Relationship between Body Mass Index and Diagnosis of Obesity in the Military Health System Active Duty Population

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Abstract

Objective: The overall rate of obesity is rising in the United States; this is also reflected in the military population. It is important that providers appropriately diagnose obesity and discuss treatment options with their patients.

The purpose of this study was to investigate diagnosis of obesity compared to documented body mass index (BMI) in the military health system.

Methods: This study included active duty military service members aged 18-65 enrolled at a military treatment facility from September 2013 to August 2018 with a weight within the range of 70-500 pounds and height between 48-85 inches. Data were collected from the Clinical Data Repository vitals and M2 encounter data to determine the percentage of each sub-population with a diagnosis of obesity according to BMI (≥30) and ICD diagnosis codes.

Results: Using BMI, 35.02% of service members can be diagnosed with obesity; however, 51.90% with a BMI ≥30 did not carry such diagnosis. This was consistent among all service branches, gender, and BMI ranges.

Conclusion: This study demonstrates that obesity is underdiagnosed when compared to BMI. This may result in insufficient resources provided to patients to reduce weight. Further investigation is warranted to identify causes of underdiagnosis and potential barriers to diagnosis.

Keywords: BMI; Diagnosis; Screening; Obesity

List of abbreviations: BMI: Body Mass Index; NHLBI: National Heart, Lung, and Blood Institute; HCP: Health Care Providers; NAMCS: National Ambulatory Medical Care Survey; DHA: Defense Health Agency; MTF: Military Treatment Facility

Introduction

It is well known that the overall obesity rate for adults in the United States continues to rise; while not as well-known, obesity rates also continue to rise in the United States military population [1-3]. This has increased military service members’ risk of developing many health conditions associated with obesity including cardiovascular disease, insulin resistance, and metabolic syndrome [4]. Furthermore, military readiness is negatively impacted by the rising rate of obesity, which is associated with increased injury risk and decreased physical performance [5,6].

Per the National Heart, Lung, and Blood Institute (NHLBI) guidelines, body mass index (BMI) is calculated as an individual’s weight in kilograms divided by the square of height in meters. Obesity is defined as a BMI ≥30 kg/m² [7]. In a more physically active population, such as the military, BMI may become less accurate as an indicator for physical fitness, as this population may have a higher muscle mass and, thus, a weaker correlation between BMI and percent fat [8,9]. However, with BMI values ≥30 kg/m², the correlation with obesity is generally strong [10,11]. Accurate identification and diagnosis of obesity is the first step prior to evaluation and treatment for obesity and associated co-morbidities.

One of the challenges facing service members is that they may have a misperception of their weight status given the unique demands of the military [12]. At a minimum, active duty service members are required to meet height and weight standards.
Depending on the branch of service, service members may be required to maintain a BMI below a specific limit; exceeding this limit may require additional testing to assess body fat percentage via waist and neck circumference measurements. Males can range from 20-26% body fat and females can range from 30-36% body fat depending on age category. Technically, a 41-year-old female with BMI of 31 can pass the physical fitness test if body fat is calculated to be 36% [13]. This discrepancy, which is created by the military in allowing its own physical height and weight parameters that do not align with the universal medical standard for obesity, may ultimately lead to individual dissonance and inability to accept their true weight category [12]. This is problematic because the positive reinforcement given for meeting military-specific weight goals might prevent important attempts at diet and lifestyle modifications in order to achieve an appropriate BMI.

Service members have also been shown to have increased motivation to lose weight when diagnosed as overweight or with obesity [14]. Motivations similar to civilian counterparts include improved quality of life, physical health, and life expectancy. Unique motivators to service members include passing the physical fitness test and meeting required height/weight standards. Motivation to want to lose weight was also shown to be greater in higher ranking and higher educational status service members [15-17]. This was thought to be tied to greater concern about passing fitness tests and meeting appropriate height/weight standards. Failing fitness tests or height/weight standards could result in loss of career, health insurance, and possibly their pension.

