis Child*. 2006 November;9(11):881-884; Cappuccio FP, et al. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*. 2008 May 1;31(5):619-626.

[266] Cappuccio, op cit.

[267] Mysliwiec V, McGraw L, Pierce R, et al. Sleep disorders and associated medical comorbidities in active duty military personnel. *Sleep*. 2013 Feb 1;36(2):167-74. doi: 10.5665/sleep.2364.

[268] Wynd CA, and NA Ryan-Wenger. Factors predicting health behaviors among Army Reserve, Active Duty Army, and civilian hospital employees. *Mil. Med.* 2004;169(12):942-947.

[269] Sanderson PW, Clemes SA, Biddle SJH. The correlates and treatment of obesity in military populations: A systematic review. *Obesity Facts.* 2011;4(3):229-237.

[270] Rowland ML. Self-reported weight and height. *Am J Clin Nutr*. 1990;52:1125-33.

Specific to military populations, in July 1999, the director of the Military Operational Medicine Research Programs at the U.S. Army Medical Research and Materiel Command requested that the IOM review existing data on optimal components of a weight-management program; the role of age, gender, and ethnicity in weight management; and current DoD activities in weight management in order to provide recommendations for military weight management programs.

DoD requested that the IOM focus on overweight (but non-obese) individuals and comment on the degree of desirable standardization across the Services, as well as whether specific aids should be considered, the impact of dietary changes on weight loss, and genetic predispositions to weight gain.[271] In response, the IOM convened its Committee on Military Nutrition Research to review the available data, which released its final report in 2003. The Committee noted that prevention of weight/fat gain throughout an individual's military career is preferable to even the most comprehensive weight-loss program, but offered several recommendations for a successful weight/fat loss program which would also help maintain weight loss. The Committee also said that an integrated program that included physical activity, diet, nutrition education, lifestyle change, environmental change, and psychological support, would offer the greatest likelihood of success.

When the IOM committee was asked whether military weight/fat loss programs should be tailored to the individual Services or be standardized, it responded that the specifics on implementation of weight-control policies and programs may need to be tailored to each Service because of differences in environment but that there were several opportunities for standardization, especially with regard to policy.[272]

Mental health is thought to be an important factor in maintaining a healthy weight and in tackling overweight and obesity. According to reports of the U.S. Surgeon General, individual body weight is the result of a combination of genetic, metabolic, behavioral, environmental, cultural, and socioeconomic influences. Behavioral and environmental factors contribute largely to overweight and obesity, and are recommended targets for actions and interventions.[273] For example, a study comparing people who suffer from frequent mental distress with those that do not found that there was no difference in levels of healthy weight between the two groups. [274] However, those with frequent mental distress were less likely to engage in healthy behaviors such as being a nonsmoker, eating at least five fruits or vegetables daily, and participating in moderate-to-vigorous physical activity during the average week.

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[271] IOM, 2003, op cit.
[272] Ibid.
[273] U.S. Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity.* Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General; 2001. Available from: U.S. GPO, Washington.
[274] McGuire LC, Strine TW, Okoro CA, et al. Modifiable characteristics of a healthy lifestyle in U.S. older adults with or without frequent mental distress: 2003 Behavioral Risk Factor Surveillance System. *Am J Geriatr Psychiatry*. 2007 Sep;15(9):754-761. PubMed PMID: 17804829.

Although research to date is not definitive on the relationship between mental health and overweight/obesity, it is likely that the association is bidirectional and has implications that should be considered in addressing programs targeting Service members who struggle with body composition issues.

Smoking Cessation

It is commonly known that weight gain is associated with smoking cessation, both in the military and elsewhere. This may keep smokers from attempting to quit because of concern about the possible effects on their weight.[275] Research by Peterson and Helton found that 88 percent of Service members gained weight after smoking cessation.[276] Research by Talcott et al. found that modifying the risk factors for post-cessation weight gain in military recruits—an intensive program that limits access to alcohol and high fat foods combined with increased physical activity—can attenuate weight gain after smoking cessation.[277]

However, information varies widely about the health benefits associated with smoking cessation and the potential weight gain that may accompany it. Studies have shown that ex-smokers weigh more on average than both non-smokers and current smokers, and that smokers weigh less than non-smokers.[278] Additionally, many studies have found that people who quit smoking have a high likelihood of gaining weight.[279, 280, 281, 282] Possible reasons for this weight gain include the roles of nicotine as an appetite suppressant and in increasing metabolism.[283, 284] Therefore, reducing the intake of nicotine may slow down the basal metabolic rate at the same time that appetite is increased. In addition, genetic factors may influence the effect of smoking cessation on weight.[285]

It is reported that smoking cessation leads to an increase of 2.9 kilograms, or 6.4 pounds, on average.[286, 287] Other research has shown that ex-smokers who participated in a clinical program

[275] Williamson DF, Madans J, Anda RF, et al. Smoking cessation and severity of weight gain in a national cohort. *NEJM.* 1991;324(11):739-745.
[276] Peterson AL, and J Helton. Smoking cessation and weight gain in the military. *Mil. Med.* 2000;165(7):536-538.
[277] Talcott GW, Fiedler ER, Peterson AL, et al. Is weight gain after smoking cessation inevitable? *Journal of Consulting and Clinical Psychology.* 1995;63(2):313-316.
[278] Klesges RC, Meyers AW, Klesges LM, et al. Smoking, body weight, and their effects on smoking behavior: A comprehensive review of the literature. *Psychol Bull.* 1989;106:204-230.
[279] Filozof C, Fernandez Pinilla MC, Fernandez-Cruz A. Smoking cessation and weight gain. *Obes Rev* 2004;5:95-103.
[280] Froom P, Melamed S, Benbassat J. Smoking cessation and weight gain. *J Fam Pract.* 1998;46:460-464.
[281] Perkins KA. Weight gain following smoking cessation. *J Consult Clin Psychol.*1993;61:768-777.
[282] Williamson et al., 1991, op cit.
[283] Filozof C et al., 2004, op cit.
[284] Stamford BA, Matter S, Fell RD, et al. Effects of smoking cessation on weight gain, metabolic rate, caloric consumption, and blood lipids. *The American Journal of Clinical Nutrition.*1986;43:486-494.
[285] Filozof C et al., 2004, op cit.
[286] Aubin HJ, Farley A, Lycett D, et al. Weight gain in smokers after quitting cigarettes: meta-analysis. *BMJ.* 2012; 345:e4439 doi: 10.1136/bmj.e4439 (Published 10 July 2012).
[287] Klesges et al., 1989, op cit.

will gain approximately 4-5 kilograms, or 8.8-11 pounds, in one year.[288] A 2012 meta-analysis of 62 studies of people who have quit for a year without formal interventions or pharmaceutical aids found that estimates of weight gain following smoking cessation varied widely and may have been underestimated in previous well-known studies.[289] These researchers found that, at 12 months after cessation, 16 percent of untreated quitters lost weight; 37 percent gained less than 5 kilograms, or 11 pounds; 34 percent gained 5-10 kilograms, or 11-22 pounds; and 13 percent gained more than 10 kilograms, or 22 pounds.[290] Successful interventions to prevent weight gain associated with smoking cessation include using a nicotine replacement, with even better results when nicotine is combined with bupropion, an antidepressant and smoking cessation drug.[291] However, a 2012 Cochrane review of interventions to prevent weight gain associated with cessation found that although some programs showed short-term success there was not enough evidence to make clinical recommendations regarding effective programs to prevent weight gain among those who quit.[292] In sum, military initiatives to promote smoking cessation have to factor in the confounding effects of smoking cessation on weight control/maintenance efforts.

Studies of Effectiveness of Programs and Strategies in Military Populations

In recent years, DoD has invested in efforts to evaluate the evidence for a variety of programs affecting military health and readiness, including improved beneficiary health.

Sponsored by DoD and the National Institute of Food and Agriculture, the Clearinghouse for Military Family Readiness provides an interactive and comprehensive resource for military families.[293] A partnership among the Military Extension Internship Program, Military REACH and the Penn State Military Personnel and Families Research Initiative produced a website which evaluates and provides evidence based programs and practices in order to assist both military families and those professionals who work with them to enhance their health and well-being. The Clearinghouse provides a searchable database on the website that offers information on a wide variety of programs which includes academic performance, alcohol and drug abuse, and social skills. Also, the DoD's working group on childhood obesity tasked the Clearinghouse to catalogue evidence-based obesity prevention programs and use empirical and scientific evidence to assist in the military's fight against obesity.

In its 2003 report, the IOM's Committee on Military Nutrition Research of the Food and Nutrition Board reviewed military weight-management programs and offered multipronged recommendations focused on prevention, assessment, weight-loss programs and research. Citing

[288] Aubin et al., 2012, op cit.
[289] Ibid.
[290] Ibid.
[291] Filozof C et al., 2004, op cit.
[292] Farley AC, Hajek P, Lycett D, et al. Interventions for preventing weight gain after smoking cessation. *Cochrane Database Syst Rev.* 2012; Published online: DOI: 10.1002/14651858.CD006219.pub3. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006219.pub3/abstract;jsessionid=9B179DD3BB5D1829D33E73F71D1B6DED.d03t01 Accessed on July 24, 2013.
[293] The Clearinghouse for Military Family Readiness. http://www.militaryfamilies.psu.edu/. Accessed on July 17, 2013.

knowledge gaps relative to the military, particularly programs relating to prevention, treatment and program evaluation, the report's recommendations drew almost exclusively from data collected in civilian populations. [294] However, the IOM committee noted that, overall, the components of any effective military weight/fat loss program would likely mirror the systemic, multi-pronged, multi-leveled approaches favored in civilian populations. Crucial attributes of these programs include:

1. Exercise
2. Behavior modification
3. Net dietary energy deficit
4. Education
5. Psychological support and counseling
6. Environmental changes
7. Structured monitoring

In 2006, Veterans Affairs and DoD published clinical practice guidelines (CPGs) for the screening and management of overweight and obesity for use in the VA or DoD healthcare system (see Table 3.3).[295] The study group examined available evidence from multiple national guidelines including the National Heart, Lung, and Blood Institute *Obesity Education Initiative*, the U.S. Preventative Services Task Force *Screening for Obesity in Adults*, and the American College of Physicians *Pharmacologic and Surgical Management of Obesity in Primary Care: A Clinical Practice Guideline.*

[294] IOM, 2003, op cit.
[295] Department of Veterans Affairs / Department of Defense: The Management of Overweight and Obesity Working Group. VA/DoD Clinical Practice Guideline for Screening and Management of Overweight and Obesity. Washington, DC:2006.

Table 3.3. Evidence Levels for VA/DoD Clinical Practice Guidelines[296]

Approach	Strong Level of Evidence	Limited Level of Evidence
Weight Loss	• Combination of diet therapy, physical fitness, and behavioral modification	• Weight loss improves sleep apnea, metabolic syndrome, and osteoarthritis
Diet Therapy	• Calorie restriction results in weight loss • Adherence to diet is more important than the specific diet choice	• Low fat or low carbohydrate diets may be better for weight loss
Physical Activity	• Physical activity and restricted calorie diet leads to weight loss • Physical activity increases fitness and reduces cardiovascular risk • Physical activity should be for at least 30 minutes most days of the week	• Physical activity is essential to maintain weight • Multiple intermittent bursts of exercise are effective • Lifestyle physical activities are as good as structured exercise
Behavioral Therapy	• Behavioral modification enables compliance with diet and exercise programs • Multiple behavioral modification strategies should be used • High intensity of the intervention is essential	• Group behavioral modification has better results than individual
Pharmacotherapy	• Listat and Sibutramine may lead to weight loss • Orlistat improves glycemic control, dyslipidemia, and blood pressure • Drugs have adverse effects	• Sibutramine improves secondary outcomes (cholesterol and glycemic control)
Surgery	• Surgery is effective for reducing weight in patients with extreme obesity (BMI > 40 kg/m2) or > 35 kg/m2 with comorbid conditions	• Surgery may improve comorbid conditions (glycemic control, dyslipidemia and blood pressure)

In alignment with the National Prevention Strategy and complementing the First Lady's "Let's Move!" campaign, DoD has developed an education, outreach and behavior change initiative.[297] Titled Operation Live Well (OLW), the initiative is aimed at promoting the health and well-being of the entire DoD community through a variety of programs ranging from fitness to psychological health to resiliency.

[296] Ibid.
[297] Discussion regarding Operation Live Well with Karen Roberts, Deputy Director, Strategic Communications, Military Health System. Defense Health Board Meeting, May 23, 2013.

One initiative under OLW is the Healthy Base Initiative (HBI). Launched in 2013, HBI is a demonstration project that will be assessing 13 select installations.[298] [299] These sites will be examined for their ability to create "environments that enable and sustain healthy lifestyles." The HBI uses a multi-pronged approach towards encouraging environments that promote healthy nutrition, active lifestyles and tobacco-free living. Specific targets of the program include:

- Active living
- Built environment
- Food and beverages
- Health and wellness
- Schools/Families
- Tobacco-free living

The targets of the initiative identified for inclusion in the HBI are in line with current evidence-based models that address obesity and tobacco use.[300] (See Section IV of this report for further discussion of the HBI.)

Additional military campaigns and programs targeting obesity and overweight have also reflected the advances and best practices used in the general population. Specific examples of these weight/health related campaigns and programs are included in Table 3.3.

There have been some assessments of the effectiveness of weight management and physical fitness programs and activities in military programs. In addition to its weight management study, IOM has addressed the topic of weight in the military in two other studies: *Body Composition and Physical Performance: Applications for Military Services* (1992), and *Assessing Readiness in Military Women: The Relationship of Body Composition, Nutrition, and Health* (1998). These earlier studies focused on body composition standards and participation in weight management programs, and recommended the evaluation of military weight management programs for effectiveness, evaluation of pharmacological treatment, computerized tracking of weight and fitness, evaluation of dietary supplements and herbal remedies, and automated technology that addresses self-monitoring and internet-based weight management support tools.

In 2008, Gantt et al. reported that the system used by the Navy to characterize personnel by weight fails to identify opportunities to identify and treat high-risk personnel.[301] Moreover, they

[298] The military installations in the initiative are Fort Bragg, North Carolina; Fort Sill, Oklahoma.; Joint Base Pearl Harbor-Hickam, Hawaii; Sub Base New London, Connecticut.; Mountain Home Air Force Base, Idaho; Yokota Air Base, Japan; Marine Corps Air Ground Combat Center/Marine Air Ground Task Force Training Command, Twentynine Palms, California; Marine Corps Base Quantico, Virginia.; U.S. Coast Guard Air Station Cape Cod, Massachusetts.; March Air Reserve Base, California; and Camp Dodge, Iowa. The other two participants are the Defense Logistics Agency, Fort Belvoir, Virginia; and Defense Health Headquarters, Falls Church, Virginia.
[299] U.S. Department of Defense, Office of the Assistant Secretary of Defense (Public Affairs). (2013) DOD Launches Healthy Base Initiative [Press release]. http://www.defense.gov/releases/release.aspx?releaseid=15867. Accessed July 17, 2013.
[300] Personal communication between Christine Bader, Director, Defense Health Board, and Ginnean Quisenberry, Director, Population Health and Medical Management Division, Office of the Chief Medical Officer.

concluded that the system does not provide a consistent or evidence-based model for early intervention and treatment of high-weight personnel.

A systematic review of the literature regarding the correlates and treatment of obesity in military populations found that the most successful treatment interventions incorporated exercise, healthy eating information, behavioral modification, self-monitoring, relapse prevention, and structured follow-up and were supported by trained personnel. Obesity was found to be more prevalent in males over the age of 35 (consistent with the civilian population), enlisted personnel (versus officers), and married individuals (specifically those accompanied by their spouses).[302] Thus, DoD may find it most productive to target initial prevention programming or pilot projects at these populations.

Most recommendations and guidelines emphasize the importance of counseling and support for successful weight management. Primary care providers are well positioned to provide early identification and counseling for overweight and obese patients. In 2008, Warner et al. examined knowledge, attitudes, and treatment practices of military family physicians regarding obesity.[303] They found that while physicians were aware of weight-related health risks, and were aware of their obligation to counsel their patients, 1 in 4 did not feel comfortable in doing so, and 1 in 2 did not find it gratifying. Reasons for this focused on lack of confidence and a sense that it would not make a difference. The authors concluded that current training programs and clinical supervision for primary care providers could improve the care and treatment provided to overweight and obese patients.

