

# Analysis of Weight and Associated Health Consequences of the Active Duty Staff at a Major Naval Medical Center

*CDR Cynthia J. Gantt, NC USN; Julie A. Neely, MD MPH; Ian A. Villafana, MPA; Chisun S. Chun, MPH; CDR Sandy M. Gharabaghi, NC USN (Ret.)*

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**ABSTRACT** Objective: The purpose of this study was to analyze the prevalence of overweight and obesity among active duty staff members at one the Navy's largest medical centers, in an effort to clarify the relationship between weight, physical fitness, health care utilization patterns, and health care costs. Methods: Data obtained from the Physical Readiness Information Management System were linked with health care utilization data obtained from the Military Health System Management Analysis and Reporting Tool. This information was applied to the National Heart, Lung, and Blood Institute risk-stratification criteria to clarify the roles overweight and obesity play as factors contributing to increased health risk, comorbid conditions, and health care costs in this military health care setting. Results: At least 53% of the active duty staff members (1,755 of 3,306) at this medical center were either overweight or obese, based on body mass index (BMI). Three hundred fifty-one personnel did not have body composition analyses recorded. Using the Navy's current system, only 149 personnel were identified as being "out of standards" and 2,806 personnel were considered to be "within standards." Remarkably, the within-standards group included 241 personnel with obese BMIs and 1,365 personnel with overweight BMIs. The National Heart, Lung, and Blood Institute risk-stratification criteria identified 445 personnel as having increased risk of premature death, based on their BMIs and other risk factors. The Navy's current program resulted in 296 (445 minus 149) missed opportunities to provide weight loss intervention when it is most effective, in the early stages of weight gain. Conclusion: The system currently used by the U.S. Navy to characterize personnel by weight ignores opportunities to identify and to treat high-risk personnel and provides neither a consistent nor an evidence-based model for early intervention and treatment of high-weight personnel at risk for increased morbidity, loss of productivity, and associated increased medical costs.

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## INTRODUCTION

Obesity is a serious, growing, national health crisis of epidemic proportions in the United States and, regrettably, within the Department of Defense. Through the Navy's commitment to Force Health Protection, maintaining a "fit and healthy force" becomes vital to operational readiness. Astonishingly, the prevalence of obesity (i.e.,  $\geq 30$  lb overweight) in U.S. adults increased 61% between 1991 and 2001, and the prevalence continues to increase, especially among children.<sup>1</sup> Military personnel mirror the nation's civilian populace in terms of steadily increasing body weight.<sup>2</sup> In response to this crisis, a panel of national experts was convened by the National Institutes of Health to provide an authoritative opinion on effective weight management strategies. Their work indicated that the most-successful weight management programs include prevention, early identification, and intervention directed at the overweight population. The final evidence-based consensus report from the National Heart, Lung, and Blood Institute (NHLBI) was Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults.<sup>3</sup> These guidelines target overweight and

obese persons for intervention by using a risk-stratification scheme based on the degree of increased health risk attributable to increased body mass index (BMI) and other identified risk factors, such as comorbidities.

According to the NHLBI, overweight and obesity are conditions that substantially increase the risk of morbidity attributable to hypertension, type 2 diabetes mellitus, stroke, gallbladder disease, osteoarthritis, certain cancers (endometrial, breast, prostate, and colon), and respiratory problems, such as sleep apnea. Epidemiological data show increased mortality rates beginning at BMIs of  $>25$  kg/m<sup>2</sup>. For persons with BMIs of  $\geq 30$  kg/m<sup>2</sup>, mortality rates for all causes, and especially cardiovascular disease, are generally increased 50% to 100% above those of persons with BMIs in the range of 20 to 25 kg/m<sup>2</sup>.<sup>3</sup>

Increased health risks attributable to overweight and obesity translate directly into increased medical care and disability costs; as BMI increases, so do numbers of sick days, medical claims, and health care costs.<sup>4</sup> In the civilian sector, obese adults  $<65$  years of age have annual medical expenses that are 36% higher than those of normal-weight people. The cost ramifications for the military health system health plan are obvious as they relate to both active duty members and retirees.