In a survey of people with obesity (n=3008) and health care providers (HCP) (n=606), attitudes toward and perceptions of obesity varied [18]. Although obesity is perceived as a disease by the majority of people with obesity (65%) and HCP (80%), providers and patients struggle with talking about weight for different reasons [18]. Patients who do not seek help from their HCP believe it is their personal responsibility (44%); they already know what to do (37%); and/or do not have financial means to support a weight loss effort (23%). The primary reasons HCP did not initiate discussions about weight loss were time constraints (52%) and having more important issues to discuss with the patient (45%). Other HCP beliefs cited were that the patient was not motivated to lose weight (27%); the patient was not interested in weight loss (26%); and/or concern over emotional state or psychological issues (22%) [18]. For patients that had weight loss discussions with their HCP, 47% of patients reported broaching the topic while 53% reported the HCP mentioning weight loss. This was very different according to HCP who report that they brought up weight loss (67%) versus the patient (33%) [18].

Recognition and coding for obesity in civilian healthcare settings is poor. One study found that while 52% patients met objective criteria for obesity (BMI ≥30), only 5.6% of patient records included an obesity code; another study found that 40% of patients that met the definition of obesity of BMI ≥30 were not coded as such [19,20]. A cross-sectional study using 2005-2006 National Ambulatory Medical Care Survey (NAMCS) data revealed that nearly 50% of clinical visits did not have complete height and weight records to facilitate calculating BMI. In addition, of patient encounters with a BMI ≥30, 66-74% lacked obesity coding in the health record [21]. A smaller study (n=289) in Israel examined data from seven family practice clinics and found 27% of patients could be diagnosed with obesity (BMI ≥30) and only 24.4% of those were documented as such [22]. Even more alarming, 66% of patients with known obesity co-morbidities (including type 2 diabetes, hypertension, obstructive sleep apnea, etc.) were not diagnosed with obesity [18]. A Mayo Clinic primary care study (n=9827) examined data from 2004-2005 and found that 25.9% of patients can be diagnosed with obesity by BMI with the majority lacking obesity documentation (80.1%) [23]. Furthermore, older patients and men were significantly less likely to have an obesity diagnosis, and presence of an obesity diagnosis was the strongest predictor of creating a plan to address obesity [23].

The purpose of this study was to first determine an accurate rate of obesity in active duty service members who sought clinical care in the military health system. Then we investigated the rates of diagnosis coding of obesity amongst individuals with a BMI fitting an obesity diagnosis and how these rates compare based on age and gender.

**Methods**

Data were collected from the Defense Health Agency (DHA) Clinical Data Repository vitals and Military Health System Management Analysis and Reporting Tool (M2) encounter data from 1 September 2013 through 31 August 2018. Only active duty service members with a clinical encounter at a military treatment facility (MTF) with vitals during this period were included (Figure 1).

Records were included if they met the following inclusion criteria: 1) DOD identification number present; 2) Between 18-65 years old; 3) 70-500 pounds; and 4) 48-85 inches tall. All included records met NHLBI guidelines for obesity defined as a BMI ≥30 [7]. BMI was calculated based on height and weight as BMI = [weight in pounds/(height in inches)²] * 703.

Exclusion criteria were the following: 1) questionable accuracy of sponsor service branch; 2) missing or undetermined gender; 3) height inaccuracies defined as multiple heights not within 5 inches; and 4) pregnant women during the study period. Finally, obesity ICD codes for the clinical encounter were added. Obesity ICD-10 codes included E66.0, E66.01, E66.09, E66.8, and E66.9. Obesity ICD-9 codes 278.00 and 278.01 were also included. Overweight ICD codes were not included.
Results

Branch of Service Differences

By this data, we see similar overall rates of obesity in active duty members by height and weight measurement across the Army, Air Force, and Navy (27.3-30%); followed by the Coast Guard (24.2%), and finally by the Marines (15.3%). Coding for obesity differs slightly compared to measured obesity with the Army and Air Force having similar rates (37.4% and 39.4% respectively), followed by the Navy and Coast Guard (26.7% and 27% respectively), and the Marines at 14.8% (Figure 2).
Gender Differences

