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Obesity and the US Military Family

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Abstract

Objective—This review discusses the current knowledge and future directions regarding obesity within the US military family (i.e., active-duty servicemembers, as well as military spouses, children, retirees, and veterans). The increasing rates of overweight and obesity within the US military adversely impact military readiness, limit recruitment, and place a significant financial burden on the Department of Defense.

Design and Methods—The following topics are reviewed: 1) The prevalence of and the financial, physical, and psychological costs associated with overweight in military communities; 2) military weight regulations, and challenges faced by the military family related to overweight and disordered eating; 3) the continued need for rigorous program evaluations and new intervention development.

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¹Although the number of discharged servicemembers may seem excessive, it should be noted that withdrawal of troops and force reduction in the military likely have contributed to a greater number of discharges (or exclusion of potential recruits) than during periods of war, specifically for failing to meet weight and/or fitness standards. For example, operational requirements and retention goals may supersede requirements to administratively discharge service members for non-disciplinary reasons during wartime. It is also likely that a greater number of recruits are permitted to enlist within the military during these times without meeting service-based body composition standards, on the condition that they do so upon completion of initial entry training.

²Given the focus of the present review on health care utilization within the DoD and VA system, in addition to military retirees, "Veteran" is operationalized to include prior servicemembers who are eligible to receive VA health care benefits. This includes "Wounded Warriors" who are currently maintained under the VA and DoD system through service-connected disability and discharge, as well as Vietnam-era veterans, Persian Gulf-era veterans, prior Prisoners of War, Purple Heart awardees, and military personnel who have received a discharge from military service that is not dishonorable within the past five years. Prior service individuals who are not connected to the VA or DoD health care utilization are not included in the present review.

³National Guard and Reserve eligibility for TRICARE coverage is activation status dependent. National Guard and Reserve personnel make be eligible for other TRICARE coverage programs, such as TRICARE standard, TRICARE for Life, TRICARE Reserve Select, among others.

Results—Overweight and its associated sequelae impact the entire military family. Military families share many similarities with their civilian counterparts, but they face unique challenges (e.g., stress related to deployments and relocations). Although the military has weight management resources, there is an urgent need for rigorous program evaluation and the development of enhanced obesity prevention programs across the lifespan of the military family—several of which are proposed herein.

Conclusions—Interdisciplinary and collaborative research efforts and team-based interventions will continue to inform understanding of obesity treatment and prevention within military and civilian populations.

Introduction

The prevalence of overweight and obesity is a significant public health problem, affecting increasing numbers of adults and children in all racial/ethnic groups (1). The military is not immune to this trend (2), directly impacting the health and readiness of the active-duty service branches of the Armed Forces (Army, Navy, Marine Corps, Air Force, and Coast Guard) and their respective Guard and Reserve units. Within the civilian population, 68.8% are overweight (i.e., body mass index [BMI] ≥ 25 kg/m²), including 35.5% of the population classified as obese (BMI ≥ 30) (1). Rates of overweight and obesity within the active-duty military now approach civilian estimates (2). Further compounding this troubling trend, overweight is more common among certain racial/ethnic minorities, who represent over 36% of the US military (3–5).

The prevalence of overweight poses a threat to national security. Twenty-seven percent of American young adults between the ages of 17 and 24 (i.e., over 9 million potential recruits) are unable to serve in the Armed Forces due to excess weight (6). Overweight is now the leading medical reason for failing to qualify for military service (6,7). Additionally, individuals who struggle to make weight for entry may be at increased risk of failing weight and/or fitness standards later in their career, and eventually may face administrative action, including discharge from the military. Loss of personnel can result in a significant financial loss for the military, considering the time incurred training individuals, their level of specialization, and the cost to recruit and train a replacement.

The high rate of overweight in the military incurs significant medical and related financial burdens. Excess weight is associated with numerous costly co-morbidities, such as arthritis, hyperlipidemia, cardiac problems, chronic pain, and diabetes (8,9). The Department of Defense (DoD) Military Health System (MHS) is one of the largest care providers in the US, serving approximately 9.2 million beneficiaries, including active-duty personnel, retirees, military spouses, and children. The annual cost to the MHS for morbidities associated with overweight exceeds \$1 billion annually (10). Approximately, 70% of adult MHS beneficiaries (80% of men, 60% of women) (8) and 72% of veterans (8,11,12) are overweight or obese. Veterans Affairs Medical Centers (VAMCs) have incurred a significant obesity-related financial burden for the over 8.5 million enrollees in VAMC benefits (13), spending billions of dollars annually on obesity-related comorbidities (14).

The military, therefore, faces many of the same challenges as the general population regarding overweight and its associated conditions.

This review will describe the prevalence, costs, and challenges associated with overweight and obesity within the US military family. In this context, the military family is comprised of active-duty military servicemembers, their families (i.e., spouses and children), military retirees and their families, and veterans. Specifically, we include: (a) a discussion of military weight and fitness standards and regulations; (b) an overview of the physical and psychological challenges faced by the military family regarding maintaining a healthy body weight; and (c) a description of the DoD MHS and VAMCs in the context of healthcare delivery for addressing overweight and obesity among its beneficiaries. Finally, intervention proposals for preventing over-weight and obesity across the lifespan of the military family are briefly presented, as rigorous research in these areas is lacking. Indeed, additional research is required on the development of effective obesity intervention programs, as well as on the prevalence and correlates of disordered eating—spanning not only multiple service branches, but the entire military family.