The NHLBI approach to effective weight management requires a combined, three-pronged program with behavior counseling, nutrition counseling, and physical fitness. The chances of individual success at weight loss are increased through simultaneous participation in all three aspects of the

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Population Health Department, Naval Medical Center San Diego, San Diego, CA 92134.

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program. The study by Lewis et al.<sup>5</sup> of 784 formerly obese or overweight individuals who had successfully maintained weight loss of  $\geq 30$  lb for a minimum of 5 years revealed that  $>80\%$  had adopted a combination of nutritional, behavioral, and physical activity strategies. The individuals were able to sustain lifestyle changes that included healthy eating habits and moderate/high levels of physical activity for  $\sim 1$  hour on most days of the week. Unfortunately, a small proportion of people who attempt weight loss follow such recommended combined strategies, which contributes to the high rate of failure to achieve weight loss goals and the high rate of recidivism.

The Navy's current approach to evaluating body weight is the physical fitness assessment (PFA) program, which uses "within standards" or "out of standards" as cutoff points that are based on body composition analyses (BCAs) including height and weight screening combined with the "Navy circumference measurement." Using this system, obesity is defined as 20% above the midpoint weight based on the 1983 Metropolitan Life Insurance tables.<sup>3</sup> Male obesity is defined as 22% (+1.20) body fat; female obesity is defined as 33.5% (+0.18) body fat.<sup>6</sup> This system does not use BMI to guide the identification of the overweight-at-risk population.

Mandatory weight management and fitness treatment efforts are limited to the Fitness Enhancement Program, which is required by the Chief of Naval Operations as stated in Naval Operations Instruction 6110.1H. This program focuses on personnel who have failed either the physical readiness test (PRT) or the BCA. The Fitness Enhancement Program was designed to provide sailors with the remedial exercise support necessary to salvage their careers jeopardized by PFA failure. The Fitness Enhancement Program emphasizes the physical activity aspect of weight loss and fitness enhancement and is not a complete weight management intervention package, as outlined by the NHLBI.<sup>7</sup>

BMI is the most commonly used surrogate for body fat measurement in the medical literature today. The mathematical formula for BMI expresses weight relative to height, that is, a person's body weight in kilograms is divided by the square of his or her height in meters. The BMI is more highly correlated with body fat than is any other current indicator of height and weight.<sup>3</sup> The NHLBI recommends weight loss therapy for obese patients with BMIs of  $\geq 30$  kg/m<sup>2</sup> and for overweight patients with BMIs between 25 and 29.9 kg/m<sup>2</sup> who are at high risk, as determined by having two or more cardiovascular risk factors or a large waist circumference,<sup>3</sup> using the following Centers for Disease Control and Prevention definitions: obese individuals, BMI of  $\geq 30$  kg/m<sup>2</sup>; overweight individuals, BMI of 25–29.9 kg/m<sup>2</sup>; normal individuals, BMI of 18.5–24.9 kg/m<sup>2</sup>; underweight individuals, BMI of  $< 18.5$  kg/m<sup>2</sup>; large waist circumference for men,  $> 102$  cm ( $> 40$  in); large waist circumference for women,  $> 88$  cm ( $> 35$  in).

BMI data are not currently collected for Navy personnel as part of the PFA. Furthermore, height and weight are not consistently recorded during clinical encounters and are not

easily retrievable electronic data elements. However, BMI values can be manually calculated for Navy personnel by using data available from the Navy Personnel Command in the Physical Readiness Information Management System (PRIMS). The PRIMS database houses the results of the semiannual PFAs for every Navy command, which provide individual service members and their command leadership with height and weight information (BCA), related cardiovascular risk status from the Personnel Assessment of Risk Factors Questionnaire (PARFQ), and measures of ability to complete a PRT. Use of the NHLBI risk-stratification approach (using BMI and risk factors from the PRIMS database) to target personnel at highest risk would allow for the provision of more proactive, evidence-based interventions that are more likely to be effective. The goals of this analysis were to determine the prevalence of overweight and obesity and to risk-stratify active duty staff members by using the NHLBI criteria.