Crombie et al. performed an intervention in military dining facilities (DFACs) at Fort Bragg by implementing Healthy People 2010 nutrition objectives, strategic placement of healthy foods, and provision of educational nutrition information.[304, 305] During the yearlong intervention, fat and energy intake declined. Surveys showed that DFAC patrons appreciated and were significantly more satisfied with the healthy foods provided.

In 2012, Smith et al. tested the efficacy of Alli® (over the counter Orlistat) as weight loss medication for soldiers. The study was prompted by Army Weight Control Program surveys suggesting that the use of the drug was likely to be high once it became available. At that point, efficacy of the drug was not well characterized in young active people. During the six month study, Alli® users lost a greater percentage of body fat and fat mass and less lean body mass as compared to those taking a placebo.[306]

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[301] Gantt et al., 2008, op cit.
[302] Sanderson et al., 2011, op cit.
[303] Warner CH, Warner CM, Morganstein J, et al. Military family physician attitudes toward treating obesity. *Mil. Med.* 2008;173(10):978-984.
[304] Crombie A, Funderburk L, Smith T. Effects of modified foodservice practices in military dining facilities on ad libitum nutritional intake of US Army soldiers. *J Acad Nutr Dietetics.* 2013;113(7)920-927.
[305] Young A, USARIEM. "Research Overview: Military Diet and Weight Mitigation Strategies." Presentation to the Defense Health Board, May 23, 2013.
[306] Young, op. cit.

Technology-Based Interventions

Use of the Internet as a health communication tool increasingly is being shown to be an effective tool for addressing several public health concerns such as smoking, alcohol abuse, and risky sexual behavior. In 2003, Hunter et al. launched the Health Education Lifestyle Initiative for Optimal Service (HELIOS) to test an interactive Internet intervention for weight gain prevention in Air Force personnel, ages 18 to 55 years, ranks Airman to Colonel, with high BMIs (29.4 ± 3).[307] In a randomized controlled trial, the relative effectiveness of two approaches to weight management were compared: 1) minimal contact behavioral Internet therapy with usual care, and 2) usual care. The experimental intervention proved to be an effective strategy, achieving an average 1.5 percent weight change at six months. However, weight was gained back once the program ended.

Robbins et al. also tested the use of the Internet as a low-intensity intervention to prevent weight gain in Active Duty Air Force personnel.[308] In this study self-directed behavior change booklets were augmented by weekly e-mail messages that aimed to educate, motivate, and sustain behavior change in the intervention arm of the study. The intervention was found to prevent weight gain in a subgroup of the study population when compared to the control group, which gained weight over the same period of time.

DoD has a number of technology-based programs to assist with weight loss and management that were developed with the intention of making resources more readily accessible and enabling Service members to more easily track their progress. Across the Services, there are a variety of Internet-based resources and materials for Service members to access. The Navy has a web-based virtual trainer and meal builder that is available to anyone as a mobile application and will soon be available for use with iPads. Army Wellness Centers have online health and wellness questionnaires that can be used to individualize weight loss and exercise programs to the specific needs of the soldier.

According to a 2013 briefing to the DHB by the U.S. Army Research Institute of Environmental Medicine (USARIEM), studies have shown that Service members are engaged by personal digital assistants (PDA) for self-monitoring and prefer using a PDA over traditional diaries.[309]

In 2002 the Pennington Biomedical Research Center and USARIEM partnered with the Army to develop the Healthy Eating, Activity, and Lifestyle Training Headquarters study (HEALTH), an Internet-based tool. This tool is an evidence-based program for maintaining or losing weight and improving fitness. Its design uses individualized nutrition and fitness plans and interactive tools to track diet, activity, and weight over time.[310] It is Web- and smartphone-based and can be accessed from anywhere in the world through the Internet at any time. Although similar to other

[307] Hunter CM, Peterson AL, Alvarez LM, et al. Weight management using the Internet: A randomized controlled trial. *American Journal of Preventive Medicine*. 2008;34(2):119-126.
[308] Robbins AS, Chao SY, Baumgartner N, et al. A low-intensity intervention to prevent annual weight gain in active duty Air Force members. *Mil. Med.* 171(6):556-561.
[309] Young, op cit.
[310] Ibid.

commercial products, for example, MyFitnessPal, it focuses on Army specifications for nutrition and fitness, and has information, such as calories in "meals ready to eat" (MREs), that is useful to Service members. Per a USARIEM update, technology for self-monitoring that provides virtual guidance is likely to be as effective for supporting healthy nutrition and physical activity to facilitate and maintain weight loss as other approaches.

Pilot studies of the Internet-based tool were carried out from 2003 to 2009 and from 2005 to 2010. Additionally, the program was included in the technology chosen for the Army Surgeon General's Performance Triad Demonstration Project for Forts Bragg, Hood, and Joint Base Lewis-McCord. An evaluation of the program by the members of the Louisiana Army National Guard was initiated in 2010 and is planned to conclude in 2016.[311]

Post-Service Weight Gain

As mentioned previously, NHANES data show that the prevalence of obesity is higher among males who previously served versus those who never served in the military.

In a study using Millennium Cohort data, Littman et al. provided the first prospectively collected evidence for an increased rate of weight gain around the time of military discharge.[312] Weight gain was greatest around the time of and following discharge from service and in the three years before discharge. The authors speculated that the excess weight gain was related to lower levels of energy expenditure without a compensatory decrease in food intake. This study indicates that discharge from military service presents a window of risk and opportunity to prevent unhealthy weight gain in military personnel and Veterans.

Littman et al. also studied Veteran populations and found that only a minority of Veterans met physical activity recommendations, and the prevalence of inactivity was particularly high in Veterans receiving care from VA facilities.[313] Similarly, Koepsall et al. have studied overweight and obesity and life course trajectories in Veteran populations and also documented a burst of weight gain after military discharge.[314]

High rates of overweight and obesity can be found in Veteran populations. In-depth interviews conducted with Veterans to assess eating behaviors during and after military service found several factors that could lead to increases in weight and body fat following service.[315] Smith et al. found that four major factors can contribute to weight gain and high body fat following service: 1) a change in the food environment (from less to more desirable food options); 2) food

[311] Ibid.
[312] Littman AJ, Jacobson IG, Boyko EJ, et al for the Millennium Cohort Study Team. Weight change following US military service. *International Journal of Obesity.* 2012:1-10.
[313] Littmann AJ, Forsberg CW, Koepsell TD. Physical activity in a national sample of veterans. *Medicine and Science in Sports and Exercise.* 2009;41(5):1006-1013.
[314] Koepsell TD, Littman AJ, Forsberg CW. Obesity, overweight, and their life course trajectories in veterans and non-veterans. *Obesity (Silver Spring).* 2012; 20: 434-439.
[315] Smith C, Klosterbuer A, Levine AS. Military experience strongly influences post-service eating behavior and BMI status in American veterans. *Appetite.* 2009;52:280-289.

insecurity experienced during service; 3) eating patterns during service (eating fast, too much, and too many carbohydrates and then being unable to break those patterns); and 4) stress-related eating because of military experiences. With regard to stress-related eating, Littman et al. found that weight gain was greater in those who deployed with combat exposures.[316]

Vieweg et al. found that post-traumatic stress disorder (PTSD) is a risk factor for overweight and obesity among male military Veterans.[317] An unpublished study of data collected over seven years as part of the Millennium Cohort study found a strong temporal relationship between screening positive for PTSD and subsequent weight change. Among non-obese participants, a positive PTSD screen was significantly associated with the development of obesity. Study investigators plan to explore whether PTSD is associated with the later development of binge eating, and whether those who engage in binge eating gain more weight than those not reporting binge eating.[318] In a published study using Millennium Cohort data, PTSD symptoms at baseline (cohort participants in July 2001 through June 2003) were significantly associated with future risk of self-reported diabetes.[319] In a U.S. population sample of over 20,000 participants, PTSD was also associated with a higher risk of obesity. Among those with past-year PTSD, 32.6 percent were obese, compared to 25.5 percent with a history of PTSD and 24.1 percent without a history of PTSD. These findings are consistent with previous population-based studies in other countries, as well as U.S. studies demonstrating the association of trauma with increased risk for obesity.[320]

[316] Littman et al., 2012, op cit.
[317] Vieweg WVR, Julius DA, Bates J, Quinn III JF et al. Posttraumatic stress disorder as a risk factor for obesity among male military veterans. *Acta Psychiatrica Scandinavica.* 2007;116:483-487.
[318] Electronic communication from Nancy F. Crum-Cianflone, Department Head, Deployment Health Research Department Naval Health Research Center. October 11, 2012.
[319] Boyko et al., 2010, op cit.
[320] Pagoto SL, Schneider KL, Bodenlos JS, et al. Association of post-traumatic stress disorder and obesity in a nationally representative sample. *Obesity (Silver Spring).* 2012;20(1):200-205.

Findings and Recommendations: Attaining and Maintaining Fitness Among Service Members

Data collection on weight varies across DoD population surveys, as do the measures used to indicate overweight and obesity. In some cases, surveys rely on self-reports, while in other cases ICD-9 codes are used, sometimes in combination with BMI measures. Still other surveys rely on a classification of "clinical overweight," which includes all BMI levels of 25 and greater. Thus, it is difficult to ascertain precisely what portion of a percentage represents obese versus overweight. A more systematic, timely, and uniform methodology would enhance analysis of the adequacy of the fitness of the force. In response to this need, DoD required the Services to establish an automated data registry. The Military Services Fitness Database was subsequently developed and successfully tested; however, the program was not implemented.

> **Recommendation 5: DoD should implement an automated data registry Department-wide, which would document baseline statistics and track physical fitness, weight for height and body fat percentages at the individual level over time. Although accession and retention standards differ across the Services, the methods for collecting and recording such data should be uniform.**

In addition to body fat/weight assessments, each Service deploys its own form of physical readiness test. Individuals who do not meet the standards can be involuntarily enrolled in a reconditioning program or discharged from service. Although the fitness requirements for service reasonably can vary among the Services based on mission, strategies for remediation could be standardized based on widely accepted evidence regarding effectiveness.

> **Recommendation 6: Although some customization of retention and physical fitness standards is necessary, the Services should, where possible, standardize remediation programs to reduce costs to the Department and ensure that only evidence-based interventions are implemented. Evaluation metrics should be developed prior to the initiation of any program.**

It is widely accepted that weight gain is associated with smoking cessation in the military and elsewhere. This may keep smokers from attempting to quit because of concern about the possible effects on their weight. Evidence shows that ex-smokers weigh more on average than both non-smokers and current smokers, and that smokers weigh less than non-smokers. Although some interventions to prevent weight gain have demonstrated short-term success, there is as yet insufficient evidence regarding programs to prevent weight gain on a long-term basis among those who quit.

> **Recommendation 7: DoD should consider the confounding effects of smoking cessation on weight control and maintenance efforts, and develop strategies to mitigate the negative effects on weight associated with smoking cessation efforts.**

DoD already has a number of technology-based programs to assist with weight loss and management. These technologies and applications can make health-related resources more

readily accessible and enable Service members to easily track their fitness and progress toward weight loss and/or maintenance. The Defense Health Board was impressed with technology-based programs aimed at fitness and health already in use by the Services and encourages their broader use and evaluation.

Recommendation 8: DoD should continue to develop and promote technology-based approaches to improved fitness, with the additional aims of enhancing standardization of metrics and facilitating the analyses of effectiveness of such approaches.

The peer-reviewed literature on obesity in military populations reports that the most successful treatment interventions incorporate exercise, healthy eating information, good sleep hygiene, behavioral modification, self-monitoring, relapse prevention, and structured follow-up by trained personnel.

Recommendation 9: To ensure personnel are receiving tailored and appropriate guidance regarding weight, DoD should require that military healthcare personnel receive enhanced training, at appropriate levels, on effective counseling and support approaches to weight management in military patient populations.

Anecdotal evidence indicates that personnel often experience stigma when assigned to a weight loss remediation program. This can negatively influence their motivation to participate in these programs and their eventual ability to achieve and maintain weight loss goals. The development of Service-specific universal wellness programs applicable to all Service personnel might help mitigate this problem.

Recommendation 10: DoD should develop strategies to address the stigma often experienced by personnel assigned to weight remediation programs.

Although local, base-specific, and Service-specific programs and policies across DoD adequately address overweight, obesity, and failure to meet physical fitness standards, most have not been systematically evaluated in a standardized and independent manner. The Healthy Base Initiative provides an opportunity to develop a program that is based on lessons learned from existing programs while advancing knowledge of effectiveness based on prospectively developed, well-designed metrics.

Recommendation 11: Before launching new military fitness and nutrition initiatives and campaigns, DoD should assess the effectiveness of existing campaigns. Future campaigns should be evidence-based with clear metrics prospectively developed for assessing effectiveness.

Numerous assessments of strategies for preventing overweight and obesity and maintaining healthy weight have endorsed system-based, multi-pronged, multi-leveled approaches. Effective military weight/fat loss programs should mirror approaches found to work in civilian populations, recognizing the unique challenges and opportunities in military populations.

Recommendation 12: To ensure that Service members successfully achieve *and sustain* a healthy weight, DoD leadership at all levels should aggressively and persistently pursue a multi-dimensional, long-term approach that reflects the Services' retention standards and is consistent with the systems-approach strategies outlined by the Institute of Medicine in 2012 and the National Prevention Strategy of the U.S. Surgeon General. This requires that the Department take the following actions.

a) **Emphasize a focus on a lifetime course of health for military personnel, addressing all of the variables that influence healthy weight.**
b) **Provide 24-hour access to healthy foods, physical fitness programs, and support for military personnel.**
c) **Set nutritional standards for food offered through DoD dining facilities and by on-base contract vendors.**
d) **Facilitate access to healthcare providers appropriately trained in health and wellness management.**

Current data indicate that high rates of overweight and obesity are found in Veteran populations. Weight gain is greatest from the time of discharge from service and in the three years before discharge. Many factors contribute to this phenomenon, including lower levels of energy expenditure without a compensatory decrease in food intake, lack of incentives to manage and control weight, the change in the food environments, and stress or disability related to Service experiences. Discharge from military service creates a window of risk as well as an opportunity to prevent unhealthy weight gain in Veterans.

Recommendation 13: DoD's discharge/separation process should include a discussion about the potential for weight gain and programs and services available to prevent its occurrence. In particular, personnel diagnosed with PTSD or mental illness should receive appropriate counseling and follow-up services to prevent unhealthy weight gain.

The costs associated with treatment of obesity-related illnesses are considerable, not only in terms of capital but also in human costs that affect quality of life and life expectancy. The transition of care between the DoD and the Department of Veterans Affairs health systems offers both challenges and opportunities to create a seamless passage into healthy retirement.

IV. Weight Management Among DoD Dependents and Retirees

Introduction

As part of its charge, the Defense Health Board (DHB) was asked to review and suggest optimal strategies for addressing overweight and obesity in DoD dependents and retirees. Because of the diversity of this population, it mirrors the general population in many ways. Where it is unique is in its use of the Military Health System (MHS), its potential access to military facilities (e.g., food sources, fitness centers), its mobility relative to the general population, and its exposure to the unique stressors of deployment.

Dependents may seek healthcare at a Military Treatment Facility (MTF) or in the civilian sector. Retirees might be receiving care through TRICARE or through Veterans' benefits. Yet all are exposed to the environmental, social, and cultural influences that may promote or discourage the maintenance of a healthy weight. For this reason the DHB reviewed statistics on overweight and obesity in this population, evidence-based best practices for weight control in the general civilian population, and, where the information was available, data from programs targeted at DoD dependent and retiree populations. Also included is a description of a new initiative focused on overall health and wellness in the military population.