Prevalence and Cost of Obesity

Active-duty

From 1998 to 2010, there was a threefold increase in the annual number of active-duty personnel diagnosed as overweight or obese (15). As of 2008, 60% of male and 40% of female active-duty military personnel were overweight, including 13% who qualified as obese (15,16). Certain demographic factors (i.e., over 35-years old and being male, married, or of African-American or Hispanic race/ethnicity) further increase the risk for overweight and obesity (2,3).

Despite mandatory physical performance standards, military personnel are not immune to overweight. In 2008, over 4,500 servicemembers were discharged for failing to meet weight standards, incurring a cost of more than \$183 million in annual recruiting and training expenses to the DoD (17)¹. Estimated costs for recruitment, screening, and initial training are ~\$75,000 per servicemember, according to Accession Medical Standards Analysis and Research Activity (AMSARA), and an estimated 30% of servicemembers do not complete their first tour of duty. Additionally, the DoD incurs an annual cost of over \$1.1 billion to keep active-duty members within their respective weight standards and to cover weight-related health costs and expenses associated with lost work productivity (2).

Current obesity rates have serious implications for national defense. The US Armed Forces face a continual flux of enlistments and discharges from military service. Over 90% of applicants and entrants for military service are under the age of 25 (7), highlighting concern regarding the rates of overweight among youth and young adults. Over the last 15 years, the rate of actively serving obese individuals has more than tripled. Armed Forces Health reported that in 2010, 86,186 servicemen (5.3% of the military) had at least one obesity-related diagnosis (15). Across all services, 15% of men and 20% of women self-reported difficulty meeting weight and/or body fat standards (16).

Military weight and body composition standards and regulations—Potential recruits must first meet accession weight and fitness standards to enlist in the military, and servicemembers must meet weight and fitness retention standards throughout their service to remain on active-duty or reserve status. Personnel repeatedly failing to meet standards risk separation from the military. Current DoD retention standards set an upper BMI limit of 27.5 (18), in addition to branch-specific standards (Table 1). Individuals who exceed weight-for-height requirements may be subject to additional physical assessment (e.g., neck or waist circumference measurements), differing by service branch, age, and/or sex (17). It has been recommended that BMI not be used as a sole proxy for fitness, considering that other methods (e.g., fitness/body composition testing) are likely to be more predictive of adiposity (19). The primary purpose of weight and fitness standards is to ensure that personnel are prepared for the physical demands of military service, based on the assumptions that proper body weight and adequate fitness contribute to good health, appropriate military appearance, physical and combat readiness, and reduced likelihood of combat injury and mortality. Indeed, obesity impacts military career advancement, as opportunities for positive personnel action (e.g., additional training and promotions) and the ability to deploy or to re-enlist are regulated partly by the outcomes of these tests (18,20).

Military reservists and members of the National Guard also must pass an annual physical fitness test. This group may be at even higher risk for weight gain during intermittent periods of demobilization and at risk for disordered eating behaviors to compensate for weight gained (21).

Military family

The military family encompasses all DoD beneficiaries—active-duty personnel, their spouses and children, and veterans and retirees². Within the military family, data suggest that approximately 45% of military spouses are either overweight or obese (22). Of MHS youth beneficiaries, 15% are obese (BMI 95th percentile) and an additional 15% are overweight (BMI 85th–95th percentile) (23). As children from military families are more likely to serve in the military as adults than their civilian counterparts (24), such high rates of obesity within this population may negatively impact the number of eligible volunteers for future military service.

The financial burden of obesity within the military does not end when personnel retire or separate from active-duty. Retirees continue to receive care within the MHS, while all other veterans eligible for care are treated at VAMCs for obesity and associated comorbidities. As such, the federal health care system incurs an obesity-related financial burden past military retirement or discharge (8) for over 8.57 million enrollees (13). Despite a substantial decrease in the number of veterans served by the VAMC system, annual medical care expenditures have increased by more than \$10 billion since the year 2000, including billions spent on obesity and overweight related morbidities, including \$1.66 billion on diabetes care alone (14). Estimates suggest that 73–80% of male veterans and 54–60% of female veterans are overweight or obese (8,11), similar to rates within the US general population (12,25,26).

The Impact of Military Life on Obesity

Active-duty

Some aspects of military life are thought to protect against obesity risk (e.g., mandatory weight/fitness standards). However, the stress of military life (particularly deployments and relocations) takes a toll on both the psychological and physical health of servicemembers and their families. Factors such as combat, exposure to heavy casualties, war zone deployments, unit re-assignment, and unexpected mobilizations of Reserve units are all associated with higher levels of psychological distress (27–30). More recently, downsizing of military personnel and longer and more frequent deployments (31) have led to a net increase in individual duties and responsibilities. Further, psychological changes (e.g., increased rates of depression, anxiety, and acute stress) are related to long deployments or short dwell times between repeat deployments (32), including higher rates of depression associated with deployments involving combat exposure (28). For example, high rates of reported mental health issues have been noted among Operation Iraqi Freedom veterans (33). Chronic stress is strongly linked with excess body weight and related metabolic markers (34). Additionally, subsequent weight gain could contribute to a failure to meet weight and fitness standards, which may further exacerbate perceived stress among active-duty personnel. This weight gain often occurs gradually. Data indicate that the average Air Force servicemember gains weight (0.6–1.4 lbs for men, 0.8 lbs for women) each year, adding up to substantial weight gain for many personnel over the course of their military careers (35). Furthermore, military personnel who choose to undergo smoking cessation may be at additional risk for weight gain (36), and thus may be deterred from quitting smoking (36,37).