## METHODS

Data from the spring 2005 PFA for this military treatment facility (MTF) were obtained from the PRIMS database, which included three summary reports listing PRT, BCA, and PARFQ results. Reports were converted from text files into Microsoft Excel and/or Microsoft Access (Microsoft, Redmond, Washington) files; height and weight were converted into BMIs and then collapsed into four BMI categories by using the Centers for Disease Control and Prevention definitions for underweight, normal-weight, overweight, and obese status. Waist circumferences were obtained from the BCA results when available. The PARFQ information was analyzed to obtain risk factor information pertinent to the NHLBI risk-stratification scheme. This analysis examined the ramifications of the obesity problem at this command by using Military Health System Management Analysis and Reporting Tool (M2) data to enhance information obtained from the PRIMS database. M2 health care utilization information, including diagnoses, associated costs, and number of outpatient visits at our MTF and its affiliated branch medical clinics between April 2004 and June 2005, was used for our analysis to compare the health care utilization patterns between persons with overweight, obese, and normal BMIs.

SPSS version 11.5 (Chicago, Illinois) and Epi Info version 3.3 (Atlanta, Georgia) statistical software was used for all data analysis. Descriptive statistics, including measures of central tendency, were obtained for the independent variables. Two-sided probability testing and an  $\alpha$  level of 0.05 were used in all comparisons. Univariate tests of association and analyses of variance between independent variables and both BMI category and PRT category were conducted by using the  $\chi^2$  statistic. Odds ratios with 95% confidence intervals were calculated between independent variables and both BMI and PRT categories. Incorrectly coded data and outliers were investigated and corrected as appropriate.

## LIMITATIONS

For a small subpopulation of the staff, using BMI as a surrogate for obesity may not be completely accurate, because high weight measurements may or may not be attributable to increased body fat mass. Measured weight may reflect increased amounts of lean muscle mass, as in the case of “body builders.”

Waist circumference is currently neither required by Navy instructions nor recorded for all PFA participants. At this command during the spring 2005 cycle, the number of participants who, because of their high height and weight values, needed additional measurements, including a waist or abdominal circumference, was 746, that is, 22.57% of the total number of PFA participants (746 of 3,306 participants). Seven of those 746 members measured had a high waist circumference value; therefore, the estimated number of personnel at increased health risk because of BMI of  $>25 \text{ kg/m}^2$  and high waist circumference value is assumed to be low.

The PFA was designed to assess the physical fitness of active duty personnel and was not developed to serve as a tool for identifying or tracking weight issues as health problems. Consequently, use of the PRIMIS data in an obesity analysis has the following limitations: variables such as gender, rank, rate, waist circumference, and cardiovascular risk factors exist as data fields in the PRIMIS database; however, they are listed in separate reports, each with a different format and different denominator. The process of collating and manipulating the data into a useful format increased the possibility of introducing data entry errors.

Our analysis was completed on available data and did not include either personnel who did not participate in the BCA (351 of the total of 3,306 participants; 10.62%) or those who did not take the PRT (1,102 of the total of 3,306 participants; 33.33%). Outpatient visits at this MTF, including the affiliated branch clinics, were used in the study. Inpatient or outpatient network purchased care or claims were not analyzed.

## RESULTS

Table I illustrates the rates of participation in the BCA and PRT portions of the spring 2005 PFA. Various reasons accounted for nonparticipation, including deployment, pregnancy, medical waiver, temporary additional duty, limited time at the command (reported aboard within  $<10$  weeks), unexplained “no-shows,” and leave status.

On the basis of BMI values, at least 53% of the active duty staff members (1,755 of 3,306 staff members) who participated in the spring 2005 PFA were obese ( $n = 347$ ; 10.5%) and/or overweight ( $n = 1,408$ ; 42.5%). Three hundred fifty-one personnel did not have BCA results recorded. The distribution based on BMI values is presented in Figure 1.