Population Prevalence of Overweight and Obese

At the end of fiscal year 2012, military retirees and family members accounted for 5.5 million, or 56 percent, of the 9.1 million people eligible for DoD health care benefits in the United States and 43 percent of the 580,000 MHS beneficiaries abroad.[321] Similar to trends in the civilian population, the MHS faces an aging beneficiary population, with 21 percent of all eligible beneficiaries being retirees and family members over the age of 65.[322]

Thus, retirees and military dependents account for a significant proportion of the costs to the MHS and, therefore, cannot be ignored when considering the health effects and economic impacts of overweight and obesity. However, data on the prevalence of overweight and obesity among retiree and dependent populations are extremely limited; the only published or publicly available source for this data is the Health Care Survey of DoD Beneficiaries (HCSDB).

HCSDB was developed by the TRICARE Management Activity (TMA) in 1993 in response to a congressional mandate to assess TRICARE-eligible beneficiary access to and experience with their DoD health care benefits.[323] The Adult HCSDB is fielded quarterly via email to Active Duty Service members and via postal mail to all other beneficiaries (responses are accepted via

[321] DoD. Evaluation of the TRICARE Program: Access, Cost, and Quality. Fiscal Year 2012 Report to Congress, p 11. http://tricare.mil/tma/congressionalinformation/downloads/TRICARE%20Evaluation%20Report%20-%20FY12.pdf. Accessed August 8, 2013.
[322] Ibid.
[323] Health Care Survey of DoD Beneficiaries. http://www.tricare.mil/survey/hcsurvey/default.cfm. Accessed July 16, 2013.

Web or mail) worldwide.[324] The HCSDB uses self-reported data and is a population-based survey providing a worldwide representation of the DoD Active Duty, retiree, and adult dependent populations. The survey includes these populations regardless of whether they are actively receiving benefits, or whether they receive care in military treatment facilities, offering perhaps the most accurate prevalence estimates within the DoD population.[325] However, since the data are self-reported, they are subject to recall bias. No objective validation tool is used to verify accuracy of BMI results.[326]

In addition to asking about access to and experience with care, the survey also covers beneficiaries' health and health behaviors. The questions on the HCSDB are based in part on questions from the Consumer Assessment of Healthcare Providers and Systems (CAHPS) Health Plan Survey. These nationally recognized standardized questions and reporting formats are used to collect and report information about health care experiences of consumers. The National CAHPS Benchmarking Database offers benchmarks that MHS can use to compare against the civilian population (MHS adjusts the CAHPS benchmarks to correspond to the age and health of the MHS population). Benchmarks for preventive care, obesity and non-smoking are taken from the *Healthy People 2020* objectives.[327] Although much of these data are publicly available online, detailed analysis is usually not conducted unless specifically requested.

The last detailed analysis was published in 2005 in the *American Journal of Health Promotion*, using data from the 2002 HCSDB.[328] The authors examined progress among retirees and dependents between the ages of 38 and 64[329] in achieving the *Healthy People 2010* targets pertaining to healthy eating, physical activity, and alcohol and tobacco use. The authors also examined socio-demographic characteristics, finding that subsets of the population who were at greatest risk to fail to meet the *Healthy People 2010* objectives included men, persons with less than a college degree, and persons reporting a less-than-excellent health status. The article reported high rates of obesity (31.7 percent) and overweight (50.4 percent), noting that the *Healthy People 2010* objectives for these measures had not been met.[330]

As noted in Section III of this report, obesity rates reported through the HCSDB are lower than the overall 33.8 percent of U.S. adults reported as obese (data from the National Health and Nutrition Examination Survey [NHANES]) for all military health beneficiary groups *except*

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[324] DoD. Evaluation of the TRICARE Program, op cit., p. 94.
[325] Personal communication between Defense Health Board staff and Dr. Richard Bannick, Director, Beneficiary and Benefit Analysis & Evaluation Defense Health Cost Assessment and Program Evaluation , Office of the Assistant Secretary of Defense (Health Affairs)/TRICARE Management Activity. January 3, 2013.
[326] DoD. Evaluation of the TRICARE Program, op cit., p. 94. The HCSDB collects height and weight data; from this data, researchers extrapolate BMI.
[327] TRICARE Beneficiary Reports.
http://www.tricare.mil/survey/hcsurvey/2012/bene/Q4FY2012/html/help.htm#user. Accessed July 16, 2013.
[328] Kress AM, and MC Hartzel. Burden of disease associated with overweight and obesity among U.S. military retirees and their dependents, aged 38-64, 2003. *Prev Med.* 2005;41:63-69.
[329] Retirees and dependents over age 65 are entitled to a different set of benefits and were therefore left out of the sample.
[330] These data are not directly comparable with the HCSDB data for 2012 as reported in the table because this population includes those over age 64.

Recent unpublished data from NHANES collected between 2007 and 2010 suggest that there is a greater prevalence of both overweight and obesity among individuals over the age of 18 who report prior service in the U.S. military when compared to those who did not serve. Although this population would include retirees, as they are a subset of Veterans, it would also include Veterans receiving benefits from the Department of Veteran's Affairs (VA), who are not eligible for TRICARE benefits. The difference in prevalence of obesity between the two population groups is 39.1 percent of those reporting prior service having a BMI of 30 or greater, compared to 33.8 percent of those without a history of service measuring in at a BMI of 30 or higher. Although the difference is not statistically significant ($P < 0.55$), the prevalence of overweight among those with prior service (38.3 percent) is higher than among those without prior service (32.9).[332]

Current and Projected Costs of Weight-Related Health Problems

Researchers investigating expenses related to overweight and obesity have found that these conditions and their associated co-morbidities are significantly affecting healthcare spending for both public and private payers. The medical costs of obesity encompass the resources devoted to managing obesity-related disorders, including the costs incurred by excess use of ambulatory care, hospitalization, medications, radiological and laboratory tests, and long-term care.[333] In addition to medical costs, society incurs substantial indirect costs from obesity as a result of decreased years of disability-free life, increased morbidity before retirement, early retirement, disability pensions, and work absenteeism and reduced productivity.[334]

Using data from a nationally representative survey, and working in partnership with the Centers for Disease Control and Prevention (CDC) and the Agency for Healthcare Research and Quality, Finkelstein, et al. found that costs of overweight and obesity may have reached $78.5 billion in 1998 and that approximately half of this amount was financed by Medicare and Medicaid.[335] In a follow-up study, Finkelstein, et al. determined that the annual medical burden of obesity had risen to almost 10 percent of all medical spending, and that the increased prevalence of obesity was responsible for an increase of $40 billion in 2006.[336] Their research also showed that obese Medicare beneficiaries cost the program over $600 more per beneficiary per year, on average, as compared to normal-weight beneficiaries.

In 2008, across all payers, the prevalence of obesity in the U.S. population was associated with increases of $44.7 billion for inpatient services, $45.2 billion for non-inpatient services, $69.3

[332] Ogden C, Epidemiologist and Branch Chief, NHANES, National Center for Health Statistics, CDC. "NHANES Military Data." Presentation to the Defense Health Board, November 16, 2012.
[333] Wang YC, McPherson K, Marsh T, et al. Health and the economic burden of projected obesity trends in the USA and UK. *Lancet.* 2011;378:815-825.
[334] Ibid.
[335] Finkelstein EA, Fibelkom IC, Wang G. National medical spending attributable to overweight and obesity: How much, and who's paying? *Health Affairs.* doi: 10.1377/hlthaff.w3.219. 2003
[336] Finkelstein EA, Trogdon JG, Cohen JW, et al. Annual medical spending attributable to obesity: Payer-and service-specific estimates. *Health Affairs.* 2009; 28(5):w822-w831.

billion for pharmaceutical services, and $146.6 billion for all services combined per year.[337] Costs may be even higher, according to a report by the Society of Actuaries (2010) which provided estimates that overweight and obesity may cost the United States $270 billion per year based on medical expenditures and the loss of productivity caused by excess disability and mortality related to overweight and obesity.[338]

In a study examining obesity trends, Wang et al. projected an expansion of obesity-related and chronic diseases, with a significant effect on healthcare expenditures. Compounded by an aging population, in the next two decades, extrapolation of the U.S. data projects an increase in annual medical cost from treating obesity-related disorders by $28 billion per year to 2020 to $66 billion per year by 2030.[339] The top contributors to these cost increases are arthritis, coronary heart disease, and diabetes, and about half these costs would be incurred by individuals 65 years and older who are covered by Medicare.

Wang et al. also present a scenario illustrating how small improvements would greatly affect expenditures. A hypothetical program that results in a 1-percent reduction in BMI across the entire population, or the equivalent of losing approximately 1 kg for an adult of average weight, would prevent over 2 million incident cases of diabetes, over 1 million cases of cardiovascular disease, and approximately 100,000 cases of cancer, and gaining about 16 million quality-adjusted life years (QALYs).

With regard to the MHS, according to the Fiscal Year 2012 TRICARE Annual Report, $54 billion was slated for the Unified Medical Program, of which $17.2 billion went to the Direct Care Program.[340] Data from 2007 show that that the Department spends nearly $1.1 billion annually treating obesity-related illness for Service members and their families.[341]

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[337] O'Grady M, and JC Capretta. *Assessing the economics of obesity and obesity interventions. A report for Robert Wood Johnson Foundation: Campaign to End Obesity*. March 2012. http://obesitycampaign.org/documents/StudyAssessingtheEconomicsofObesityandObesityIntervention.pdf. Accessed August 8, 2013.

[338] Behan DF et al. Obesity and its Relation to Mortality and Morbidity Costs. A Report for the Society of Actuaries. December 2010. http://www.soa.org/files/research/projects/research-2011-obesity-relation-mortality.pdf. Accessed August 8, 2013.

[339] Wang et al., op. cit.

[340] DoD. Evaluation of TRICARE Program, op. cit., p. 11.

[341] Dall TM, Zhang Y, Chen YJ et, al. Cost associated with being overweight and with obesity, high alcohol consumption, and tobacco use within the Military Health System's TRICARE Prime-Enrolled population. *Am J Health Promot.* 2007;22(2):120-139.

Considering that the number of enrollees in TRICARE Prime and the prevalence of obesity have both increased steadily over time since 2007, the costs to DoD are likely even higher today.[342] Of note, according to the Fiscal Year 2012 TRICARE Annual Report, surgical procedures for obesity, without regard for complication/comorbidity status, rank 19th in volume among the top 25 diagnoses, but rank 17th if complications/comorbidities are included. These surgical procedures cost DoD $44.9 million in 2011. The top 25 diagnoses in Fiscal Year 2011, by volume, accounted for 54 percent of all inpatient admissions in acute care hospitals.

Socioeconomic Status and Overweight/Obese

Overweight and obesity are generally accepted as being associated with socioeconomic status (SES), with obesity being more likely to be found among lower income groups.[343] In a study investigating the influence of food shopping behaviors and SES on obesity rates in Seattle and Paris, it was found that lower SES was associated with higher obesity rates in both cities.[344] The researchers found that lower education and incomes, lower surrounding property values, and shopping at stores with lower costs were consistently associated with an increased risk of obesity. A recent study of the association between family income and education with 30-year changes in dietary behaviors had results showing that the increase in energy intake, and food and beverage amount, over this time period was significant in the lowest SES categories of families.[345] Furthermore, the relative affordability of foods that are energy-dense versus nutrient-rich may contribute to the differences in dietary quality and obesity among various SES levels.

Supermarket shoppers identified as low-SES, based on education and family income, were more likely to purchase calories in inexpensive forms that were higher in fat and contained fewer nutrients.[346] According to 2005-2008 NHANES data, low-income children and adolescents are more likely to be obese than those in higher income families, but the relationship is not consistent across race and ethnicity groups.[347] Additionally, children and adolescents living in households where the head of household has a college degree are less likely to be obese compared with those living in households where the household head has less education, but the relationship is not consistent across race and ethnicity groups.

Low SES populations in areas with limited access to food may find it difficult to eat a healthy and varied diet. Using 2006 data on locations of supermarkets, supercenters, and large grocery

[342] DoD, Evaluation of TRICARE Program, op. cit., pp. 15, 57.
[343] Wang Y, Zhang Q. Are American children and adolescents of low socioeconomic status at increased risk of obesity? Changes in the association between overweight and family income between 1971 and 2002. *Am J Clin Nutr.* 2006; 84:707-716.
[344] Drewnowski A, Moudon AV, Jiao J, et al. Food environment and socioeconomic status influence obesity rates in Seattle and Paris. *International Journal of Obesity.* 2013; epub ahead of print.
[345] Kant AK, and BI Graubard. Family income and education were related with 30-year time trends in dietary and meal behaviors of American children and adolescents. *Journal of Nutrition*.2013;143(5):690-700.
[346] Appelhans BM, Milliron BJ, Woolf K, et al. Socioeconomic status, energy cost, and nutrient content of supermarket food purchases. *American Journal of Preventive Medicine.* 2012;42(4):398-402.
[347] Ogden CL, Lamb MM, Carroll MD, et al. Centers for Disease Control and Prevention. Obesity and Socioeconomic Status in Children and Adolescents: United States, 2005-2008. *National Center for Health Statistics Data Brief*. Number 51. 2010. http://www.cdc.gov/nchs/data/databriefs/db51.htm. Accessed July 18, 2013.

stores, and data from the 2000 Census, U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) has identified approximately 6,500 food desert tracts in the United States.[348] ERS defines food deserts as low-income census tracts with a substantial number or share of residents with low levels of access to retail outlets selling healthy and affordable foods.[349] Characteristics of food desert tracts include small populations, low levels of education, low incomes, and high unemployment.[350] Additionally, food desert tracts often lack other resources, such as easy access to medical care. Poor education and limited health care services in conjunction with high prices for fresh produce and other healthy food may result in poor diet and adverse health outcomes for residents of these areas. Ultimately these differences affect life expectancy.[351]

Socioeconomic Status of Military Families

According to the DoD website, military recruits generally are better educated than the average American, come from a middle-class background, and grew up in a suburban or rural environment. [352] Kane (2006) found that people who serve in the military come from wealthier neighborhoods than those who did not serve, although those in the uppermost SES are underrepresented in armed service.[353] However, one study examining race, SES, and immigration status, found that SES was the only significant predictor of military participation, with working and middle class families providing the greatest number of recruits.[354]

Data on military families show that many are young and have small children. As such, they could be at risk for overweight or obesity if they are facing financial hardships or lack access to healthy, affordable food and fitness opportunities. According to a Military OneSource report on demographics from 2011, there are approximately 2,260,000 Service members (Active Duty and Selected Reserves) and 3,131,000 family members, including spouses, children, and adult dependents.[355] Of these military personnel, 43.9 percent have children (37.0 percent are married with children and 6.9 percent, or nearly 155,000 Service members, are single with children).

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[348] Dutko P, Ver Ploeg M, Farrigan T. *Characteristics and Influential Factors of Food Deserts,* ERR-140, U.S. Department of Agriculture, Economic Research Service, August 2012.
[349] Ver Ploeg M, Nulph D, Williams R. Mapping food deserts in the U.S. *Amber Waves.* 2011; 9(10):46-49. http://www.ers.usda.gov/media/206245/datafeature_1_.pdf.
[350] Dutko et al., 2012, op cit.
[351] Murray CJL, Kulkami SC, Michaud C, et al. Eight Americas: Investigating mortality disparities across races, counties, and race-counties in the United States**.** *PLoS Med* 2006;3(9): e260. doi:10.1371/journal.pmed.0030260..http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0030260. Accessed July 16, 2013.
[352] Who is volunteering for today's military: Myth versus fact. 2005. http://www.defense.gov/news/Dec2005/d20051213mythfact.pdf. Accessed July 18, 2013.
[353] Kane T. Who are the recruits? The demographic characteristics of U.S. military enlistment, 2003–2005. Heritage Foundation Center for Data Analysis Report. No. 06-09. http://www.heritage.org/Research/NationalSecurity/cda06-09.cfm. Accessed July 18, 2013.
[354] Lutz A. Who joins the military?: A look at race, class, and immigration status. *J Political and Military Sociology*. 2008;36(2):167-188.
[355] Department of Defense Office of the Deputy Under Secretary of Defense. 2011 Demographics: Profile of the Military Community. Updated 2012. http://www.militaryonesource.mil/12038/MOS/Reports/2011_Demographics_Report.pdf Accessed July 18, 2013.