Despite the fact that the military is held to specific fitness and weight standards, active-duty military personnel are exposed to many of the same types and quantities of unhealthy food as the general population. Similar to the civilian sector, where availability of energy-dense, high-calorie foods and drinks has increased in communities and schools (38), so has the availability of these products on military installations (39). The Army & Air Force Exchange Service (ExchangeTM), which provides lower-cost products for military personnel and their families on-base, holds franchises with fast food restaurants such as Dunkin' Donuts®, Burger King®, Taco Bell®, and Popeyes®, among others. Despite the availability of some healthy food options, fast food tends to be more accessible and convenient than healthier options during deployments or relocation (40). Military personnel stationed on forward operating bases (FOBs) often have difficulty maintaining healthy eating patterns, as access to high-fat and energy-dense foods at dining facilities (DFACs) is usually quick, convenient, and free, promoting overeating for many servicemembers. Moreover, the restricted food options available to military personnel during deployment (e.g., portable meals ready-to-eat [MREs]) are often excessively high in calories (i.e., an average of 1,200 calories, for a total of over 3,700 calories in a day) as they are designed to sustain caloric intake during high periods of physical activity (e.g., during combat). For personnel who are not as active, however, such high energy-dense foods may cause weight gain.

Although some servicemembers' occupational duties require physical activity, helping to protect against weight gain, the current military operational environment is not always maximally conducive to regular exercise. Thus, despite traditionally adhering to a more rigorous fitness standard than the general population, military personnel may be inherently less active than in the past. Technology has decreased the amount of manual labor associated with many tasks (4), and many military employees have largely sedentary occupations. Only 39% of active-duty personnel report engaging in 60 min or more of vigorous physical activity 3 times per week—a trend that appears most prevalent (30%) within the Air Force (16). Furthermore, Naval personnel, who may spend periods of time at sea without access to fresh foods or suitable exercise facilities, may be at greatest risk for obesity (3).

Military spouses

Spouses of military personnel are subject to substantial stress when partners deploy. Deployments are longer and more frequent—and increasingly dangerous—in recent years (31). Spousal and family stress (e.g., marital discord, financial strain) often extends past the period of deployment, considering the potential trauma (both physical and psychological) of returning spouses (31). Military spouses have reported levels of broadly-defined generalized anxiety disorder and major depression comparable to those of servicemembers returning from combat—nearly 20% and 15–17%, respectively (41).

Low social support during a partner's deployment may exacerbate stress and heighten responsibilities for the spouse at home (e.g., financial, familial, and household responsibilities). Decreases in support may be especially difficult for spouses new to the military and for pregnant mothers, who may be entering motherhood without the direct support of a spouse or nearby family members. Pregnant wives of deployed personnel have reported experiencing higher levels of stress and changes in their eating habits than military mothers without a deployed partner (42).

Challenges faced by military children

Between September 11, 2001 and 2009 almost 2 million servicemembers were deployed (43), impacting millions of youth. Children of military personnel are exposed to unique stressors associated with their parents' military careers. Some pediatric behavioral health issues likely are influenced by physical and psychological difficulties experienced by parents following deployment, and stress related to the challenges of readjusting to civilian life following deployment. As a result, children of recently deployed personnel are susceptible to difficulties in psychological functioning (5,44–46). Among military families, children with a deployed parent self-report slightly higher levels of depression than children without a deployed parent—especially among children with preexisting psychosocial problems (44). In a study of families with a deployed parent, 32% of children were categorized as “high risk” for psychosocial morbidity by parent-report, an estimate significantly higher than for a normative sample (13%) (45). The various stressors encountered by military families likely contribute to increased childhood obesity rates (47), highlighting the importance of preventing unhealthy weight trajectories among these children.

Leaving the military: Challenges in transition

Individuals typically voluntarily leave military service after a defined service obligation or by retiring after at least 20 years of service. Military personnel, therefore, may “retire” at substantially younger ages than their civilian peers.

Although some veterans maintain healthy weight control behaviors after separation or retirement, many others show a predictable rebound weight gain due to changes in diet and physical activity. Women and individuals retiring from physically demanding military jobs (e.g., infantry) are particularly at risk, resulting in rates of over-weight among veterans that are now comparable to similarly aged civilians (25,26). In addition to diet and activity changes, individuals may experience the psychological impact of transitioning away from years of constant weight and fitness monitoring and testing, promoting a loosening of their diet and exercise regimes.

Disordered Eating and the Military

Active-duty

Emerging research has emphasized shared risk factors for eating disorders and obesity. This is of particular relevance given that the prevalence of disordered eating among military members and their families may exceed that of the general population (48–50). Disordered eating behaviors (e.g., binge eating, extreme food restriction, and other compensatory behaviors) are concerning because they place individuals at risk for excessive weight gain and obesity (51,52). Further, these behaviors promote weight cycling, potentially posing additional health risks (53).

Self-report questionnaire data suggest that rates of eating disorders in military personnel may be higher than in the civilian population (50) but comparable to samples of elite athletes [for review, see Ref. 48]; estimates range from 2 to 36% for any eating disorder, including anorexia nervosa, bulimia nervosa, and eating disorder not otherwise specified, which includes binge eating disorder (48,54). As in the civilian population, women appear to make up the majority of known eating disorder cases (48,55). One study identified 34% of a sample of active-duty Army women as at-risk for the development of an eating disorder, based on self-report questionnaires (49). When interviewed, 8% of the women met criteria for an eating disorder (including 3% with a “situational eating disorder,” described as a full-syndrome eating disorder but only reported in response to military weigh-ins or fitness testing), comparable to the 8.9% prevalence of eating disorders in the general population (56). In the absence of full-syndrome eating disorders, military members report engaging in disordered eating behaviors to lose weight, including fasting, excessive exercise, self-induced vomiting, self-induced dehydration, and using diet pills, laxatives, and diuretics (50,57). For example, one study reported that a sample of military personnel enrolled in the Air Force weight management group were four times more likely to engage in some compensatory behaviors (e.g., self-induced vomiting) than civilians in a weight management program; furthermore unhealthy weight control behaviors (e.g., fasting, use of diuretics for weight loss) were reported by 10–49% of all military personnel sampled (50). As obesity

and disordered eating have been linked (e.g., Ref. 51), the high rates of disordered eating among military personnel may further contribute to current obesity rates.