Figure 2 illustrates the distribution of staff members on the basis of NHLBI risk-stratification criteria, in which 445 personnel were identified as having increased risk of premature death on the basis of their BMI combined with high waist circumference value and cardiovascular risk factors obtained

**TABLE I.** Participation Rates for Spring 2005 PFA

|                 | No. (%)        |
|-----------------|----------------|
| Part 1: BCA     |                |
| Participants    | 2,955 (89.38)  |
| Nonparticipants | 351 (10.62)    |
| DEP/OP          | 183 (5.54)     |
| Pregnant        | 93 (2.81)      |
| No-show         | 45 (1.36)      |
| Medical waiver  | 20 (0.60)      |
| Leave           | 7 (0.21)       |
| TAD             | 2 (0.06)       |
| $<10$ weeks     | 1 (0.03)       |
| Total           | 3,306 (100.00) |
| Part 2: PRT     |                |
| Participants    | 2,204 (66.67)  |
| Nonparticipants | 1,102 (33.33)  |
| DEP/OP          | 525 (15.88)    |
| $<10$ weeks     | 209 (6.32)     |
| Medical waiver  | 208 (6.29)     |
| Pregnant        | 94 (2.84)      |
| No-show         | 54 (1.63)      |
| Leave           | 8 (0.24)       |
| TAD             | 4 (0.12)       |
| Total           | 3,306 (100.00) |

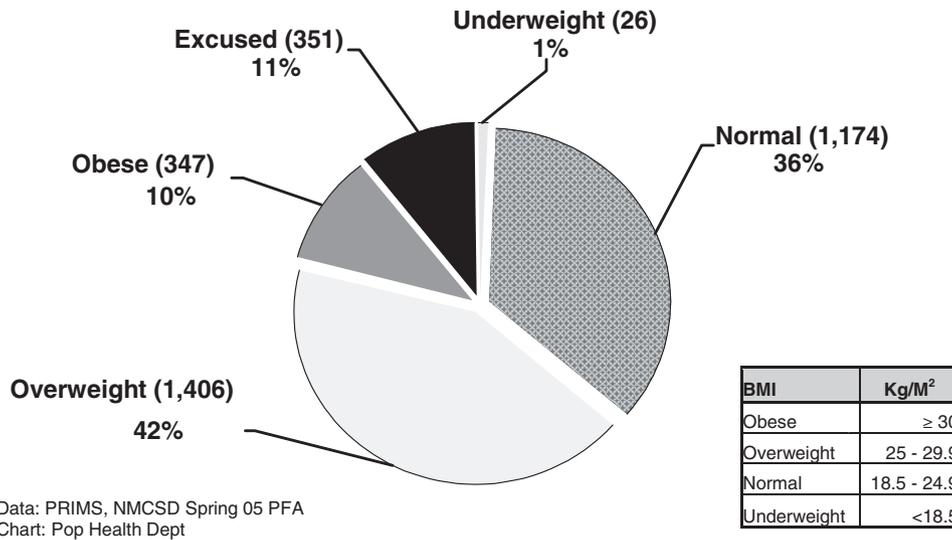
DEP/OP, deployed/operational status; TAD, temporary additional duty.

from the PARFQ. In contrast, Figure 3 illustrates the Navy’s current program based on BCA results, which identified only 149 personnel as being “out of standards,” with 2,806 personnel being classified as “within standards.” Notably, the within-standards group included 241 personnel with obese BMI values and 1,365 personnel with overweight BMI values. The Navy’s current system resulted in 296 (445 minus 149) missed opportunities to provide weight loss interventions because high-risk, overweight personnel were not recognized and treated effectively early in the weight gain process.

During the next phase of the analysis, we evaluated the relationship of the independent variables to PRT scores and BMI categories. We found no statistically significant difference in the ability to successfully complete the PRT between male and female participants during the spring 2005 PFA cycle ( $p < 0.22$ ). Successful completion of the PRT included the following PRT scores: good medium, good high, excellent low, excellent medium, excellent high, outstanding low, outstanding medium, and outstanding high. Not successful on the PRT included good low, satisfactory, failure, passorexcluded from one event, medical waiverorexcluded from two events, and no-score categories. There was no significant difference in the average BMI values between active duty men and women assigned to this MTF ( $p < 0.06$ ). There were 1,286 female PFA participants, whose mean BMI was  $24.9 \text{ kg/m}^2$  (SD,  $3.52 \text{ kg/m}^2$ ), and 1,659 male participants, whose mean BMI was  $26.49 \text{ kg/m}^2$  (SD,  $3.52 \text{ kg/m}^2$ ).