The rate of ICD coding for obesity in the electronic medical record was significantly lower than the rate of active duty service members with BMI meeting obesity criteria. Of 544,478 active duty females, 104,407 (19.18%) met criteria for obesity based on vital sign measurement; however, only 44,082 (42.22%) were coded with an obesity diagnosis at any time. Of those 44,082 females with an obesity diagnosis entered in the EMR, the majority of diagnoses (42,747) were entered within one year of a BMI measurement ≥30. A similar rate of obesity coding was seen in active duty males with a measured BMI ≥30. Of 2,476,968 males, 664,814 (26.83%) had a BMI ≥30 recorded vital sign record. Of males meeting criteria for obesity, 233,425 (35.11%) had coding for an obesity diagnosis; the majority of these (232,385) were coded within one year of the BMI ≥30 vital sign measurement (Figure 3).

Age Group Differences

Across all age groups, females meeting diagnostic criteria for obesity were more likely to be coded with an obesity diagnosis. Service members were less likely to receive a coded obesity diagnosis if they were 24 years of age or younger (33.78% of females and 29.11% of males aged 18-24). Individuals in the 35-44 and 45-65-year-old age groups were more likely to be coded for obesity when meeting diagnostic criteria. Furthermore, 49.38% of females fitting a diagnosis of obesity by BMI aged 35-44 and 47.28% of females aged 45-65 were coded with a diagnosis of obesity. In addition, 48% of males fitting a diagnosis of obesity by BMI aged 35-44 and 38.79% of males aged 45-65 were coded with a diagnosis of obesity (Figure 3).

BMI Range Differences
The rate of coding for obesity in active duty service members decreased as BMI ranges increased. Of 633,768 individuals with a BMI of 30-34, 34.5% (218,353) were coded for obesity. Of 34,424 individuals with a BMI of 35-39, 20.7% (7118) were coded for obesity. Lastly, of 4615 service members with a BMI ≥40, only 12.3% (566) were coded for obesity at any time. It should be noted that the sample size for service members with BMI ≥35 was smaller than service members with a BMI 30-34 (Figure 4).

Discussion

This study confirmed that obesity is a common health concern for the active duty military population, for both genders and across all age groups. This study also revealed that the rate of diagnosis with clinical obesity in the EMR for active duty service members meeting criteria is considerably lower than the actual rate of obesity in this population. More than half of active duty females and about two-thirds of active duty males with a BMI meeting criterion for obesity did not receive an ICD-coded diagnosis in the EMR. This represents a gap between the prevalence of obesity in service members and clinical documentation of this condition.

Gender disparities in coding may be explained by weight-related beliefs and behaviors. A prior study showed that women tend to be more concerned about their weight and more likely to broach the topic at a clinical visit, which prompts the HCP to discuss it [18]. Conversely, men may be more likely to believe that weight management is their personal responsibility or they already know what to do to address weight management [18]. There may also be the perception that men are heavier due to muscle mass, although with a BMI ≥30, the correlation with obesity is generally strong [10,11].

The youngest age group of service members are the least likely to be coded with obesity when this condition exists. Obesity should be identified and addressed early to prevent morbidity and mortality from associated medical conditions. This is concerning when considering operational readiness, duty performance, deployment capability and retention. Older patients in our study were more likely to receive an ICD coded diagnosis, but identification of overweight and obesity in younger service members would allow for early intervention and prevention of conditions related to obesity. The disparity in coding of obesity in individuals with a BMI ≥30 between services could be influenced by several factors. Medical providers may have received different coding training in different services and in different MTFs. Some MTFs include ICD diagnosis of abnormal vital signs (coding for elevated blood pressure, BMI ≥30, tachycardia for elevated heart rate) in quality assessment metrics which may lead to a higher rate of diagnosis. There may be a perception in some services that diagnosis of obesity in the medical record has a negative connotation that can impact the service member's career. The body composition of the average service member from different services may vary. In future research, comparing fitness testing data which includes waist measurement with BMI would be helpful to more fully evaluate BMI measurement.