Although two studies have reported that female military members are at greater risk for eating disorders than their male counterparts (48,55), males may be equally at risk. Although the service-wide prevalence of disordered eating among males is unclear, surveys of both Navy men (58) and women (54) have found that across both sexes, approximately 50% of Navy personnel exhibited some form of broadly-defined disordered eating behavior. It is possible that comparable pressure for both sexes to meet weight requirements may explain these similar rates. Indeed, disordered eating behaviors appear to increase surrounding physical fitness assessments (54,58). Only one prospective study has specifically examined the impact of deployment on disordered eating (59). Using data from the Millennium cohort, Jacobsen et al. (2009) did not find an association between deployment and new-onset disordered eating behaviors. Among deployed women, however, those exposed to combat were more likely to experience new-onset disordered eating (59). Although drawing comparisons to civilian studies is difficult due to differences in methodologies, these rates appear higher than civilian self-report questionnaire studies indicating that approximately 7–30% of young adult women may be at risk for an eating disorder (60). Larger-scale and more methodologically rigorous studies regarding the prevalence of eating disorders in the military are needed. However, both male and female military members may be at greater risk for disordered eating, and consequently, obesity, than the general US population.

Military families

Considering the links between psychological distress and obesity (61,62), military partners and children may use food to cope with the stresses of military life. Disordered eating appears to be one of the most common psychiatric problems identified in this population (63). Moreover, disordered eating patterns, such as binge eating and self-reported dieting, predict excess weight gain over time in pediatric samples (52,64,65). Given its established genetic link (66), the high rate of disordered eating among adolescents from military families parallels the rates noted for military adults. Additionally, parental modeling of extreme weight loss practices, particularly surrounding fitness tests, may promote unhealthy dieting among military children. Unlike healthful eating practices that involve eating in moderation and regular exercise, self-reported dieting—particularly efforts involving extreme restriction or purging behaviors—paradoxically predicts excessive weight gain (52), likely via promotion of overeating and binge eating (65). Therefore, youth who adopt the extreme weight control behaviors of their parents may be at as great of a risk for excessive weight gain as those who overeat as a result of emotional instability or stress.

Only one study has examined parental disordered eating and child eating behaviors in a military sample, using a self-report questionnaire. This study found that 21% of adolescents and 26% of military wives surveyed were at risk for the development of an eating disorder—notably higher than the 7–9% observed on the same questionnaire in the general population (63), although additional studies are needed.

Healthcare in the Military

The MHS is a \$50-billion federal organization that provides healthcare for over 9.3 million DoD beneficiaries (67) across the globe. Approximately one-third of eligible patients are active-duty service members and their immediate families, and two-thirds are retiree and Reserve³ populations (68). The MHS supports both direct care (care delivered in federal facilities) and purchased care (reimbursed care from civilian providers) for beneficiaries. In 2010, the MHS direct care system was responsible for over 42 million outpatient medical encounters, nearly 265,000 inpatient admissions, and over 50,000 births (69). The MHS operates a robust primary care infrastructure, with patient demographics, common diagnoses, and types of procedures similar to civilian ambulatory practice (70).

Weight management programs for active-duty

DoD instruction mandates the creation of service-based weight-control programs and fitness training, as well as the implementation of physical fitness tests, to prevent excess weight gain among active-duty personnel. However, individuals who fail to “make weight” at their fitness evaluation may be placed on a mandatory weight management program with a timeline by which they are expected to meet requirements. Each service operationalizes DoD instruction and sets the standards for fitness evaluations and for the mandatory weight management program; standards are presented by service in Table 1, along with the rates of overweight and obesity among active-duty servicemembers (16) and veterans (12) in Table 2. Although programs differ slightly among services, they all target healthy diet and/or physical activity to help individuals meet fitness standards (20,71).

Despite the need for effective weight management programs—ideally to include targeted prevention—empirical evidence for these programs' efficacy is limited. The relatively high prevalence of disordered eating among military personnel lends further support to the notion that current weight control programs are not maximally effective. In particular, more structured prevention efforts are needed, including those tailored to high-risk periods (i.e., times when a servicemember is particularly at risk for weight gain).

Several obstacles to data collection and analysis hinder research at the service level. For example, although the medical records for all personnel and their families are accessible through the military electronic medical record system, much of the data for individual weight management programs are collected at the local or unit level. Additionally, as defense is the primary objective of the military, the entry of data into service or unit databases may be delayed by higher priority activities. Military personnel who are ideally primed to conduct and contribute to obesity research often do so as an addition to their existing duties (e.g., clinical care), in addition to facing relocations or deployments. Therefore, the current state of research in the military does not always facilitate the thorough evaluation of weight management programs at the service level (or even across services).

Weight management resources for military children and veterans

For military children, the Resource Center for the Prevention of Military Child Obesity is an interactive, searchable web-based platform designed to help healthcare professionals address

obesity in military families (<http://www.militaryfamilies.psu.edu/initiatives/obesity-prevention>). Likewise, the DoD/VA Clinical Practice Guideline on Management of Overweight and Obesity (http://www.healthquality.va.gov/obesity/obe06_final1.pdf) was developed in 2006 to provide evidence-based recommendations for practitioners throughout the DoD and VAMCs to improve management of patients who are overweight or obese. Programs developed for military children and other TRICARE beneficiaries are listed in Table 2.