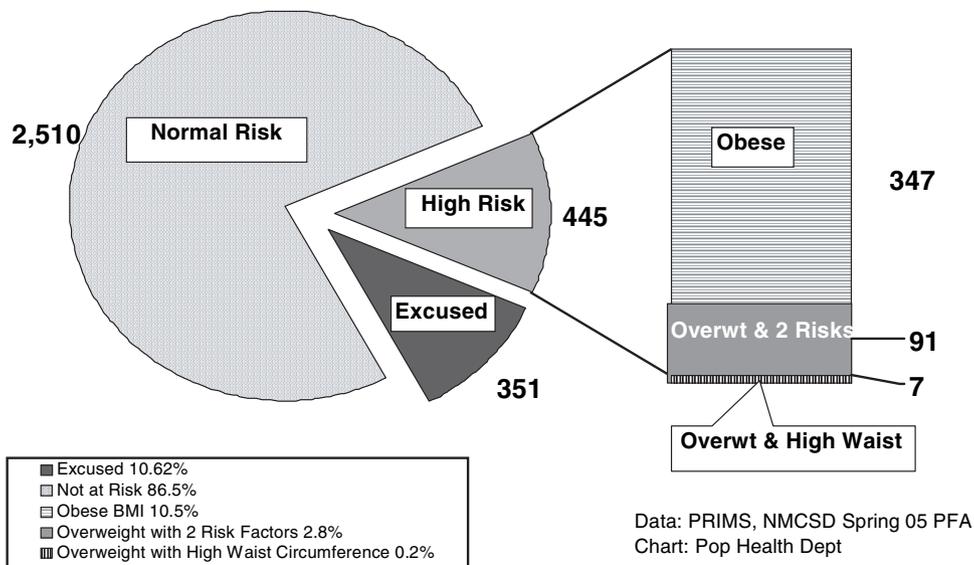
Underweight participants had a significantly younger average age than did participants in any other BMI category ( $p < 0.01$ ). Although they were older than underweight

**NMCS D Staff Body Mass Index  
Spring 05 PFA N=3,306**



**FIGURE 1.** Naval Medical Center San Diego staff BMI values from the spring 2005 PFA (N = 3,306).

**NMCS D Staff Risk Status Based on NHLBI Guidelines:  
BMI, Waist Circumference, CVD Risk factors  
N=3,306**



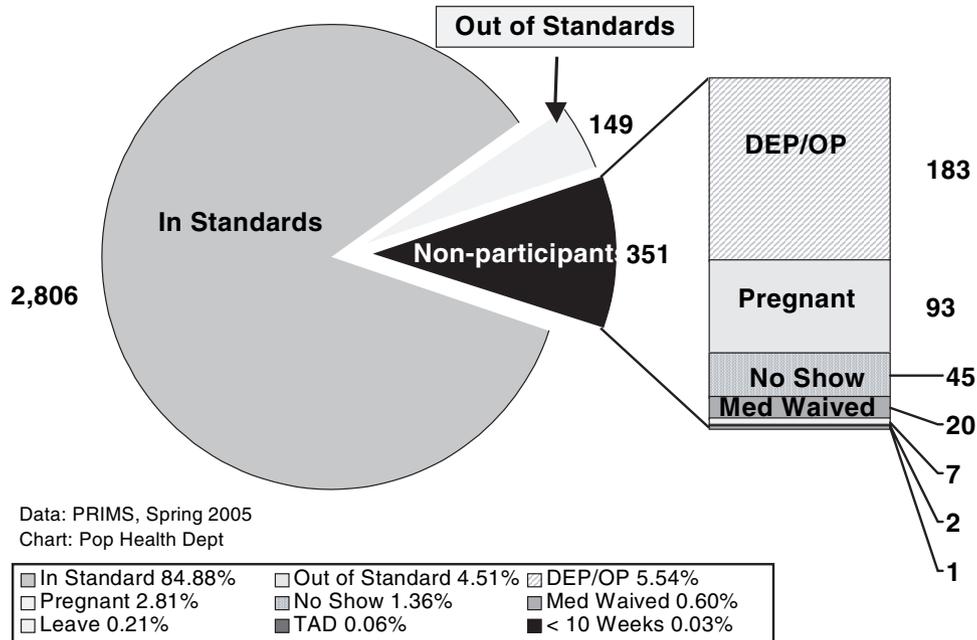
**FIGURE 2.** Naval Medical Center San Diego staff NHLBI risk-stratification criteria results from the spring 2005 PFA (N = 3,306). Overwt, overweight.

personnel, the average age of obese participants was not statistically significantly different, compared with any other weight category.