Noteworthy between the services is the relatively similar rate of measured obesity between 4 of the 5 services with the Army, Air Force, Navy, and Coast Guard ranging between 27-30% while the Marines with only 15.3%. This lends some credence to the general thought that Marines are more physically active and fit. Interestingly, the Marines has the lowest rate of coding for obesity at 14.8% while the Army and Air Force having the highest rate (37.4% and 39.4% respectively) and the Navy and Coast Guard fall in between (26.7% and 27% respectively). Without further information, we cannot assess why this coding discrepancy exists; it certainly could be impacted by the training of providers in different services, different MTF practices, or concern for career impact. Another possible reason, in particular for the Marines “poor” coding, is that indeed a higher portion of these patients are truly physically fit with a low body fat percentage but meet BMI obesity criteria based on height and weight and are therefore not coded for obesity [23-25].

Obesity was also less likely to be diagnosed amongst service members with higher BMIs, particularly in individuals with morbid obesity. Possibilities as to why this is occurring include provider bias with higher BMI individuals and other health issues that could predispose one to a higher BMI. It is also possible that these service members could be separated from the military much earlier than lower BMI service members and lack adequate follow up for diagnosis and treatment. Further investigation would need to be done to explore this phenomenon.

It is important to note, however, that a higher rate of coded obesity diagnosis does not necessarily mean that a patient was counseled regarding obesity, nor that the patient received obesity specific treatment; this could be explored in future research. We also did not analyze whether receiving an obesity diagnosis had an impact on an individual’s BMI trajectory as compared to individuals who did not receive a diagnosis of obesity. Although recognition of obesity is the necessary first step in treatment, this condition is multifaceted and can be challenging for patients and healthcare providers to manage.

A limitation of this study was the use of BMI to calculate obesity prevalence. Gold standard for diagnosis of obesity is body fat composition but this is not practical for a retrospective study in this population due to available information and cost. Because of this limitation we chose to exclude the overweight BMI which could lead to overestimation in active duty members with increased amounts of lean body mass. As we expand this study we hope to obtain waist circumference data which is recorded at least annually for active duty members associated with fitness testing for more data points. Another aspect of this study that influences interpretation is the exclusion of females with a pregnancy diagnosis from statistical analysis. This represented 25,335 individuals, which may have affected the female obesity rates had they been included. The rate of obesity prior to pregnancy, following pregnancy, and with single versus multiple pregnancies is an area which should be examined in future research; this may help to identify a subgroup of the active duty population that could benefit from a targeted weight management early intervention.
Service members carrying diagnoses that could lead to an elevated BMI not caused by percent fat such as congestive heart failure, hepatic or renal disease, or malignancies were not accounted for in the data analysis. However, we expect this number to be small due to the physical requirements of the military, as most of these individuals will be medically separated, and would not have a significant impact on the overall data.

Conclusion

Although common perception is that the military is a population less-susceptible to obesity, our data has shown service members receiving care in military treatment facilities have a high obesity rate and are not consistently coded as such, at least amongst those seeking care. Underdiagnosis and undertreatment of obesity can have major implications in overall military readiness and the general health of the military health system population [4,5]. We found a major discrepancy between obesity as measured by BMI (about 25% of active duty status across all services) and actually being diagnosed with the ICD code (12.5% of those who fit the diagnosis for obesity by BMI). Furthermore, this is occurring despite increased access to healthcare for active duty members compared to the civilian population due to the availability of universal health care coverage for active duty service members through the TRICARE program. It is clear that the active duty population is just as affected as the civilian population in regard to obesity diagnoses, and further studies should investigate why this is occurring and potential barriers to care. If active duty members do not receive the ICD code diagnosis, they are likely not receiving necessary information and referral for weight reduction which includes nutrition, exercise programs, and obesity education. This could lead to downstream effects that can have a major burden on healthcare costs, but also represents a direct threat to our mission of military readiness.

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References