Unfortunately, empirical efficacy evidence for many of these programs is lacking. One study examined the VAMC MOVE! program, finding that 18.6% of eligible veterans who participated in at least two program visits lost >5% of their body weight (72). A low adherence rate and variability in programming quality across sites likely contributed to low efficacy. Furthermore, two pilot studies have evaluated the H.E.A.L.T.H. program (Table 2) among Army active-duty and Reserve soldiers. For Army soldiers, weight loss (< 5% of weight) was associated with usage of the program website (73). All Reserve website-users, however, gained weight during the study period (74).

Obesity Intervention and Prevention in the Military across the Lifespan

The MHS offers unique advantages that foster opportunities for research, such as: 1) the availability of universal electronic medical records for patients seen within the MHS; 2) universal, quality health care for personnel; 3) universal health care for active-duty families; 4) diversity of the population served; and 5) broad implementation of the Patient-Centered Medical Home, an interdisciplinary team-based approach to individualized patient care. However, the military community has unique qualities to consider when developing and delivering interventions, such as frequent personnel moves and deployments. As having adequate social support is vital to the physical and psychological health of partners and children during a family member's deployment, healthcare providers could play a fundamental part in bolstering support for good health behaviors. Previous work in this area also supports strengthening military physician training in evidence-based weight management approaches, to support obesity treatment and prevention within the primary care setting (75).

Despite these advantages, relatively little obesity prevention research has been conducted within the military setting. A recent review of obesity treatment studies within the military yielded relatively few trials, compared to the civilian literature (3). Key findings from these studies are listed in Table 3. In the largest randomized controlled weight management trial in an active-duty military population, those receiving a 6-month weight loss (and weight gain prevention) internet program had significant reductions in BMI, body fat, and waist circumference compared to usual care (76). Obesity is a complex condition that necessitates a multidisciplinary approach, utilizing effective communication and coordination between individuals and their providers (77,78). Table 4 summarizes several recommendations and considerations for future research as proposed by researchers who have addressed this complex problem.

Sustained weight loss is difficult, highlighting the importance of targeting individuals at risk for obesity. Targeted interventions may maximize resources and reach those at greatest risk. To build upon previous efforts, our research team has developed a multi-pronged approach to preventing obesity in military communities, targeting four critical periods: 1) pregnancy (for active-duty women and/or pregnant spouses) and the first postnatal year, 2) adolescence (for children from military families), 3) the year following basic training (for active-duty servicemembers who are at risk for weight regain following basic training weight loss), and 4) deployment. These subsets of the military family represent critical periods of development and/or possess specific risk factors making them vulnerable to obesity. For example, military personnel may risk weight regain following basic training, considering the weight and fat-mass loss that often occurs during intense military training (79), the natural physiological responses that commonly follow weight loss (80), and the fact that although exercise is critical to weight loss maintenance, servicemembers typically cannot maintain the intense activity level of basic training. Given that obesity and its psychosocial and physical correlates cut across all of these developmental life stages, rigorous and enhanced interventions are required.

Conclusion

Paralleling trends in the general US population, the economic, physical, and psychological impact of obesity within the military family is substantial. Military communities are experiencing the negative physical and psychosocial consequences of obesity at increasing rates. Unique to the military population, the prevalence of obesity among active-duty military personnel has serious implications for US national defense. Challenges faced by the military merit further investigation to stem the rates of obesity in this population. These include servicemembers' eating and activity habits influenced negatively by stressors related to deployment, relocations, and limitations on healthy food availability in the military environment. Service-members also must manage these challenges alongside the fitness and weight standards required for military service. Examining factors that promote or hinder healthy weight control among military spouses and children is crucial. Finally, the military community is impacted by pediatric obesity rates, as future generations of military personnel are at risk for rejection from service due to excess weight.

Given its diverse socioeconomic and racial/ethnic makeup, the military is an ideal population to study, as interventions assessed in this population may be translated to the civilian sector. Nevertheless, the military represents a unique population with distinct stressors and living conditions, access to healthcare, physical activity levels, and types of employment. Thus, interventions deemed efficacious within the military may require modifications for effectiveness among civilians. Further, working within the military system poses a number of challenges and requires a research team both familiar with the culture and integrated into the system. Research and treatment teams composed of members from diverse disciplines from both the civilian and military sectors are likely to be maximally effective. Novel approaches are needed to reduce the rates of overweight and obesity across the military family, building upon previous work in this area.