Another 39.9 percent are single with no children and 16.2 percent are married without children. Of the nearly two million total military children in 2011, the largest percentage were those under five years of age (37.4 percent), followed by those 6 to 11 years of age (30.3 percent). Slightly more than half of DoD military personnel are married. Of these, nearly one-quarter have spouses 25 years of age or younger and almost 50 percent are married to spouses 30 years of age or younger. Many Service members who are in the lowest pay grades (36.4 percent; E1-E4) are married, as are 71 percent of those in the next higher level grades, E5-E6. [356] Although fewer junior enlisted service members (E1-E4) have children than mid-level or senior enlisted personnel, there are a large number of families, over 100,000, being supported by those in the lowest pay grades. (Note: It is not possible to discern from these data whether the spouse has a separate income.)

A Military OneSource 2009 report on the quality of life of Service members found that balancing family responsibilities with dual careers is a particularly difficult challenge for military spouses.[357] Almost 60 percent of the spouses of Active Duty personnel were either employed or seeking employment, but the spouses of junior enlisted members were the most likely to be unemployed. Frequent relocations were cited as a major obstacle for military spouses in establishing their careers, as was obtaining reliable and affordable childcare. Those with children under five years of age were most likely to be out of the labor force.

Subsisting on the salaries paid to junior enlisted personnel may be difficult should they have families or not have access to resources such as free base housing. According to a Congressional Budget Office (CBO) report on military pay and benefits, DoD uses a construct called "regular military compensation" (RMC) to determine the primary elements of cash compensation that all service members receive on a regular basis.[358] The report describes how RMC is calculated using basic pay plus allowances for subsistence (food) and housing, but also considers the savings generated by not having to pay federal income taxes on these allowances. The basic pay amount is determined by a member's pay grade and years of service. Enlisted personnel receive one monthly rate for their subsistence allowances that is different from the rate received by officers. The housing allowances also depend not only on pay grade, but also vary by location and whether the Service member has dependents.

The CBO report further describes the average salaries earned by Service members in 2012. In 2012, enlisted members in the E-4 pay grade, the fourthmost junior pay grade, with between 48 months and 72 months of service, earned $27,200 annually in basic pay and $4,180 monthly in subsistence allowance.[359] The average housing allowance for a member with dependents stationed in the continental United States was $14,820, although this varied greatly by location.

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[356] Ibid.

[357] Department of Defense Office of the Deputy Under Secretary of Defense. Report of the 2nd Quadrennial Quality of Life Review. 2009. http://www.militaryonesource.mil/12038/MOS/Reports/Quadrennial%20Quality%20of%20Life%20Review%202009.pdf. Accessed on July 18, 2013.

[358] Congressional Budget Office. Costs of Military Pay and Benefits in the Defense Budget. 2012.

[359] Congressional Budget Office, 2012, op cit.

Including an estimated tax break of $4,660, an E-4 Service member with dependents would have an RMC of $50,860.

According to the USDA website (webpage updated in 2012), the DoD estimates that approximately 5,000 DoD families, particularly those in low pay grades with large families, participate in the Supplemental Nutrition Assistance Program, formerly known as the Food Stamp Program.[360] However, the DoD does not track this information, and the numbers are likely to be lower because of a provision in the Defense Authorization Act for Fiscal Year 2001 that created the Family Subsistence Supplemental Allowance for Certain Members of the Armed Forces. Service members are entitled to this benefit if they have completed basic training and have gross incomes within the limits used by the Food Stamp Program.

According to a 2011 *Stars and Stripes* article, purchases made with food stamps at military commissaries have nearly tripled during the last four years, based on Defense Commissary Agency (DeCA) data.[361] Further, DeCA reported that nearly $88 million worth of food stamps were used at commissaries nationwide in 2011, up from $31 million in 2008.

Best Practices in Prevention and Weight Loss Programs in the General Population

In studies of the general population, the research community has emphasized focusing on the modifiers that amplify or attenuate the drivers of overweight and obesity across and within populations, including wealth, policies, cultural norms, behaviors, the built environment, genetic and epigenetic mechanisms, biological basis for food preferences, and biological mechanisms that regulate motivation for physical activity.[362] The evidence base in this area has been growing and building consensus regarding the need for systemic, multi-pronged, multi-leveled approaches. Experts agree that there is no single solution to obesity prevention and weight control and management.

For example, in its May 2012 report examining obesity in the civilian population, the Institute of Medicine (IOM) Committee on Accelerating Progress in Obesity Prevention noted that earlier research has demonstrated the need for a "meta-strategy" for obesity prevention that includes a range of recommendations.[363] The IOM committee noted that although one potential strategy could aid obesity prevention efforts, no single strategy could solve this complex challenge. Because of the need for multipronged strategies, the IOM committee used a systems approach in

[360] U.S. Department of Agriculture Food and Nutrition Service. Department of Defense – Family Subsistence Supplemental Allowance for Certain Members of the Armed Forces. Supplemental Nutrition Assistance Program. (Page last modified in 2012). http://www.fns.usda.gov/snap/rules/Memo/2000/shortfssa.htm Accessed on July 18, 2013.
[361] Robbins S. Food stamp use at military commissaries up sharply in four years. November 15, 2011. http://www.stripes.com/news/food-stamp-use-at-military-commissaries-up-sharply-in-four-years-1.160858 Accessed on July 18, 2013.
[362] Gortmaker SL, Swinurn BA, Levy D, et al. Changing the future of obesity: Science, policy, and action. *Lancet*. 2011 Aug 27;378(9793):838-47. doi: 10.1016/S0140-6736(11)60815-5.
[363] IOM. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington, DC: National Academies Press, 2012.

its review; this holistic approach is reflected in its multifaceted and interrelated recommendations and strategies, which spanned five defined critical areas: physical activity environments; food and beverage environments; message environments; health care and work environments; and school environments (see Box 4A).

Box 4A. A Systems Approach to Prevention and Treatment

Borrowed from other fields such as physics, economics, and engineering, systems science methodologies have been applied to many public health issues for the past few decades. This approach is used to generate models, or simplified versions, of reality such that the problem under study is analyzed not in isolation, but in relation to its interactions with its many environments.[364] This approach enables researchers and policy makers to better understand the complexity of an issue so that the most effective and targeted interventions and solutions can be developed. Most commonly, interventions designed to prevent or treat overweight and obesity focus on the individual, with most attempting to produce behavior changes such that the individual will engage in healthier practices involving nutrition, physical activity, and sleep, for example. However, these interventions do not take into account the micro- to macro-level influences on the individual and how they can affect choices made or whether options even exist.

In the case of overweight and obesity, researchers have shown that this problem is multi-faceted and that there is a huge range in the levels of scale involved and interconnected factors, including genes, neurobiology, psychology, family structure and influences, social context and social norms, environment, culture, markets, and public policy.[365] This variety of factors adds complexity to the study and prevention of overweight and obesity as each has its own effect on weight, may require a variety of measurement methods, and also span very different fields of science (from genetics to neuroscience to economics and political science).[366] It is also important to note not just the interaction between ecologic layers of a model, for example, social and environmental effects on behavior, but also the reality that multiple sectors operate at multiple levels and can have bidirectional influences.[367]

Despite the wide-ranging research and the many previous efforts to prevent obesity, it has steadily increased as a problematic health issue in society. Without consideration of the system as a whole, and how each component affects individual behavior, it is likely to remain a problem.

The IOM report offers four strategies concerning physical activity to meet its recommendation that "communities, transportation officials, community planners, health professionals, and governments should make promotion of physical activity a priority by substantially increasing

[364] Mabry PL, Marcus SE, Clark PI, Leischow SJ, Mendez D. Systems science: A revolution in public health policy research. *AJPH*. 2010;100(7):1161-1162.
[365] Hammond RA. Complex systems modeling for obesity research. *Prev Chronic Dis*. 2009;6(3):A97. http://www.cdc.gov/pcd/issues/2009/jul/09_0017.htm. Accessed July 21, 2013.
[366] Ibid.
[367] Ibid.

access to places and opportunities for such activity."[368] These strategies parallel the National Prevention Strategy (NPS) recommendations championed by the Office of the U.S. Surgeon General, which include:

1. Enhance the physical and built environment.
2. Provide and support community programs designed to increase physical activity.
3. Adopt physical activity requirements for licensed childcare providers.
4. Provide support for the science and practice of physical activity.

Similarly, the NPS includes five recommendations and specific action steps that policymakers at all levels, from the Federal Government to individual families, can implement to increase physical activity. The recommendations include:

1. Encourage community design and development that supports physical activity.
2. Promote and strengthen school and early learning policies and programs that increase physical activity.
3. Facilitate access to safe, accessible and affordable places for physical activity.
4. Support workplace policies and programs.
5. Assess physical activity levels and provide education, counseling and referrals. (National Prevention Council, May 2011).[369]

With regard to diet and nutrition, NPS offers six recommendations, along with action steps that stakeholders can implement. The recommendations include:[370]

1. Increase access to healthy and affordable foods in communities.
2. Implement organizational and programmatic nutrition standards and policies.
3. Improve nutritional quality of the food supply.
4. Help people recognize and make healthy food and beverage choices.
5. Support policies and programs that promote breastfeeding.
6. Enhance food safety.

The IOM report offered strategies similar to those of NPS, stating "Governments and decision makers in the business community/private sector should make a concerted effort to reduce unhealthy food and beverage options and substantially increase healthier food and beverage options at affordable, competitive prices."[371]

[368] IOM, 2012, op cit., p. 10.
[369] The Active Living priority area in the NPS cites the Physical Activity Guidelines for Americans and White House Task Force on Childhood Obesity Report to the President as key documents in implementing the recommendations and action steps.
[370] Key documents associated with these recommendations include the Surgeon General's Vision for a Healthy and Fit Nation, The White House Task Force on Childhood Obesity Report to the President, the Surgeon General's Call to Action on Breastfeeding, and the Dietary Guidelines for Americans and MyPlate.
[371] IOM, 2012, op cit., p.11.

Additionally, the IOM committee developed several strategies concerning messaging environments to meet its recommendation that "industry, educators and governments should act quickly, aggressively, and in a sustained manner on many levels to transform the environment that surrounds Americans with messages about physical activity, food and nutrition."[372]

DoD's Operation Live Well: Healthy Base Initiative

Launched in February 2013 by the Under Secretary of Defense (Personnel and Readiness), Operation Live Well (OLW) is a Department-wide education, outreach and behavior change initiative designed to improve the health and well-being of members of the defense community. Operation Live Well brings together the resources and capabilities of the entire local military community—commanders; health and medical experts; commissaries and dining facilities; education resources; and morale, welfare and recreation programs to focus on the best ways to promote health and well-being.[373] It is a three-phase effort, with Phase 1 consisting of an information and outreach campaign to the military community, as well as the implementation of the Healthy Base Initiative (HBI) pilot in June 2013 (see also Section III). Phase 2 will focus on evaluation and expansion of program services and tools that are shown to be most effective in producing behavior change, and Phase 3 involves the long-term effort to cement this behavior change, creating an environment where "healthy living becomes the easy choice and social norm."

Military Community and Family Policy is the lead for HBI. Using a systems approach, HBI aims to engage a wide range of Federal, private, non-profit and community partners to create an environment that encourages healthy and sustainable lifestyles focused on prevention. The HBI objectives are to optimize health and performance, improve readiness, reduce health care costs, and provide DoD with a framework for best practices that support the improvement of the health of the military community.

The 13[374] bases participating in the HBI pilot are currently in the process of fact-finding, with the goal of developing action plans to address identified gaps and optimize resources. The plan is to implement the HBI in August/September 2013 and collect baseline data at that time. Each base will launch its own strategies, perform quarterly evaluations using metrics developed specifically for each site, and determine whether these changes were successful in improving the health of Service members.

[372] Ibid, p. 13.
[373] Operation Live Well Fact Sheet provided by Ginnean Quisenberry, Office of the Chief Medical Officer Population Health and Medical Management. Prepared for the Defense Health Board. May 20, 2013.
[374] The following military installations are participating in the Healthy Base Initiative: Fort Bragg, NC; Fort Sill, OK; JB Pearl Harbor-Hickam, HI; Sub Base New London, CT; Mountain Home AFB, ID; Yokota AB, Japan; MCAGCC/MAGTFTC 29 Palms, CA; MCB Quantico, VA; U.S. Coast Guard Air Station Cape Cod, MA; March Air Reserve Base, CA; Camp Dodge, IA; Defense Logistics Agency, Fort Belvoir, VA; and Defense Health Headquarters, Falls Church, VA.

Outcome measures, which are still in development, may include:

1. Decrease in prevalence of health risks and increased wellness based on:
    a. Healthy weight
    b. Overweight (change in percent overweight)
    c. Obese (change in percent obese)
    d. Metabolic syndrome risk factors
    e. Tobacco use
    f. Overall health (health and wellness assessment, health-related quality of life, and change in behavior)
2. Increased readiness:
    a. Service member
    b. Family members
3. Cost avoidance:
    a. Medical costs related to: (risk-adjusted) Type II diabetes, stroke, coronary artery disease, coronary heart disease
    b. Decreased first year attrition rate because of failure to meet height-weight standards
4. Healthy community:
    a. Increased accessibility to healthy food options
    b. Improved eating habits
    c. Increased physical activity
    d. Improved physical environment
5. Better care:
    a. Physical, mental, and social well-being data on beneficiary population

The HBI is a time-limited demonstration project, and is novel in its design as it will use a systems approach, include a strategic communications campaign, and focus on self-activation efforts. It is also a low-cost endeavor that aims to achieve its goals through a redirection of resources, increased awareness, and adoption of new practices to effect behavior change.

Evaluating the Evidence

The recommendations of groups such as IOM and NPS are based on evidence that has accumulated over the past few decades. Some examples of efforts to review the evidence base are summarized below.

The Community Preventive Services Task Force is an independent, nonfederal, volunteer body whose members are appointed by the CDC Director. Its members represent a broad range of research, practice and policy expertise in community preventive services, public health, health promotion, and disease prevention. Created in 1996, the Task Force provides evidence-based recommendations about community preventive services, programs and policies that are effective in saving lives, increasing longevity, and improving Americans' quality of life. Although not specific to military populations, the recommendations offered by the Task Force and contained within the *Community Guide* have been thoroughly reviewed by the Task Force and may be

considered best practices with sufficient or strong evidence to protect and improve health, reduce the demand for future healthcare spending, and increase the productivity and competitiveness of the U.S. workforce.[375]

The Task Force bases its recommendations on rigorous, replicable systematic reviews of the evidence in the scientific literature by scientists and CDC subject matter experts in collaboration with a wide range of relevant partners representing academic, policy, and practice-based perspectives. The purpose of these reviews is to:

- Evaluate the strengths and weaknesses of published scientific studies about programs, services, and policies
- Assess whether the programs, services, and policies are effective in promoting health and preventing disease, injury, and disability
- Examine the applicability of these programs, services, and policies to varied populations and settings
- Conduct economic analyses of recommended interventions

The approaches in Table 4.1 are recommended by the Task Force for increasing physical activity levels of Americans based on a review of the evidence.[376] The Task Force has not found sufficient evidence regarding interventions to improve nutrition practices. However, it has reviewed health communication campaigns and concluded in 2010 that there is strong evidence that campaigns that include mass media and health-related product distribution are effective in changing behavior. With regard to provider-oriented interventions targeting obesity, the Task Force found in 2007 that there was insufficient evidence to make recommendations regarding provider education, provider feedback, and provider reminders. In 2008, it also determined that there was insufficient evidence for provider education with a client intervention, multicomponent provider interventions, and multicomponent provider interventions with client interventions.[377]

[375] Community Preventive Services Task Force. First Annual Report to Congress and the Agencies Related to the Work of the Task Force, 2011. http://www.thecommunityguide.org. Accessed July 18, 2013.
[376] The full Community Guide contains several reviewed approaches, some of which the Task Force has found to offer insufficient evidence for implementing. These approaches are not included in this report.
[377] A complete listing of the most up to date recommendations pertaining to provider-oriented interventions targeting obesity may be found at The Community Guide's website.
http://www.thecommunityguide.org/obesity/provider.html. Accessed July 18, 2013.