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TABLE 1

Physical fitness assessment standards by military service branch

Service	Frequency of fitness assessment	Description of fitness assessment	Source
Air Force	Semi-annual for annual if achieving a composite score 90 out of possible 100 points)	<ul style="list-style-type: none"> • Abdominal circumference measurement • 1.5-mile timed run in light running gear* • Number of sit-ups and push-ups completed within 1 minute <p>*May complete an alternate 1-mile walk with proper medical clearance</p>	AFI 36_2905; June 26, 2012
Army	Semi-annual	<ul style="list-style-type: none"> • Height/weight, body fat • 2-mile timed run in light running gear* • Number of push-ups and sit-ups completed within 2 minutes <p>*May complete an alternate bike, swim, or walk cardio assessment with proper medical clearance</p>	TC 3-22.20; August 10, 2010
Navy	Semi-annual, to be completed January 1-June 30 and July 1-December 31	<ul style="list-style-type: none"> • Medical screen • Body composition assessment (BCA) • Physical readiness test (PRT) 1.5-mile timed run/walk* <p>Number of curl-ups and push-ups completed within 2 minutes</p> <p>*May complete an alternate elliptical, swimming, or bike cardio assessment as per instructions of Commanding Officer</p>	OPNAV INST 6110.1J; July 11, 2011
Marine Corps	Annual, to be completed January 1-June 30	<ul style="list-style-type: none"> • Physical Fitness Test: • 3-mile timed run in light running gear • Number of abdominal crunches completed within 2 minutes • Number of pull-ups completed (men) or sustained time maintaining flexed-arm hang (women; replaced with pull-ups beginning January 2014) 	MCO 6100.13; August 1, 2008
	Annual, to be completed July 1-December 31	<ul style="list-style-type: none"> • Combat Readiness Test: • Movement to Contact (MTC) 0.5-mile timed run over level ground in Marine Pattern utility uniform and boots • Ammunition Lift (AL) Number of consecutive 30 lb ammo can lifts (shoulder to above head) completed within 2 minutes • Maneuver Under Fire (MANUF) 300-yard timed shuttle run; includes crawls, buddy drag/carry, ammunition re-supply, grenade throw, agility run 	MCO 6100.13; August 1, 2008
Coast Guard	Semi-annual, to be completed in April and October	<ul style="list-style-type: none"> • Body mass index (BMI) within the acceptable range (19–27.5), height • Body fat measurements <p>Men: Height, neck circumference, and abdominal circumference at the naval Women: Height, neck circumference, waist circumference at the thinnest portion of the abdomen, and hips</p>	COMDTINST M1020.8H; September 5, 2012

TABLE 2

Supplemental volunteer and mandatory weight management programs within Military Service Branches and for veterans

Service	Percentage		Program	Description	Additional Information
	Overweight (BMI 25)	Obese (BMI 30)			
Active Duty					
Air Force	58.8%	13.8%	Air Force Fitness Program	Year-round physical conditioning program focusing on aerobic conditioning, strength and flexibility training, and education regarding healthy eating behaviors.	http://www.afpc.af.mil/affitnessprogram/index.asp
Army	61.0%	12.9%	Army Move!	<i>In person:</i> 13 one-hour modules taught by registered dietitians and dietetic technicians, focusing on healthy behaviors, nutrition, and physical activity. <i>Online:</i> Personalized weight management program that offers real-time (synchronous) distance learning instruction, meeting the needs of soldiers who are unable to seek care at a Medical Treatment Facility or who require flexible scheduling for classes. Enhances soldier readiness by providing healthy lifestyle choices and strategic policy oversight to promote force readiness. Mandatory for personnel who fail to comply with height/weight standards. Positive personnel action may not occur until program standards have been met.	http://www.wamc.amedd.army.mil/patients/deptservices/dmm/Documents/Army%20Move%20Brochure%20%20panel.pdf http://www.apd.army.mil/pdf/files/r600_9.pdf
			Healthy Eating, Activity, and Lifestyle Training Headquarters (H.E.A.L.T.H.)	Online program that provides nutritional and exercise information to help active duty and reserve Army personnel prepare to meet service fitness standards. Available to Army beneficiaries as a tool for promoting nutritional health and fitness.	Ref. 73) Ref. 74)
			Pregnancy/Postpartum Physical Training Program	Mandatory program designed to educate all pregnant Army women about maintaining healthy exercise habits during and after pregnancy. The program is designed to promote soldiers' physical and psychological well-being, as well as ease the post-partum transition to meeting fitness standards.	http://phc.amedd.army.mil/PHC%20Resource%20Library/PPPT%20FS%2046-002-1010.pdf
Navy	62.7%	14.3%	Navy Fitness Program	Provides resources and information regarding fitness standards, exercise safety, and recommended physical activities to navy personnel, to encourage the creation of individualized fitness plans.	http://www.navyfitness.org

Service	Percentage		Program	Description	Additional Information
	Overweight (BMI 25)	Obese (BMI 30)			
Active Duty			Senior Health Assessment Program Enterprise (SHAPE)	Promotes the maintenance of physical health through exercise for senior service members over the age of 40.	http://www.navyfitness.org/shape
			Navy Operational Fitness and Fueling Series (NOFFS)	Program that strives to maximize physical performance while preventing injury by focusing on exercises that mimic sailors' daily operational activities.	http://www.navyfitness.org
			Shipshape	Promotes healthy weight loss and weight management through nutritional, behavioral, and exercise education in Naval personnel who did not meet service fitness standards, as well as overweight Naval dependents.	Shay et al. <i>Eat Behav</i> 2009;10:220-227.
			Blue H	Surgeon General Health Promotion and Wellness Award presented annually to nominated military medical, fleet, and Semper Fit commands to support and reward health promotion in the US Navy and Marine Corps.	http://www.med.navy.mil/sites/nmcphc/health-promotion/Pages/blue-h.aspx
Marine Corps	55.1%	6.1% ^a	Marine Corps Community Services (MCCS) / Semper Fit Programs	Comprehensive program incorporating fitness, 14.1% active leisure promotion, nutrition education, and general health promotion to support healthy lifestyles and combat readiness.	http://www.marines.mil/Portals/59/Publications/MCO%20P1700.29%20W%20Ch%201.pdf
Coast Guard	62.9%	14.1%	Physical Fitness Program	Provides descriptions of and access to electronic resources for various exercise regimens, which can be combined to create need-specific fitness programs for individual coast guard personnel and units.	http://www.uscg.mil/hq/cg111/physical_fitness_program.asp
Veterans	75.4%	32.8%	Motivating Veterans Everywhere (VA MOVE!®)	Utilizes evidence-based, individually-tailored weight management strategies to help veterans lose weight, maintain lost weight, and improve health. The program is currently provided at all Veterans Health Administration (VHA) hospitals and VHA community-based outpatient clinics.	http://www1.va.gov/vhapublications/ViewPublication.asp?pub_ID=2403 Ref: 72)
Children of Military Personnel and Beneficiaries	30% ^a	15%	Triple Play: A Game Plan for the Mind, Body and Soul	Provides children and adolescents from military families with nutritional, fitness, and social skills-building education for the maintenance of health weight and eating behaviors.	http://www.bgca.org/whatwedo/SportsFitnessRecreation/Pages/TriplePlayResources.aspx

Service	Percentage		Program	Description	Additional Information
	Overweight (BMI 25)	Obese (BMI 30)			
Active Duty			Up For the Challenge: Lifetime Fitness, Healthy Decisions	Promotes healthy lifestyle and behaviors among children and adolescents from military families through nutrition and physical activity education.	http://www.4-hmilitarypartnerships.org/doc13533.asbx
			SMART Girls	Provides female children and adolescents from military families with support through pubertal changes, through pubertal, nutrition, fitness, and social skills-building education, and emphasis on maintaining self-esteem.	http://www.bgca.org/whatwedo/HealthLifeSki11Is/Pages/SMARTGirls.aspx
			The Food Friends®: Fun With New Foods®	Provides children ages 3 to 5 years with fun, structured activities to increase child willingness to try new, healthier foods.	http://www.foodfriends.org/index.php?id=41&page_name=Research+and+Funding
			The Food Friends®: Get Movin' With Mighty Moves®	Provides children ages 3 to 5 years with activities that aim to encourage physical activity and aid in the development of motor skills.	http://www.foodfriends.org/index.php?id543&Page5Get%20Movin-With-Mighty-Moves
			FitFactor	Provides children, teens, and parents from US Air Force and US Navy families with an online system to track healthy fitness behaviors and provide nutrition awareness, while earning points for rewards.	http://www.afyouthprograms.com/FitFactor.htm
All TRICARE Beneficiaries	-	-	Healthy Weights	Promotes the maintenance of healthy weight among healthy adult TRICARE-beneficiaries through nutrition and fitness education.	https://www.hmfs.com/content/hmfs/home/tn/bene/wellness/hw/landing.html
			Crews Into Shape Challenge	Promotes nutrition and physical activity among TRICARE-beneficiaries and DoD employees through a group health promotion initiative and competition.	http://www.med.navy.mil/sites/nmephc/health-promotion/pages/crews-into-shape.aspx
			LE3AN	Program for adult TRICARE-beneficiaries with obesity related morbidities, which includes intensive nutritional, fitness, and behavioral education from a psychologist and dietician, as well as individual monthly sessions with a health psychologist to implement a healthier lifestyle and prevent further obesity-related complications.	James et al. <i>Mil med</i> 1999;164:389-395. Simpson et al. <i>J Natl Med Assoc</i> 2004;96:1332-1336.
			Hooah 4 Health	Interactive website-based program for active duty personnel and their families, which includes healthy eating, nutrition, and exercise guidance and tips.	http://www.hooah4health.com
			US Air Force Fit Family	Interactive website for active duty personnel and their families, which provides healthy eating and exercise tips, fitness contests, and a family fitness	http://www.usafffamily.com/new-home

Service	Percentage		Additional Information
	Overweight (BMI 25)	Obese (BMI 30)	
Active Duty			
			<p>goal tracker to help military families maintain health and fitness. goal tracker to help military families maintain health and fitness.</p> <p>Go For Green™ Program that employs the colors used for traffic lights (red, yellow, green) to designate healthier, moderately healthy, and unhealthy foods in cafeterias on military installations.</p> <p>http://www.quartermaster.army.mil/jccoe/Operations_Directoriate/QUAD/Nutrition/G4G_Instructions.pdf</p>

Programs available for obesity prevention and treatment for military families can be found at the PennState Clearinghouse for Military Family Readiness - Resource Center for Obesity Prevention (Accessible at: <http://www.militaryfamilies.psu.edu/initiatives/obesity-prevention>). BMI = Body Mass Index (kg/m²).

^aThe prevalence of obesity in the Marine Corps was reported to be significantly lower than any other service (16). For children, “overweight” and “obese” were defined as 85th percentile for BMI and >95th percentile, respectively.

TABLE 3

Weight management randomized controlled trials conducted among active duty US Military Personnel

Citation	Population studied	N	Intervention type	Intervention duration	Primary outcomes
Dennis et al., 1999	Male Naval Personnel aboard an aircraft carrier who previously failed body composition standards	Intervention: 21 Control: 18	Intervention: Group lectures on diet, behavior modification, cognitive, emotional, and social factors influencing weight, and exercise by Navy dietician; Control: Navy usual care (i.e., exercise only)	16 weeks	Intervention had significantly greater reductions in body weight, triglycerides, and depressive and disordered eating symptoms.
James et al., 2001 ^a	Army and Navy Personnel assigned to Hawaiian military bases	Standard intervention: 34 Interactive video/web-based intervention: 14	Intervention: 3 week cognitive behavioral day treatment for weight loss plus follow-up either in the clinic (standard) or via interactive online site for deployed personnel	12 months; findings reported at 3 months	Both treatment groups experienced significant weight loss, with no significant differences between groups.
Veverka et al., 2003	Air Force Personnel	Intervention: 20 Control: 19	Intervention: Access to internet website containing individualized diet and physical activity information; Control: No intervention	6 months	Intervention did not significantly improve fitness scores, but significantly decreased body weight, BMI, percent body fat, and blood pressure (among those for whom it was medically indicated) relative to control.
Robbins et al., 2006	Air Force Personnel (BMI of 24–29.9)	Intervention: 3,502 Control: 65,089	Intervention: Access to two behavioral change booklets and an Air Force weight loss memorandum; weekly emails targeting healthy eating or physical activity; Control: No intervention	12 months	Intervention had significantly greater weight loss among women and men of higher rank above maximum allowable weight at baseline than control. No significant differences among men of lower rank.
Hunter et al., 2008 (76)	Air Force Personnel within 5 lbs of or above maximum allowable weight for fitness standards (BMI 27.5 for men, BMI 25 for women)	Intervention: 227 Control: 224	Intervention: Access to internet program with behavioral, dietary, and exercise components; two motivational phone interviews; Control: Usual care	6 months	Intervention had significantly greater decrease in BMI, waist circumference, and body fat, and better prevention of weight gain than control.
Smith et al., 2010	Army Personnel enrolled in the Army “Weigh to Stay” program who previously failed body composition standards	Intervention: Randomized: 55 Completed: 29 Randomized Control: 56 Completed: 17	Intervention: Two calorie-restricted meal replacements provided to soldiers in addition to usual Weigh to Stay intervention; Control: Usual Weigh to Stay Intervention	Meeting of body composition standards, or 6 months	Intervention had significantly greater weight, fat mass, and percent body fat loss, and lower attrition than control.