Table 4.1. Evidence Levels for Fitness Strategies: Community Preventive Services Task Force

Approach	Evidence level	Finding Date
Behavioral and Social Approaches		
Enhanced School-Based Physical Education	Strong	10/19/2000
Individually-Adapted Health Behavior Change Programs	Strong	2/8/2001
Social Support Interventions in Community Settings	Strong	2/8/2001
Campaigns and Informational Approaches		
Community-Wide Campaigns	Strong	2/8/2001
Environmental and Policy Approaches		
Community-Scale Urban Design and Land Use Policies and Practices	Sufficient	6/10/2004
Creation of or Enhanced Access to Places of Physical Activity Combined with Informational Outreach Activities	Strong	5/1/2001
Point-of-Decision Prompts to Encourage Use of Stairs	Strong	6/1/2005
Street-Scale Urban Design and Land Use Policies and Practices	Sufficient	6/10/2004

The approaches listed in Table 4.2 were reviewed by the Task Force as interventions targeting obesity that may be offered in the community setting.

Table 4.2. Interventions in Community Settings[378]

Interventions to Reduce Screen Time (e.g., time in front of a TV, computer monitor)	
Behavioral Interventions to Reduce Screen Time	Recommended January 2008
Mass Media Interventions to Reduce Screen Time	Insufficient Evidence January 2008
Technology-Supported Interventions (e.g., computer or web applications)	
Multicomponent Coaching or Counseling Interventions:	
To Reduce Weight	Recommended June 2009
To Maintain Weight Loss	Recommended June 2009
Interventions in Specific Settings	
Worksite Programs	Recommended February 2007
School-Based Programs	Insufficient Evidence October 2003

In a comprehensive review of the literature on worksite interventions, Anderson et al. found that there was evidence of a modest reduction in weight as a result of worksite health promotion programs that targeted the improvement of nutritional practices, physical activity, or both.[379] Among workers at 6- to 12-month follow-up, program effects were consistent and resulted in both sustained weight loss and decreased BMI. Among the group of studies comparing one intervention with another, additional or more-intensive modes of intervention provided to participants appeared to increase program impact. For example, offering structured programs was more effective than unstructured approaches, and providing behavioral counseling with information was more beneficial than providing information alone.

CDC also initiated the Common Community Measures for Obesity Prevention Project (the Measures Project).[380] The goal of the Measures Project was to identify and recommend a set of

[378] A complete listing of the most up to date recommendations pertaining to community setting interventions targeting obesity may be found at The Community Guide's website. http://www.thecommunityguide.org/obesity/communitysettings.html. Accessed July 18, 2013.

[379] Anderson LM, Quinn TA, Glanz K et al. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity. *American Journal of Preventive Medicine.* 2009;37(4):340-357.

[380] Centers for Disease Control and Prevention. Recommended community strategies and measurements to prevent obesity in the United States. *Morbidity and Mortality Weekly Report.* 2009;58(RR-7):1-29.

obesity prevention strategies and corresponding measurements that local government and communities could use to plan, implement, and monitor initiatives to prevent obesity. This work was performed by CDC staff in collaboration with a variety of consultants and experts in urban planning, the built environment, obesity prevention, nutrition, physical activity, and measurement.

The Measures Project process was guided by expert opinion and included a systematic review of the published scientific literature, resulting in the adoption of 24 recommended environmental and policy level strategies to prevent obesity. These were the first comprehensive recommendations published by CDC to promote healthy eating and active living and reduce the prevalence of obesity in the United States. The 24 strategies were divided into six areas of focus, and the evidence for each is presented in the report:

1. Strategies to promote the availability of affordable healthy food and beverages
2. Strategies to support healthy food and beverage choices
3. A strategy to encourage breastfeeding
4. Strategies to encourage physical activity or limit sedentary activity among children and youth,
5. Strategies to create safe communities that support physical activity
6. A strategy to encourage communities to organize for change

The U.S. Preventive Services Task Force (USPSTF) is a government-supported group, distinct from the Community Preventive Services Task Force that has investigated the issues of overweight and obesity in the United States. The USPSTF is a separate independent group of national experts in prevention and evidence-based medicine that works to improve the health of all Americans by making evidence-based recommendations about clinical preventive services such as screenings, counseling services, or preventive medications. The USPSTF was formed in 1984 and is composed of 16 volunteer members who come from the fields of preventive medicine and primary care. The work of the USPSTF complements that of the Community Preventive Services Task Force; however, the USPSTF focuses primarily on clinical practices for patients whereas the Community Preventive Services Task Force focuses on community interventions, policies and programs.[381]

McTigue et al. prepared a Systematic Evidence Review (SER) for the Agency for Healthcare Research and Quality that examined the evidence of the benefits and harms of screening and earlier treatment in reducing morbidity and mortality from overweight and obesity.[382] SERs are conducted with guidance from USPSTF and input from Federal partners, primary care specialty societies, and the Evidence-based Practice Center at Oregon Health Sciences University to systematically review the evidence of the effectiveness of a wide range of clinical preventive services in the primary care setting.

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[381] Centers for Disease Control and Prevention. FAQs: The Community Preventive Services Task Force. http://www.thecommunityguide.org/about/aboutTF.html. Accessed on July 18, 2013.

[382] McTigue K, Harris R, Hemphill MB. Screening and interventions for overweight and obesity in adults. *Systematic Evidence Review.* 2003; 21:1-118.

Using the USPSTF review process, the researchers developed an analytic framework and six key questions that investigated the relationship between screening and sustained weight reduction and reduced morbidity and mortality. The researchers also concluded that screening with BMI would detect a large percentage of adults who are obese or overweight. Some evidence suggested that counseling interventions could promote modest weight loss among overweight individuals (BMI 25-29.9). Effective treatments for obese people (BMI $\geq$ 30) included intensive counseling and behavioral interventions for lifestyle change, and pharmacotherapy. Surgery was found to be effective in reducing weight for people with a BMI of 35 or greater. However, adverse effects included increased blood pressure, gastrointestinal distress with drugs, and a slight risk of serious side effects with surgery.

The VA/DoD Clinical Practice Guidelines (CPG) for the Screening and Management of Overweight and Obesity also noted that pre-operative clinical depression can occasionally persist post operatively or in patients who were not previously depressed.[383] Tindle et al. cite a substantial excess of suicides among bariatric surgery patients during a 10-year follow-up; however, because of the study's small sample size, there was insufficient power to establish statistical significance. [384] The authors contend that the reasons for the excess suicides are not known, despite the high prevalence of depression and co-morbid mental illness among morbidly obese and bariatric surgery candidates. The guidelines note the need for lifelong medical surveillance, to include monitoring for nutrition, changes in chronic health conditions, and specific complications related to the surgery such as anemia.[385]

In its review of overweight and obesity interventions often used at worksites, the USPSTF concluded that outcomes were mixed.[386] There was insufficient evidence to suggest behavioral counseling in primary care settings was effective in promoting physical activity or a healthy diet among patients without risk factors. However, for patients who possessed risk factors for obesity-related diseases, such as hyperlipidemia and cardiovascular disease, there was good evidence that intensive counseling (combined nutrition education with behavioral dietary counseling provided by a nutritionist, dietician, or specially trained primary care clinician) could result in meaningful changes in the adoption of healthy eating practices.

Additionally, the USPSTF found fair to good evidence that high-intensity counseling in primary care settings—about diet, exercise, or both—combined with activities focused on patient skill development, motivation, and support strategies produced modest, sustained weight loss (typically 3–5 kg for 1 year or more) in adults who were obese, defined as BMIs equal to or greater than 30. There was insufficient evidence to determine the effectiveness of moderate- or

[383] Department of Veterans Affairs / Department of Defense. *The Management of Overweight and Obesity Working Group. VA/DoD Clinical Practice Guideline for Screening and Management of Overweight and Obesity*. Washington, DC, 2006.
[384] Tindle HA, Omalu B, Courcoulas A, et al. Risk of suicide after long-term follow-up from bariatric surgery. *Am J Med*. 2010;123(11):1036-1042.
[385] The Management of Overweight and Obesity Working Group. *VA/DoD Clinical Practice Guideline for Screening and Management of Overweight and Obesit*y. 2006; Version 1.0:69-72.
[386] Anderson et al., 2009, op cit.

low-intensity counseling among obese adults, or to determine the effectiveness of counseling to promote sustained weight loss in overweight adults.[387]

At the individual (clinical) level, the National Heart, Lung, and Blood Institute (NHLBI) in cooperation with the National Institute of Diabetes and Digestive and Kidney Diseases issued "Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report" in 1998.[388] These were the first guidelines developed by the Federal Government to address overweight and obesity conditions.

NHLBI's evidence-based guidelines present an approach for the assessment of overweight and obesity and establish principles for safe and effective weight loss. The recommendations were based on the most extensive review of the scientific literature at the time. The guidelines provide a clinical tool for any health professional who works with overweight and obese patients, including a treatment algorithm and other convenient references to aid the clinician. Importantly, the guidelines emphasize early identification of those at risk. Gantt et al. recommended in 2008 that the Navy Bureau of Medicine and Surgery adopt these guidelines. [389]

Based on these guidelines, NHLBI and the North American Association for the Study of Obesity jointly developed "The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults" for providers.[390] The goal of the Practical Guide is to give providers the tools needed to manage overweight and obese adult patients. Furthermore, both the Guidelines and the Practical Guide serve as the basis for the NHLBI overweight and obesity prevention program "Aim for a Healthy Weight," which offers patient education materials and provider kits developed in 2005.[391]

As mentioned earlier, workplace interventions have been recommended as a best practice in treating overweight and obesity. One meta-analysis of the workplace interventions literature included 36 studies on the costs and savings associated with employer-based wellness promotion policies.[392] The meta-analysis authors screened the studies for analytical rigor and compiled standardized estimates of return on investment from the workplace interventions.
Baicker et al. focused on studies for which there was a comparison group of nonparticipants, and examined effects of wellness program interventions on health care costs and absenteeism.[393] The two most common interventions were health risk assessments, used by 80 percent of the

[387] Summberbell CD, Cameron C, Glasziou RP. Advice on low-fat diets for obesity. *The Cochrane Library.* 2002.
[388] NIH. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. NIH Publication No. 98-4083. September 1998. http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed July 10, 2013.
[389] Gantt CJ, Neely JA, Villafana IA, et al. Analysis of weight and associated health consequences of the active duty staff at a major naval medical center. *Military Medicine.* 2008;173(5):434-440.
[390] National Institutes of Health. The practical guide: Identification, evaluation, and treatment of overweight and obesity in adults. Rockville, MD: NIH, 2000.
[391] National Heart, Lung, and Blood Institute. Aim for a Healthy Weight. http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/index.htm Accessed on July 18, 2013.
[392] Baicker K, Cutler D, Song Z. Workplace wellness programs can generate savings. *Health Affairs.* 2010;29(2):304-311.
[393] Baicker et al., 2010, op cit.

programs, followed by the provision of self-help education materials, individual counseling with healthcare professionals, or on-site group activities led by trained staff. The most common areas of program focus were obesity and smoking, and more than 60 percent of the programs focused primarily on weight loss and fitness. Their review of the evidence suggested that large employers adopting wellness programs see substantial positive returns, even shortly after adoption. Medical costs decreased about $3.27 for every dollar spent on wellness programs, and absentee day costs fell by about $2.73 for every dollar spent.

Box 4B. Example of Research-Tested Intervention Programs (National Cancer Institute)[394]

The National Cancer Institute's (NCI's) Complete Health Improvement Program (CHIP) is a lifestyle modification course for groups of adults, who are 18 or older, that can take place in any community or workplace setting. The goal of the CHIP curriculum is to improve nutritional choices and reduce cardiovascular disease risk factors by educating participants about the medical benefits of eating well and exercising. CHIP is both a Research-Tested Intervention Program, per NCI, as well as a program recommended by the Community Preventive Services Task Force.

The CHIP curriculum includes a series of educational lectures on downloadable video files. Over a course of 12 weeks, the lectures are delivered by several health experts in a group setting in 90-minute sessions that incorporate facilitated discussions and a series of three health risk assessments. Participants receive educational materials and are encouraged to follow preset dietary and exercise goals. To assist in the maintenance of the new behaviors, participants are encouraged to join support groups after completing the course. Members also receive a monthly newsletter with relevant news to assist in these efforts.

[394] National Cancer Institute. Complete Health Improvement Program (CHIP). Research-Tested Intervention Programs (RTIPs). http://rtips.cancer.gov/rtips/programDetails.do?programId=1194633. Accessed July 18, 2013.

Findings and Recommendations: Dependents and Retirees

Recent efforts focused on the growing rates of overweight and obesity in the military community include numerous base-specific campaigns as well as the HBI. The HBI is novel in its design as it will use a systems approach, include a strategic communications campaign, and focus on self-activation efforts. It is also a low-cost effort that aims to achieve its goals through a redirection of resources, increased awareness, and adoption of new practices to effect behavior change. However, it is a time-limited demonstration project. Thus, it is important to adequately resource and evaluate the effort to determine its effectiveness and potential for expansion of those elements that prove to be successful.

As discussed in Section III of this report, base-specific as well as DoD-wide programs need to be evidence-based and periodically assessed for effectiveness. The DHB recognizes the challenge of offering programs to such a complex population, one that varies by status, age, demography, Service, location, and provider environment. With so many moving parts, it is critical to maintain a sustained focus on these issues at the Department level, which has the vantage point to view the system in its entirety.

Recommendation 14: DoD should consistently embrace a systems approach in addressing overweight and obesity in its beneficiary and retiree populations, consistent with the strategies outlined by the Institute of Medicine in 2012 and the National Prevention Strategy of the U.S. Surgeon General. This requires that the Department take the following actions.

a) Emphasize a focus on a lifetime course of health for dependents and retirees, addressing all of the variables that influence healthy weight.
b) Provide 24-hour access to healthy foods, physical fitness programs, and support for military families living on or near military facilities.
c) Facilitate access to healthcare providers appropriately trained in health and wellness management.
d) Promote seamless coordination of care as retirees transition from the DoD health system to the VA health systems, with a focus on prevention.
e) Develop and sustain Department-level quality assessment and improvement activities that address large-scale population-based programs focused on health and wellness, particularly weight management.
f) Identify and prioritize interventions for those populations at greatest risk for unhealthy weight, for example, young military families lacking sufficient access to healthy foods or affordable and accessible weight management programs.
g) Set nutritional standards for food offered through DoD dining facilities and by on-base contract vendors
h) Ensure that the physical environment of military installations supports the principles of a healthy lifestyle, such as bicycle paths and walkways.

Using a systems approach, HBI is a good example of an initiative that addresses the key contributors to obesity, and seeks to create an environment that encourages healthy and sustainable lifestyles focused on prevention. The HBI objectives are to optimize health and performance, improve readiness, reduce health care costs, and provide DoD with a framework for best practices that support improvement of the health of the military community.

V. Children of Military Personnel

The Defense Health Board was charged to review strategies and best practices for ensuring that children of military personnel specifically, and the overall population more generally, achieve healthy weight.

Youth with a parent who served in the military are twice as likely to consider military service than are children of those with no record of military service.[395] As this cohort is likely to be cared for through the Military Health System (MHS) and be the recipient of installation-based services, such as childcare and child development centers, it is important that efforts be made to ensure healthy weight for these children not only for reasons of health but also to help support force readiness in the future.

Calculating Overweight and Obese in Children and Youth

As in adults, BMI is used to determine childhood overweight and obesity. It is calculated using a child's weight and height and an age- and sex-specific percentile for BMI rather than the BMI categories used for adults. This is because children's body composition varies as they age and varies between boys and girls.

Centers for Disease Control and Prevention (CDC) Growth Charts are used to determine the corresponding BMI-for-age and sex percentile. For children and adolescents (aged 2 to 19 years):

- Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex.
- Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex.[396]

In 2005, the U.S. Preventive Services Task Force (USPSTF) found adequate evidence that BMI was an acceptable measure for identifying children and adolescents with excess weight.[397]

Prevalence

Most prevalence data focus on obesity and not overweight. Results from the 2007-2008 National Health and Nutrition Examination Survey (NHANES), using measured heights and weights, indicate that an estimated 16.9 percent of children and adolescents aged 2 to19 years are

[395] Poling T, Principal Research Scientist, Joint Advertising, Market Research and Studies (JAMRS). "Joint Advertising Market Research and Studies Accessions Data." Presentation to the Defense Health Board, November 16, 2012.
[396] Barlow SE and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics.* 2007;120 Supplement December 2007:S164-S192.
[397] USPTF. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation. *Pediatrics.* February 2010;125(2):361-367. http://www.uspreventiveservicestaskforce.org/uspstf10/childobes/chobesrs.pdf. Accessed July 17, 2013.