BMI = body mass index (kg/m^2).

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^aJames et al. (2001) was included due to its quality as a controlled comparison of two active treatment groups (one of which was done via telemedicine when personnel were deployed and unable to visit the clinic in-person); however, this study does not meet standards of a randomized controlled trial in that personnel were not necessarily randomly assigned to deployment.

TABLE 4

Conclusions drawn from previous intervention studies and recommendations for obesity prevention and treatment programs within the military family

Conclusions and recommendations	Selected References
<p>Program content</p> <ul style="list-style-type: none"> • Treatments supported by theoretical methodologies demonstrate greater efficacy. The cognitive behavioral treatment model shows promise for treating active duty military personnel • Provide education about the risks of unhealthy weight control behaviors • Include a self-monitoring component (i.e., tracking diet, physical activity, and/or weight) • Target not only weight loss (i.e., for overweight or obese individuals) but also weight maintenance (i.e., obesity prevention) for those for whom it is indicated (e.g., healthy weight military personnel, youth who are still growing) 	<p>Earles J, Kerr B, James L, Folen R. Clinical effectiveness of the LE³AN program: A military healthy lifestyle program. <i>J Clin Psychol Med Settings</i> 2007;14:51–57.</p> <p>Ref. 76</p> <p>Ref. 2</p> <p>Shay LE, Seibert D, Watts D, Sbrocco T, Pagliara C. Adherence and weight loss outcomes associated with food-exercise diary preference in a military weight management program. <i>Eat Behav</i> 2009;10:220–227.</p> <p>Ref. 73</p>
<p>Program delivery</p> <ul style="list-style-type: none"> • Incorporate multidisciplinary staff in a cooperative team to capitalize on varied expertise (e.g., medicine, nutrition, psychology, physical therapy, etc.) • Group treatment is more cost effective and allows members to get support and share experiences • Include a “support person” in treatment (e.g., spouse or partner, friend, etc.) • Have treatment of sufficient duration to promote sustained changes, and include a focus on relapse prevention • Utilize interventions that are flexible and portable to accommodate the needs of active duty personnel (including during deployments) • Interactive internet-based programs have several advantages (e.g., flexibility and portability; online diet and fitness trackers; ease of data collection; tailored information delivery and feedback; and anonymous participation, which helps reduce stigma) <p>Other study design considerations Whenever possible, research trials should aim to:</p> <ul style="list-style-type: none"> • Recruit large and diverse samples • Employ a randomized controlled trial design to determine a program's effects against a control group (e.g. usual care) • Include follow-up assessments to gauge long-term effectiveness 	<p>Bowles SV, Picano J, Epperly T, Myer S. The LIFE program: A wellness approach to weight loss. <i>Mil Med</i> 2006;71:1089–1094.</p> <p>Ref. 76</p> <p>Ref. 3</p> <p>Ref. 73</p> <p>Trent LK, Stevens LT. Evaluation of the Navy's obesity treatment program. <i>Mil Med</i> 1995;160:326–330.</p> <p>Ref. 76</p> <p>Ref. 3</p>
<p>Outcome measures</p> <ul style="list-style-type: none"> • Evaluate a program's impact beyond just body weight, to include participants' quality of life, metabolic, physiological, and psychological functioning, and usage of unhealthy weight control behaviors • Continue to examine motivating factors (e.g., fear of separation from military, body image, improved well-being, etc.) in order to minimize attrition from programs • Measure variables that are potential mediators of change • Collaboration between civilian and military researchers • It is important to build a trusting and respectful relationship when engaging any community in research, including the military community • Utilize a shared leadership approach, from both civilian and military investigators • Civilian researchers must be mindful of unique military considerations, such as perceived pressure to participate in a research program, respect for military personnel's other operational demands, pressure to attain body composition and fitness standards, and an understanding of the 	<p>Bowles et al., 2006</p> <p>Earles et al., 2007</p> <p>Ref. 3</p> <p>Earles et al., 2007</p> <p>Shay et al., 2009</p> <p>Williams EM, Lee MD, Preston G, et al. Development of the soldier health promotion to examine and reduce health</p>

Conclusions and recommendations

modifications necessary for civilian weight management programs to be relevant and successful within a military setting, particularly among active duty personnel

Selected References

disparities (SHPERHD) project coordinating center: Challenges and opportunities within a university/community partnership. *Mil Med* 2011;176:757–762.