Obesity in childhood can also have other harmful effects, such as:

- Breathing problems, e.g., sleep apnea, asthma[406]
- Joint problems and musculoskeletal discomfort[407]
- Fatty liver disease, gallstones, and gastro-esophageal reflux[408]

Obese children and adolescents also are at greater risk of social and psychological problems, such as discrimination and poor self-esteem, which can continue into adulthood.[409]

Childhood overweight and obesity have implications that last a lifetime. Overweight adolescents have a 70 percent chance of becoming overweight or obese adults, which increases to 80 percent if one or more parent is overweight or obese.[410] In addition, obese children are more likely to become obese adults, and their obesity in adulthood is likely to be more severe.[411, 412, 413, 414] Adults who were overweight and obese as children are three times more likely to have heart disease, high blood pressure, high cholesterol, type 2 diabetes, polycystic ovary syndrome (in women), various cancers, and eating disorders.[415]

Best Practices and Strategies for Preventing and Treating Overweight and Obesity in Children and Youth

Much attention has been paid to preventing overweight and obesity in children, as well as treating the conditions once they develop.

Numerous studies have evaluated three major types of interventions that are expected to produce weight gain prevention effects: 1) health supervision (clinical recommendations), 2) interventions designed to increase physical activity, and 3) dietary and nutritional programs that promote use of healthy weight management skills (see Table 5.1). Substantial evidence supports the importance of behavioral modification and supportive counseling as well as parental engagement.[416]

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[406] Sutherland ER. Obesity and asthma. *Immunol Allergy Clin North Am.* 2008;28(3):589-602, ix.
[407] Taylor ED, Theim KR, Mirch MC, et al. Orthopedic complications of overweight in children and adolescents. *Pediatrics.* Jun 2006;117(6):2167-2174.
[408] Han JC, Lawlor DA, Kimm SY. Childhood obesity. *Lancet.* May 15 2010;375(9727):1737-1748.
[409] Whitlock EP, Williams SB, Gold R, et al. Screening and interventions for childhood overweight: A summary of evidence for the US Preventive Services Task Force. *Pediatrics.* 2005;116(1):e125-144.
[410] Torgan, C. 2002. Childhood obesity on the rise. The NIH Word on Health. http://www.nih.gov/news/WordonHealth/jun2002/childhoodobesity.htm. Accessed July 17, 2013.
[411] Biro FM, Wien M. Childhood obesity and adult morbidities. *Am J Clin Nutr.* May 2010;91(5):1499S-1505S.
[412] Whitaker RC, Wright JA, Pepe MS, et al. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* 1997;37(13):869-873.
[413] Serdula MK, Ivery D, Coates RJ, et al. Byers T. Do obese children become obese adults? A review of the literature. *Prev Med.* 1993;22:167-177.
[414] Freedman DS, Khan LK, Dietz WH, et al. Relationship of childhood overweight to coronary heart disease risk factors in adulthood: The Bogalusa Heart Study. *Pediatrics* 2001;108:712-718.
[415] Field AE. Epidemiology of the health and economic consequences of pediatric obesity. In Goran MI, Sothern MS, eds. *Handbook of Pediatric Obesity.* Boca Raton, FL: Taylor & Francis; 2006; 1-18.
[416] Stice E, Shaw H, Marti CN. A meta-analytic review of obesity prevention programs for children and adolescents:

Several organizations have reviewed effectiveness of strategies for weight loss and maintenance.

USPSTF found adequate evidence that multicomponent, moderate- to high-intensity behavioral interventions for obese children and adolescents aged 6 years and older can effectively yield short-term (up to 12 months) improvements in weight status.[417] It recommends that in addition to appropriate screening for obesity, clinicians should offer, or refer children found to be obese to, comprehensive, intensive behavioral interventions to promote improvement in weight status. The USPSTF reviewed 13 behavioral intervention trials conducted with 1,258 overweight or obese (primarily obese) children and adolescents aged 4 to 18 years. Interventions were deemed comprehensive and effective for weight loss if they included: 1) counseling for weight loss or healthy diet; 2) counseling for physical activity or a physical activity program; and 3) instruction and support for the use of behavioral management techniques to help make and sustain changes in diet and physical activity. The intensity of efforts was an important factor, with higher intensity interventions in terms of time and duration being the most effective. Limited evidence suggests that reductions in insulin-resistance levels are possible with moderate to high-intensity comprehensive interventions; however, decreases in cardiovascular risk factors were not consistent. Studies of combined pharmacologic and behavioral interventions are less conclusive =regarding impact.

The skinny on interventions that work.

[417] Whitlock EP, O'Connor EA, Williams SB, et al. Effectiveness of Primary Care Interventions for Weight Management in Children and Adolescents: An Updated, Targeted Systematic Review for the USPSTF. Evidence Synthesis No 76. AHRQ Publication No 10-05144-EF-1. Rockville, MD: Agency for Healthcare Research and Quality; 2010.

Table 5.1. Childhood Obesity and Overweight Prevention Strategies[418, 419, 420, 421]
Health Supervision • Identify and track patients at risk by family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors. • Calculate and plot BMI in children and adolescents. • Use BMI change to identify excessive weight gain. • Promote breastfeeding. • Improve sleep.
Dietary • Promote healthy eating patterns including nutritious snacks, vegetables and fruit, low-fat dairy foods, and whole grains. • Limit unhealthy foods and beverages (such as refined grains and sweets, red and processed meat and sugary beverages) • Encourage self-regulation of food choices and limits.
Physical Activity • Promote routine physical activity including unstructured play at home, school and in the community. • Limit television and video time to a maximum of two hours per day.

In 2007, an American Medical Association (AMA) committee representing 15 professional medical organizations revised AMA recommendations on how clinicians should approach the prevention, assessment, and treatment of childhood obesity.[422, 423] The AMA advised that a clinician's assessment should include a BMI calculation as well as evaluation of medical and behavioral risks for obesity. For overweight and obese patients, clinicians should use a stepwise approach that divides treatment into several stages including counseling, provision of a structured weight management plan, and use of a comprehensive multidisciplinary intervention/tertiary care intervention delivered by multidisciplinary teams with expertise in childhood obesity. The American Academy of Pediatrics endorsed the AMA recommendations and also recommended the annual plotting of BMI for all patients aged 2 years and older.[424]

[418] American Academy of Pediatrics, Committee on Nutrition. Prevention of Pediatric Overweight and Obesity. *Pediatrics*. August 1, 2003;112(2):424-430.
[419] Saguil A, and M Stephens. Interventions to prevent childhood obesity. *American Family Physician*. July 1, 2012;86(1):30-32.
[420] Obesity Prevention Strategies. The Obesity Prevention Source, Harvard School of Public Health. http://www.hsph.harvard.edu/obesity-prevention-source/obesity-prevention/. Accessed July 17, 2103.
[421] Fact Sheet. Overview of the Institute of Medicine. Preventing childhood obesity: Health in the balance. Washington, DC: The National Academies Press; September 2005.
[422] Barlow SE; Expert Committee. Expert Committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(suppl 4):S164 – S192.
[423] Barlow SE, and WH Dietz. Obesity evaluation and treatment: Expert Committee recommendations. *Pediatrics*. 1998;102(3). Available at: www.pediatrics.org/cgi/content/full/102/3/e29.
[424] Krebs NF, and MS Jacobson; American Academy of Pediatrics, Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112(2):424-430.

The Institute of Medicine (IOM) has produced a series of assessments of approaches to prevent and manage childhood obesity (see Table 5.2). These reports provide the evidence for strategies to reduce the nation's rate of childhood obesity. In general, they recommend multifaceted interventions that involve collaborative efforts among multiple responsible parties, such as health care providers; parents; schools; local, state, and federal government officials; and the food and beverage industries. In particular, the IOM reports have focused on the social determinants of overweight and obesity, for example, television marketing, food deserts, and the built environment.

Table 5.2. Institute of Medicine Reports on Childhood Obesity

Local Government Actions to Prevent Childhood Obesity (2009) recommends action steps for local government officials to curb obesity among children in their communities.

School Meals: Building Blocks for Healthy Children (2009) offers recommendations to update the nutrition standard and the meal requirements for the National School Lunch and School Breakfast Programs. The report sets standards for menu planning that focus on food groups, calories, saturated fat, and sodium and that incorporate Dietary Guidelines for Americans and the Dietary Reference Intakes.

The Public Health Effects of Food Deserts: Workshop Summary (2009) contains discussions on the absence of affordable healthy food options such as fresh produce in low-income neighborhoods and the effect this has on residents' health.

Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth (2007) offers recommendations about appropriate nutrition standards for foods and beverages offered in competition with federally reimbursable school meals programs.

Progress In Preventing Childhood Obesity: How Do We Measure Up? (2006) assesses the progress made by obesity prevention initiatives in the two-year period following the release of Preventing Childhood Obesity: Health in the Balance.

Food Marketing to Children and Youth: Threat or Opportunity? (2005) determines that food and beverage marketing practices puts children's long-term health at risk and offers a guide for developing effective marketing and advertising strategies that promote healthier foods, beverages, and meal options to children and youth.

Preventing Childhood Obesity: Health in the Balance (2004) offers a comprehensive national strategy with specific actions for families, schools, industry, communities, and government.

SOURCE: Institute of Medicine. http://iom.edu/Global/News%20Announcements/IOM-Reports-Provide-Science-Based-Foundation-for-Efforts-to-Curb-Childhood-Obesity.aspx

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

8 December 2010

MEMORANDUM FOR THE DEFENSE HEALTH BOARD
ATTN: MS. CHRISTINE BADER

FROM: HQ USAF/SG
1780 Air Force Pentagon
Washington, DC 20330-1780

SUBJECT: Obesity Implications for the Department of Defense (DoD) and Military Health System (MHS)

Last month you requested that the Air Force present a topic of concern that the Defense Health Board might be willing and able to address. The questions presented on the attachment relate to the current nationwide epidemic of obesity, specifically how this epidemic will affect the DoD and the MHS, and whether there were proven interventions that could be instituted both among uniformed members and among dependents that might mitigate some of the prevailing trends.

I understand that many members of the Board were favorably disposed towards reviewing and evaluating many of these difficult questions. I recognize the topic of obesity is cross-cutting, challenging, and will likely take some time to thoroughly review. I look forward to the response from the Board when it comes available.

The Air Force Liaisons to the Defense Health Board are Lt Col Meletios Fotinos, (210) 395-9046, DSN 969-9046, or meletios.fotinos@us.af.mil and Lt Col Philip Gould, (703) 588-6470, DSN 425-6470, or philip.gould@pentagon.af.mil.

THOMAS W. TRAVIS
Major General, USAF, MC, CFS
Deputy Surgeon General

Attachment:
Questions to the Defense Health Board on Obesity: Implications for the DoD and MHS

QUESTIONS TO THE DEFENSE HEALTH BOARD

IMPLICATIONS FOR THE DEPARTMENT OF DEFENSE AND MILITARY HEALTH SYSTEM

1. Given the trends in obesity in the U.S., how will the Defense Department's and Air Force's ability to recruit and retain active duty, guard, and reserve military personnel be affected? Will there be a need to modify accession standards? Should there be job related weight and fitness standards (more lax for some, e.g. cyber forces, as opposed to more rigorous for others, e.g. special operations forces)?

2. What are the best practices to attain appropriate body weight for overweight and obese active duty, guard, and reserve military personnel? Assuming some overweight and obese personnel will fail to attain appropriate body weight despite "best practice" intervention, what further action should the Defense Department take with regard to these personnel?

3. What is the optimal strategy that the Defense Department should adopt to address overweight and obesity in DoD dependents and retirees? What long-term costs related to dependent and retiree overweight and obesity should the Defense Department expect, assuming DoD dependent and retiree weight follows general population trends in the U.S.? What are the best practices and economically reasonable methods for addressing overweight and obesity in DoD dependents and retirees?

4. Are the sons and daughters of active duty or retired military more likely to join the military than individuals who are not the sons and daughters of active duty or retired military personnel? If they are more likely, what best practices should the Defense Department adopt so the sons and daughters attain and/or maintain appropriate weight prior to accession? What practices are economically feasible for the Defense Department to undertake to influence children and adolescents in the general population such that a sufficient number of young adults will have the appropriate weight for accession into the military?

Appendix B
Terms of Reference

These terms of reference establish the objectives for the Defense Health Board's (DHB) investigation of the implications of the obesity epidemic on the Department of Defense (DoD). They outline the scope of the Board's examination as well as the Board's methodology for responding to the Department's request.

Mission Statement: To conduct a comprehensive assessment of the effects of the obesity epidemic on DoD, focusing on recruitment, retention and best practices for obtaining appropriate weight. The Board will review current obesity treatment and prevention best practices and activities, including DoD activities, and recommend a strategy for DoD to address this issue within the Active Duty, Reserve, retiree and military family populations.

Issue Statement: Excessive weight and body fat has become the leading medical reason applicants are disqualified for military service. Obesity/overweight is also affecting more and more current Service members, with 1,200 enlisted members leaving the military every year because of excess weight. TRICARE, the health insurance program for Service members, their dependents and retirees, spends nearly $1.1 billion annually treating obesity-related illness. Recognizing this problem, the Department is seeking feasible solutions. On April 20, 2012, the Acting Under Secretary of Defense for Personnel and Readiness endorsed a request by the Deputy Surgeon General of the Air Force that the DHB examine the issue of obesity and its implications for the Department, and provide a recommended strategy for DoD to address this growing problem.

Objectives and Scope: The Board will address the following questions in its report:

1. Given the trends in obesity in the U.S., how will the Defense Department's and Air Force's ability to recruit and retain Active Duty, Guard, and Reserve military personnel be affected? Will there be a need to modify accession standards? Should there be job related weight and fitness standards (lax for some, e.g. cyber forces, as opposed to increased rigor for others, e.g. Special Operations Forces)?
2. What are the best practices to attain/maintain appropriate body weight for overweight and obese Active Duty, Guard, and Reserve military personnel? Assuming some overweight and obese personnel will fail to attain appropriate body weight despite "best practice" intervention, what further action should the Defense Department take with regard to these personnel?
3. What is the optimal strategy that the Defense Department should adopt to address overweight and obese DoD dependents and retirees? What long-term costs related to dependent and retiree overweight and obesity should the Defense Department expect, assuming DoD dependent and retiree weight follows general population trends in the U.S.? What are the best practices and economically reasonable methods for addressing overweight and obesity in DoD dependents and retirees?
4. Are the sons and daughters of Active Duty or retired military more likely to join the military than individuals who are not the sons and daughters of active duty or retired military personnel? If they are more likely, what best practices should the Defense Department adopt so the sons and daughters attain and/or maintain appropriate weight prior to accession? What

practices are economically feasible for the Defense Department to undertake to influence children and adolescents in the general population such that a sufficient number of young adults will have the appropriate weight for accession into the military?

Methodology: A subset of the DHB, consisting of four Board members, will receive briefings from subject matter experts (SMEs) in obesity prevention and best practices, as well as from DoD leaders who are currently operating initiatives to address this issue. The members will review the literature and available best practices, and, using this information as well as the information received from briefings, will present their findings and positions to the DHB for consideration and deliberation. The DHB will deliberate the findings, during which time members may propose recommendations, and vote on those recommendations in an open public session.

Deliverable: The Board will have one year to complete its review. The subset of Board members conducting the primary review will provide a progress update to the Board at the November 2012 meeting. The Board will deliberate the interim findings and positions provided by the subset of members at its February 2013 meeting and produce an interim report shortly thereafter. The Board will deliberate the final findings and positions presented by the subset of members at its June 2013 meeting and produce the final report immediately following.

Membership: Four appointed DHB members will comprise the subset of the Board leading the primary investigation, and will consult SMEs as needed.

Support:

1. The DHB office will provide any necessary administrative, analytical/research and logistical support for the Board.

2. Funding for this review is included in the DHB operating budget.

Appendix C
Meetings and Presentations

July 16, 2012
Falls Church, VA

Obesity in the U.S.: Descriptive Epidemiology
Dr. Cynthia Ogden, Epidemiologist and Branch Chief, National Health and Nutrition Examination Survey (NHANES), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS)

Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation
Ms. Leslie Sim, Senior Program Officer, Food and Nutrition Board, Institute of Medicine (IOM), The National Academies

Office of the Chief Medical Officer Population Health and Medical Management
- Dr. John Kugler, Deputy Chief Medical Officer, Office of the Chief Medical Officer (OCMO), Health Affairs/TRICARE Management Activity (HA/TMA)
- Ms. Ginnean Quisenberry, Director, Population Health and Medical Management, OCMO, HA/TMA
- CAPT (Dr.) Kimberly Elenberg, Deputy Director, Population Health and Medical Management, OCMO, HA/TMA

August 22, 2012
Chicago, IL

Members discussed the way ahead and reviewed their terms of reference and guiding principles. There were no briefings at this meeting.

September 17, 2012
Falls Church, VA

Accession Policy Overview
LTC Kathrine Ponder, Assistant Director, Reserve and Medical Manpower, Office of the Under Secretary of Defense for Personnel & Readiness, Military & Personnel Policy, Accession Policy Directorate

DoD-wide Data from the Accession Medical Standards Analysis and Research Activity
MAJ Marlene Gubata, Chief, Accession Medical Standards Analysis and Research Activity, Preventive Medicine Program, Walter Reed Army Institute of Research

Military Recruiting & Eligibility: A Focus on the Impact of BMI
Dr. Taylor Poling, Principal Research Scientist, Joint Advertising, Market Research & Studies (JAMRS), DoD Human Resources Agency (DHRA)

Accessions Briefings from the Services and DoD

- Mr. Alphonso Green, Chief, Recruiting Policy Branch, Army Deputy Chief of Staff Office (G-1)
- CMSgt Charles Lamer, Jr., Chief, Enlisted Accessions Policy, Air Force Deputy Chief of Staff, Manpower and Personnel/A1PT
- CAPT Norberto Nobrega, Chief of Staff, Navy Recruiting Command
- CAPT Melanie O'Brien, Director of Operations, Navy Recruiting Command
- Mr. Mike Styka, Deputy Head, Enlisted Recruiting Operations, Marine Corps Recruiting Command

November 16, 2012
Alexandria, VA

Obesity Among U.S. Adults Who Previously Served in the Military, 2007-2010
Dr. Cynthia Ogden, Epidemiologist and Branch Chief, NHANES, CDC, NCHS

JAMRS Eligibility and Propensity Data
Dr. Taylor Fairley (Poling), Principal Research Scientist, JAMRS, DHRA

Military Health System Innovation Strategy: Obesity Innovation Deep Dive
Ms. Rachel Foster, Director, Financial Performance & Planning, Health Budgets and Financial Policy, and Military Health System Chief Innovation Officer

National Heart, Lung, and Blood Institute's Overweight and Obesity Activities
Ms. Karen Donato, Deputy Director, Division for the Application of Research Discoveries; Coordinator, Overweight and Obesity Research Applications, National Heart, Lung, and Blood Institute, National Institutes of Health (NIH)

NIH Obesity Resources
CAPT (Dr.) Christine Hunter, Director of Behavioral Research, National Institute of Diabetes and Digestive and Kidney Diseases, NIH

Addressing Obesity by Changing Defaults
Dr. Kelly Brownell, James Rowland Angell Professor of Psychology, Professor of Epidemiology and Public Health Director, Rudd Center for Food Policy and Obesity, Yale University

Best Practices Interventions for Weight Maintenance
Dr. William (Bill) Dietz, Former Director of the Division of Nutrition, Physical Activity and Obesity, CDC

January 25, 2013
Falls Church, VA

Active Duty, Reserves, Retirees, and Military Families: "What to do about Obesity?"
Dr. Howard Fishbein, Senior Epidemiologist, Battelle Memorial Institute

Weight Management in the Military
Dr. Alan Peterson, Professor, Department of Psychiatry, Chief, Division of Behavioral Medicine; Director, STRONG STAR Multidisciplinary PTSD Research Consortium; Deputy Chair for Military Collaboration, University of Texas Health Science Center at San Antonio

Healthy Base Initiative
Mr. Charles (Chuck) Milam, Acting Deputy Assistant Secretary of Defense for Military Community and Family Policy

A Multi-Sector Systems Approach to Obesity Prevention
Dr. Christina Economos, Director, ChildObesity180; Associate Professor, New Balance Chair in Childhood Nutrition, Friedman School of Nutrition Science and Policy, Tufts University

NHANES Military Data Update
Dr. Cynthia Ogden, Epidemiologist and Branch Chief, National Health and Nutrition Examination Survey (NHANES), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics

March 1, 2013
On this teleconference, members discussed and reviewed the draft of the report. There were no briefings at this meeting.

March 25, 2013
On this teleconference, members discussed and reviewed the draft of the report. There were no briefings at this meeting.

May 23-24, 2013
Falls Church, VA

Retention Related Fitness and Weight for Height Standards

- Capt Katherine Bopp, Air Force Personnel, Air Force Headquarters
- LCDR Jennifer Wallinger, Navy Personnel Readiness and Community Support Branch
- Dr. Steve Heaston, Navy and Marine Corps Public Health Center
- Ms. Lisa Sexaeur, Commander, Navy Installations Command
- Mr. Brian McGuire, Physical Readiness Programs Officer, Marine Air-Ground Task Force Training Standards Division, Training & Education Command

Army AR 600-9 Weight Control Program
MAJ Christine Ludwig, Chief, Health Promotions Policy, Program Executive Officer, Deployment Health Assessment, Office of the Deputy Chief Of Staff (G-1)

Army TRADOC-Army Fitness
Mr. Frank Palkoska, Chief, Army Physical Readiness Division

Army Wellness Centers
Mr. Todd Hoover, Program Manager, Army Wellness Centers

Army Weight Control Program/MOVE! Program
LTC Sandra Keelin, U.S. Army Public Health Command

Army Performance Triad
LTC Anne Andrews, U.S. Army Office of the Surgeon Genera*l*

Military Diet and Weight Mitigation Strategies
Dr. Andrew Young, Chief, Military Nutrition Division, U.S. Army Research Institute of Environmental Medicine

Food Systems
Mr. Michael Conard, Project Coordinator, Urban Design Lab, Adjunct Associate Professor, Graduate School of Architecture, Planning, and Preservation, Columbia University

Overweight Morbidity and Mortality
Dr. Walter Willett, Professor and Chair, Department of Nutrition, School of Public Health, Harvard University

Roundtable Discussion of Healthy Base Initiative

- Dr. Warren Lockette, Deputy Assistant Secretary of Defense for Clinical and Program Policy, Office of the Assistant Secretary of Defense (Health Affairs)
- CAPT (Dr.) Kimberly Elenberg, Deputy Director, Population Health and Medical Management Division, OCMO, HA/TMA
- Ms. Karen Roberts, Deputy Director, Military Health System Strategic Communications

July 9, 2013

On this teleconference, members discussed and reviewed the draft of the report. There were no briefings at this meeting.

July 23, 2013

On this teleconference, members discussed and reviewed the draft of the report. There were no briefings at this meeting

October 31, 2013

On this teleconference, members discussed and reviewed the draft of the report. There were no briefings at this meeting.

Appendix D
Service-Specific Height-Weight Accessions Policies

Army
Department of the Army, Headquarters. Army Regulation 40-501. *Standards of Medical Fitness*. December 14, 2007.

Navy
U.S. Navy, Commander, Navy Recruiting Command. *Exhibit 020701 Navy Recruiting Manual-Enlisted COMNAVCRUITCOMINST 1130.8J. vol 2*. May 17, 2011.

Air Force
Department of the Air Force. Air Force Instruction 36-2905. *Fitness Program*. August 2, 2013.

Marine Corps
Department of the Navy, Headquarters. MCO 6110.3 *Marine Corps Body Composition and Military Appearance Program*. August 8, 2008.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
Accession Medical Standards Analysis and Research Activity (AMSARA)	Continuously since 1997	In the most recent year, approximately 270,000 active duty, reserve, and National Guard enlisted applicants examined for medical fitness at Military Entrance Processing Stations (MEPS)	Sources: MEPS; Gain and Loss Files; Accession Medical Waivers; Hospitalizations; EPTS Discharges; Disability Evaluations	BMI; body fat percentage	Basic applicant and accession data provided for all Service members processed through MEPS. Additional data collected varies based on what is provided by the Services to AMSARA. In 2012, data was provided for 270,000 examined applicants. However, for some metrics, subpopulations are smaller (for example, there are few accessions than applicants).[434]
Armed Forces Health Surveillance Center	Active Duty/Reserve personnel data since 1990;	All five Services of the Armed Forces.	Health-related conditions among all five Services of the Armed Forces. Health status, prior to and after	Outpatient encounter with a diagnosis of "overweight or obesity" (ICD-9-CM: 278.00-	The latest analysis published in 2011 included a sample size of 86,186 (2010 data)

[434] Gubata ME, Niebuhr DW, Cowan DN, et. al. Attrition & Morbidity Data for 2011 Accessions, Annual Report 2012. Silver Spring, MD: Accession Medical Standards Analysis and Research Activity; 2012: 1.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
(AFHSC)	Active Duty Casualty data since 1980; MEPS data since 1985		deployment, vaccine safety, immunization rates, acute respiratory diseases, and sero-epidemiologic surveillance in support of clinical care. Defense Medical Surveillance System (DMSS) contains up-to-date and historical data on diseases and medical events (e.g., hospitalizations, ambulatory visits, reportable diseases, etc.) and longitudinal data relevant to personnel characteristics and deployments experience for all Active Duty and reserve component Service members	278.02); a V-coded diagnosis indicating BMI greater than 25 for adults (ICD-9-CM: V85.2-V85.4); or a pediatric BMI above the 85th percentile for persons younger than 20 years (ICD-9-CM: V85.53, V85.54)	and 25,766 (1998 data).[435]
Behavioral Risk Factor	Continuously since 1984	On-going telephone health risk survey	Tracking health conditions and risk behaviors,	BMI	The most recent data report year, 2011,

[435] Diagnoses of Overweight/Obesity, Active Component, U.S. Armed Forces, 1998-2010. *MSMR*. 2011; 18(01):7-11.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
Surveillance System (BRFSS) Centers for Disease Control and Prevention (CDC)		system, in the United States. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. Survey includes 400,000 adults aged 18 and over	preventive health practices, and health care access primarily related to chronic disease and injury		included 509,002 participants. It yielded a 27.9 percent cell phone response rate and 53 percent landline response rate. Response rates by state vary. Additionally, sample size and response rates vary widely by question on the survey.[436, 437]
Department of Defense (DoD) Survey of Health Related Behaviors – Active Duty Service	Since 1980, every three years	Individuals are randomly selected to represent men and women in all pay grades of the active force throughout the world.	Self-administered survey (via group sessions at military installations and via mail) to assess lifestyle factors affecting health and readiness; identify and track health-related trends and high-risk groups; target	BMI	The most recent survey (2008) included 28,546 Active Duty military personnel. The overall response rate was 71.6 percent.[438]

[436] BRFSS Combined Landline and Cell Phone Weighted Response Rates by State, 2011. http://www.cdc.gov/brfss/annual_data/2011/response_rates_11.htm. Accessed July 11, 2013.
[437] Behavioral Risk Factor Surveillance System 2011 Summary Data Quality Report (Version #5—Revised 2/04/2013). Centers for Disease Control: 2013. http://www.cdc.gov/brfss/pdf/2011_Summary_Data_Quality_Report.pdf. Accessed July 11, 2013.
[438] 2008 Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel. Research Triangle Park, NC: Prepared by RTI International; 2009.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
Members			groups and/or lifestyle factors for intervention.		
Department of Defense (DoD) Survey of Health Related Behaviors Among the Guard and Reserve Force	Once since 2006. The 2009/2010 survey (currently underway) will be the second iteration.	All Reserve component personnel (including fulltime and/or activated Guard and Reservists) except military academy students, personnel absent without official leave (AWOL), and personnel who had a permanent change of station (PCS) at the time of data collection. Guard and Reserve personnel, referred to collectively as the Reserve component, came from six Reserve components: Army Reserve, Army National Guard, Navy	Self-administered survey to assess lifestyle factors affecting health and readiness; identify and track health-related trends and high-risk groups; target groups and/or lifestyle factors for intervention.	BMI	The 2006 survey included 18,342 Reserve and Guard members who completed self-administered questionnaires either in a group setting at military installations or via mail. The overall response rate was 55.3 percent.[439]

[439] 2006 Department of Defense Survey of Health Related Behaviors Among the Guard And Reserve Force. Research Triangle Park, NC: Prepared by RTI International; 2007.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
		Reserve, Marine Corps Reserve, Air Force Reserve, and Air National Guard			
Health Care Survey of Defense Beneficiaries (HCSDB)	Continuously since 1995	Congressionally directed mail survey of a random sample of eligible military beneficiaries. Adults: four times/year. Children: once per year (formerly administered; this survey was canceled after 2009)	Overall health, use of health care services, level of satisfaction with health care services	Height and weight: BMI	The quarterly survey is delivered via mail to approximately 50,000 DoD beneficiaries and eligibles. The most recent reported response rates ranged from 12 percent (active duty family members not enrolled in TRICARE Prime), and 69 percent (retirees and their family members age 65 and older).[440]
Millennium Cohort Study	Continuously since 2001	Survey data from all Services, including Active Duty and Reserve/National Guards	Physical, mental health, behaviors, occupational exposures	BMI	There are four panels enrolled in four different starting years (2001; 2004; 2007; and 2011). All panels combined,

[440] http://www.tricare.mil/survey/hcsurvey/2012/2012AdultSamplingReport.pdf.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
					there are 190,000 study participants.[441]
National Health and Nutrition Examination Survey (NHANES)	Initially 1960; continuously since 1999	U.S. population of all ages	A combination of survey and physical examination data, including chronic conditions, health status, nutrition, physical fitness, reproductive history, and others.	Weight history; body weight, height, and BMI	The survey includes a nationally representatives sample of about 5,000 persons each year.[442] The 2009-2010 survey (the most recent completed survey year) had an unweighted sample size of 10,253, for an overall unweighted response rate of 77.3 percent. This is the total number examined (a subgroup of those screened and then of those ultimately interviewed).[443]
Youth Risk	Continuously	Surveys of youth	Monitors six categories of	Self-reported height and	In 2011, response rates

[441] Electronic communication from Dr. Nancy Crum-Cianflone, Study Director, Millennium Cohort Study, Naval Health Research Center, November 2012.
[442] National Center for Health Statistics. National Health and Nutrition Examination Survey, 2013-2014: Overview. Available at: http://www.cdc.gov/nchs/data/nhanes/nhanes_13_14/2013-14_overview_brochure.pdf. Accessed: July 12, 2013.
[443] Unweighted Response Rates for NHANES 2009-2010 by Age and Gender. Available at: http://www.cdc.gov/nchs/nhanes/response_rates_CPS.htm. Accessed July 12, 2013.

Appendix E Sources of Epidemiological Data					
Name	**Year(s)**	**Population**	**Data Collection**	**Weight Metric**	**Data Sample Size and Response Rate (where applicable)**
Behavior Surveillance System (YRBSS)	since 1991	grades 9 through 12	priority health-risk behaviors among youths and young adults: 1) behaviors that contribute to unintentional injuries and violence; 2) sexual behaviors that contribute to HIV infection, other sexually transmitted diseases, and unintended pregnancy; 3) tobacco use; 4) alcohol and other drug use; 5) unhealthy dietary behaviors; and 6) physical inactivity. In addition, YRBSS monitors the prevalence of obesity and asthma among this population.	weight	for the state, territorial, tribal and large urban school district surveys ranged from 60 to 100 percent. The national YRBSS is designed to produce estimates within ±5 percent at a 95 percent confidence level. The sample size in 2011 was 15,425 (usable questionnaires after data-editing protocols were applied). The overall response rates were 81 percent and 87 percent, for schools and students, respectively.[444]

[444] Centers for Disease Control and Prevention. Methodology of the Youth Risk Behavior Surveillance System-2013. *MMWR*. 2013;62(1): 11-13.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
Army *MOVE!* [445]	2009	Ongoing	Army	Weight management program: Facilitated by registered dietitians and healthcare providers, Army *MOVE!* is the Army's standardized weight management program available at most Army MTFs. Army *MOVE!* focuses on behavior modification, physical activity, and diet. In addition, emphasis is placed on self-monitoring (food and activity logs) and maintenance of weight loss. Army *MOVE!* requires intensive face-to-face contact during the first 3 months and monthly follow-up visits thereafter. Target audience is Soldiers who do not meet body composition standards per AR 600-9.	Active Duty Army
Better Foods, Better Bodies[446]	2013	Ongoing	Air Force/ DoD	Program provides online tools and resources to educate and enable	Airmen and families

* Empty cells appear where there was no information available.

[445] Lt Col McKinney, P. Army Move! Helps Maintain, Lose Weight. Army Medicine Web site. http://www.armymedicine.army.mil/hc/healthtips/13/201007armymove.cfm. Accessed July 18, 2013.

* The military installations in the initiative are Fort Bragg, NC; Fort Sill, OK; Joint Base Pearl Harbor-Hickam, HI; Sub Base New London, CY; Mountain Home Air Force Base, ID; Yokota Air Base, Japan; Marine Corps Air Ground Combat Center/Marine Air Ground Task Force Training Command, Twentynine Palms,

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				individuals to make smarter food choices. The program is being piloted at Andrews, Langley and Lackland, before going to all bases.	
Healthy Base Initiative[447,448]	2013	Ongoing		Program will assess 13 different installations to develop a program for participants to take charge of their health through nutrition and fitness.* Assessments will consider such factors as healthy commissary offerings, ease of exercising, choices for healthy meals, and what healthy snacks are in vending machines. Weight issues and tobacco cessation are also targets of the initiative. **	Service members, their families and civilians
Living Fit[449]		Ongoing	Air Force	A web-based platform providing recipes and tips for healthy living. Users can log activities and weight	Adults 18 and older.

CA; Marine Corps Base Quantico, VA.; U.S. Coast Guard Air Station Cape Cod, MA; March Air Reserve Base, CA; and Camp Dodge, IA. The other two participants are the Defense Logistics Agency, Fort Belvoir, VA; and Defense Health Headquarters, Falls Church, VA.

[446] Air Force Medical Service. Better Foods, Better Bodies resource page. http://www.afms.af.mil/betterhealth/bfbb/. Accessed July 18, 2013.

[447] Military One Source, Healthy Base Initiative resource page. http://www.militaryonesource.mil/hbi. Accessed July 18, 2013.

[448] Cronk TM. Healthy Base Initiative Seeks Better Lifestyles. American Forces Press Service. Washington, DC. March 18, 2013. http://www.defense.gov/news/newsarticle.aspx?id=119560 Accessed July 18, 2013.

**Joint effort between AFMOA, Army and Air Force Exchange Services (AAFES), Air Force Personnel Center Food & Beverage and Fitness, and the Defense Commissary Agency (DeCA).

[449]U.S. Air Force Living Fit portal. http://www.usaflivingfit.com/. Accessed July 18, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				online to track progress and goals. A subprogram of Fit Family.	
Soldier Fueling Initiative[450]	2011		Army	Effort to provide healthier meal options to soldiers. Part of the Soldier Athlete program.	
Total Force Fitness[451]	2011	Ongoing	CJCS	Paradigm for building and maintaining health, readiness, and performance in the U.S. Armed Forces, comprised of eight domains: physical, nutritional, medical and dental environmental, behavioral, psychological, spiritual, and social.	All DoD
Go For Green[452]			Army	Labeling program for dining facilities, to color code food according to nutrition level. Part of the Soldier Fueling Initiative.	
Living Fit[453]		Ongoing	Air Force	A web-based platform providing recipes and tips for healthy living. Users can log activities and weight online to track progress and goals.	Adults 18 and older.

[450]U.S. Army Food Program Implementation Guide for Initial Military Training Soldier Refueling Initiative. Revised 2012. http://www.quartermaster.army.mil/jccoe/operations_directorate/quad/nutrition/Implementation_Guide_January_2012.pdf. Accessed July 18, 2013

[451]Totally Force Fitness Articles overview. Human Performance Resource Center. http://hprc-online.org/total-force-fitness. Accessed July 18, 2013.

[452] Electronic communication from Renita Frazier, Army Center of Excellence, Subsistence, Joint Culinary Center of Excellence. Defense Health Board Follow-up. May 6, 2013.

[453] Fit Family. U.S. Air Force. http://www.usaflivingfit.com/. Accessed July 31, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				A subprogram of Fit Family.	
Operation Live Well[454]			DoD	Web-based paradigm promoting active living, healthy eating, tobacco-free living and mental and emotional well being. The goal of Operation Live Well is to encourage making the healthy choice the easy choice and the social norm.	All DoD
CHOW[455]			Navy/Marine Corps	The Choose Healthy Options for Wellness (CHOW) Course is a full-day training, offering students the opportunity to receive information in basic as well as more advanced nutrition topics. The course outline includes the following: Introduction to Nutrition Basics, Performance Nutrition, Nutritional Ergogenics, Environmental Changes to Support Healthy Eating, Supporting Healthy Behavior Change, and Resources as Sources of Support. The course is offered annually at the Navy and Marine Corps Public Health	

[454] Operation Live Well. U.S. Department of Defense http://www.defense.gov/home/features/2012/0812_live-well/. Accessed July 18, 2013.
[455] Navy and Marine Corps Public Health Center. Health Promotion Training. http://www.med.navy.mil/sites/nmcphc/education-and-training/Pages/default.aspx. Accessed July 18, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				Conference and can be offered at other conferences upon request	
Semper Fit[456]			Marine Corps	Semper Fit Health Promotion programs provide support, awareness and educational campaigns in other related areas of health. Using the Department of Health and Human Services' *Healthy People 2020* initiative, Semper Fit Health Promotion programs focus on seven subject areas: Physical Activity, Tobacco Use Prevention and Cessation, Weight Management, Nutrition, Sexual Health and Responsibility, Injury Prevention, and Chronic Disease Prevention.	
Hooah4Health[457]			Army National Guard		
Fit to Fight[458]	2010		Air Force	Revised fitness standards, removing specific weight requirements in	

[456] McGuire B. Physical Readiness Programs Officer, Marine Air-Ground Task Force Training Standards Division, Training & Education Command. "USMC Fitness and Weight Control Policy Brief." Presentation to the Defense Health Board. May 23, 2013.
[457] H4H Challenge Syllabus. http://h4hchallenge.com/syllabus.htm. Accessed July 18, 2013.
[458] Zimmerman F. Air Force getting Fit to Fight .*Stars and Stripes.* January 10, 2004. http://www.stripes.com/news/air-force-getting-fit-to-fight-1.15249. Accessed July 31, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				favor of physical fitness standards.	
Military Nutrition Environment Assessment Tool (m-NEAT)[459]	2010	Ongoing	Tri-Service	A standardized tool used to measure accessibility to healthy food options. The tool assesses environmental factors and policies at the community level that support healthy eating. This program combines several nutrition programs (including DINE and CHOW) and is designed to help health promotion professionals, commanding officers, and others in the DoD community measure accessibility to healthy food options.	
Fit Family[460]	2010	Ongoing	Air Force	Web-based goal incentive program centered on families. Families have the opportunity to set goals and monitor their progress online.	All active duty, Air Force Reserve, Air National Guard, DoD and civilians and their families
Navy Operational Fitness and Fueling Series (NOFFS)[461]	2009	Ongoing	Navy	Project provides the Navy with a "best in class" physical fitness and nutrition performance resource that	Active Duty

[459] Military Nutrition Environment Assessment Tool. Navy and Marine Corps Public Health Center. http://www.med.navy.mil/sites/nmcphc/health-promotion/healthy-eating/Pages/m-neat.aspx. Accessed July 18, 2013.
[460] USA Fit Family resource. http://www.usaffitfamily.com/new-home. Accessed July 18, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				provides guidance to Sailors and Navy health and fitness professionals. NOFFS instructs individuals on how to physically train effectively and safely, and how to make healthy nutrition choices in both shore-based and operational environments. NOFFS provides Sailors with an evidence-based performance tool that will address injury prevention by physically training operational job movement patterns.	
ShipShape[462]	2002		Navy/Marine Corps	Weight management program: Eight-week regimen that uses current information on weight loss. The program is designed to provide basic instruction and background on nutrition, stress management, physical activity, and behavior modification. Together these techniques work to lower and	Active Duty Navy and MC personnel, family members and retirees should also be allowed to participate

[461]Fitness, Sports and Deployed Forces Support. Project Overview. Commander Navy Installations. http://www.navyfitness.org/fitness/noffs/project_overview/. Accessed July 18, 2013.
[462]Naval Medical Center Portsmouth ShipShape Weight Management Program Guiding Instruction. http://www.med.navy.mil/sites/nmcp/wellness/pages/shipshape.aspx. Accessed July 18, 2013.

Appendix F Military Fitness and Nutrition Campaigns*					
Program/Campaign Name	**Year Initiated**	**Completed/ Ongoing**	**Originator/ Other Adopters**	**Description & Goals**	**Target Audience**
				maintain an acceptable body weight within Navy Standards.	
Operation Supplement Safety (OPSS)[463, 464]	2012	Ongoing	DoD	Operation Supplement Safety is an educational initiative directed from Health Affairs with active participation by all services requested. Its purpose is to increase awareness, or minimize misconceptions about dietary supplements so everyone in DoD is a smart supplement user.	Service members, Leaders, DoD civilians, Family members, healthcare providers, and retirees

[463] Operation Supplement Safety resource page. Human Performance Resource Center. http://hprc-online.org/dietary-supplements/opss. Accessed July 18, 2013.
[464] Electronic communication from Patricia Deuster, Uniformed Services University of the Health Sciences. Defense Health Board Follow-up. May 6, 2013.

Appendix G
Acronyms and Glossary

ABCP	Army Body Composition Program
AC	Abdominal circumference
ADSEP	Administrative separation
AFHSC	Armed Forces Health Surveillance Center
AMA	American Medical Association
AMSARA	Accession Medical Standards Analysis and Research Activity
AMSWG	Accession Medical Standards Working Group
APFT	Army Physical Fitness Test
ARMS	Assessment of Recruit Motivation and Strength
BCA	(Navy) Body Composition Assessment
BMI	Body mass index
BRFSS	Behavioral Risk Factor Surveillance System
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CBO	Congressional Budget Office
CDC	Centers for Disease Control and Prevention
CDP	Child Development Programs
CHD	Coronary heart disease
CHIP	Complete Health Improvement Program
CMNR	Committee on Military Nutrition Research, Institute of Medicine
CPG	Clinical practice guideline
CVD	Cardiovascular disease
DASD	Deputy Assistant Secretary of Defense
DeCA	Defense Commissary Agency
DFAC	Military dining facility
DHB	Defense Health Board
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DODMERB	Department of Defense Medical Evaluation Review Board
DXA	Dual-energy X-ray absorptiometry
ERS	Economic Research Services
FA	Fitness Assessment (Air Force)
FDA	Food and Drug Administration
FEP	Fitness Enhancement Program (Navy)
GAO	Government Accountability Office
HBI	Healthy Base Initiative
HCSDB	Health Care Survey of Department of Defense Beneficiaries
HRB	Department of Defense Survey of Health-Related Behaviors
ICD-9	International Classification of Diseases, Ninth Revision
IOM	Institute of Medicine
JAMRS	Joint Advertising Market Research and Studies
MEDPERS	Medical and Personnel Executive Steering Committee

MEPS	Military Entrance Processing Station
MHS	Military Health System
MSFD	Military Services Fitness Databases
MSMR	Medical Surveillance Monthly Report
MTF	Military Treatment Facility
NCI	National Cancer Institute
NHANES	National Health and Nutrition Examination Survey
NHES	National Health Examination Survey
NHLBI	National Heart, Lung, and Blood Institute
NIH	National Institutes of Health
NPS	National Prevention Strategy
NRC	National Research Council
OLW	Operation Live Well
OUSD(P&R)	Office of the Under Secretary of Defense for Personnel and Readiness
PFA	Physical Fitness Assessment (Navy)
PT	Physical training
PTSD	Post-traumatic stress disorder
QMA	Qualified Military Available
RMC	Regular military compensation
ROTC	Reserve Officers' Training Corps
SER	Systematic Evidence Review
SES	Socioeconomic status
TMA	TRICARE Management Activity
USD (P&R)	Under Secretary of Defense for Personnel and Readiness
USDA	U.S. Department of Agriculture
USARIEM	U.S. Army Research Institute of Environmental Medicine
USMEPCOM	U.S. Military Entrance Processing Command
USPSTF	U.S. Preventive Services Task Force
VA	Veteran’s Affairs
WC	Waist circumference
WHO	World Health Organization
YRBSS	Youth Risk Behavior Surveillance System

Glossary

Abdominal circumference: Measurement taken horizontally around the abdomen, so that a measuring tape is snug but does not compress the skin.

ARMS test: A test designed to determine physical fitness and motivation to complete basic combat training. The test has two components: a step test measuring fitness and motivation and a pushup test to measuring muscular endurance. The step test requires applicants to step up to and down from a 12-inch step at a 30 times a minute, for five minutes. The pushup test requires applicants to complete a minimum of 15 pushups in one minute for males and 4 pushups in one minute for females. A failure of either component results in failure of the overall test.[465]

Body fat percentage: The relative amount of body tissue composed of fat.

BMI: A numerical indicator of fatness, calculated from a person's height and weight. The formula used to establish the indicator is (lb)/height (inches)^2 x 703.

Obesity: Maintaining a BMI $\geq$ 30. In children, this is defined by a BMI greater than or equal to the age- and sex-specific 95th percentiles of CDC growth charts.

Overfat: Excess fat

Overweight: Maintaining a BMI $\geq$ 25 and $\leq$ 30.

Waist circumference: see abdominal circumference.

[465] Loughran DS, and BR Orvis. op cit; p. xviii.

Appendix H
Relevant Policy Documents

Department of Defense Directives

DoDD 1010.10, *Health Promotion and Disease/Injury Prevention*. August 22, 2003.
DoDD 1308.1, *DoD Physical Fitness and Body Fat Program*. June 30, 2004.
DoDD 1308.2, *Joint DoD Committee on Fitness*. February 4, 2005.
DoDD 6130.3, *Physical Standards for Appointment, Enlistment, or Induction*. December 15, 2000.

Department of Defense Instructions

DoDI 1304.26, *Qualification Standards for Enlistment, Appointment or Induction*. September 20, 2005.
DoDI 1308.3, *DoD Physical Fitness and Body Fat Programs Procedures*. November 5, 2002.
DoDI 5210.90, *Minimum Training, Certification, and Physical Fitness Standards for Civilian Police and Security Guards (CP/SG) in the Department of Defense*. July 9, 2007.
DoDI 6130.03, *Medical Standards for Appointment, Enlistment or Induction in the Military Services*. April 28, 2010.
DoDI 6060.02, *Child Development Programs (CDPs).* January 19, 1993.

Other Department of Defense Documents

Directive-Type Memorandum (DTM) 08-018 *Enlistment Waivers*. June 27, 2008
VA/DoD Clinical Practice Guideline for Screening and Management of Overweight and Obesity, 2006.

Military Service Policies

Army

Department of the Army, Headquarters. FM 7-22. *Army Physical Readiness Training*. October 2012.
Department of the Army, Headquarters. Army Regulation 40-501. *Standards of Medical Fitness.* December 14, 2007.
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Department of the Army, Headquarters. Army Regulation 635-40. *Physical Evaluation for Retention, Retirement, or Separation.* February 8, 2006.

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U.S. Navy, Commander, Navy Recruiting Command. *Navy Recruiting Manual-Enlisted COMNAVCRUITCOMINST 1130.8J. Vol 2* May 17, 2011.

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Marine Corps
Department of the Navy, Headquarters. MCO 6110.3 *Marine Corps Body Composition and Military Appearance Program*. August 8, 2008.

Other Department of Defense Documents
32 Code of Federal Regulations (CFR) 199.2

Appendix I
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