The average age of participants who failed the PRT was significantly lower than the average age of participants in all other PRT score categories ( $p < 0.01$ ). The average age of participants who received an outstanding score on the PRT was significantly higher than the average age of participants who failed the PRT ( $p < 0.01$ ).

A larger proportion (11.53%) of obese participants failed the PRT, compared with participants in any other BMI category; 79.82% of participants with PRT failures were obese (36.70%) or overweight (43.12%), compared with 18.35% for normal-BMI participants. An obese participant was twice as likely to fail the PRT, compared with a participant in any other BMI category (odds ratio, 2.30; 95% confidence interval, 1.79–2.95;  $p < 0.01$ ). A larger proportion of normal-weight personnel (14.74%) received an outstanding score on

NMCS D Staff Body Composition Analysis  
Spring 05 PFA N=3,306



**FIGURE 3.** Naval Medical Center San Diego staff BCA results from the spring 2005 PFA ( $N = 3,306$ ). DEP/OP, deployed/operational status; TAD, temporary additional duty; Med Waived, medically waived.

the PRT, compared with any other BMI category, and 37.31% of participants with normal BMIs received either an outstanding or an excellent score on the PRT; 57.28% of the outstanding scores on the PRT were achieved by participants with normal BMIs.

In the final phase of this analysis, we evaluated the relationship between health care utilization patterns and costs, chronic disease, and BMI. There were 29,791 outpatient visits to this command and its affiliated branch clinics between April 2004 and June 2005, made by 3,087 (93.38%) of the 3,306 total spring 2005 PFA participants. Two hundred nineteen (6.62%) of the 3,306 participants did not have any outpatient visits during that time period. The mean number of outpatient visits per PFA participant was 9.01 visits, ranging from 1 to 128 visits (SD, 14.52 visits;  $N = 3,306$ ), and values did not vary significantly between the various BMI categories ( $p < 0.33$ ). Obese participants incurred statistically significantly higher outpatient costs than did patients with normal BMIs. The average cost of an outpatient visit ranged from \$240.37 for a patient without a BMI measurement to \$274.45 for an obese patient (M2-defined “full cost raw” was used as the basis for cost comparisons in this analysis).

Seventy-two members were coded with International Classification of Diseases, 9th Revision, Clinical Modification code 278.00 for obesity as any one of the four possible outpatient diagnoses, for a total of 98 visits. Only 37 (10.66%) of the 347 total obese PFA participants were ever diagnosed with obesity.

Twenty overweight personnel (1.42%; 20 of 1,408 personnel), one normal-BMI participant, and 15 personnel who were not measured during this PFA cycle were also diagnosed with obesity.

One hundred three personnel from all BMI categories had 154 total nutrition counseling visits, in which International Classification of Diseases, 9th Revision, Clinical Modification code V653 for dietary surveillance/counseling was used for any one of the four possible outpatient diagnoses. Thirty-five of those individuals were obese (accounting for 55 visits), 42 were overweight (65 visits), 10 had normal BMIs (11 visits), and 16 had no BMI measurements (23 visits). The nutrition counseling visit/patient ratio was 1.5 visits per patient.

A review of the top 20 outpatient primary diagnoses received by PFA participants who were seen as outpatients between April 2004 and June 2005 at this treatment facility or affiliated branch clinics was performed according to patient BMI category and revealed that obese and overweight personnel did not have a unique constellation of health disorders. Lumbago and various forms of depressive and anxiety states were diagnoses found across all BMI categories. However, overweight and obese personnel received a primary diagnosis of hypertension or hyperlipidemia more often than did normal-weight and underweight active duty staff members. An overweight or obese person was more than twice as likely to be diagnosed with hypertension as a normal-weight or underweight person (odds ratio, 2.55; 95% confidence interval,

1.66–3.96;  $p < 0.01$ ) and almost 3 times as likely to be diagnosed with hyperlipidemia (odds ratio, 2.85; 95% confidence interval, 1.69–4.84;  $p < 0.01$ ).

## DISCUSSION

This is the first known analysis designed to evaluate the prevalence of obesity using BMI and its relationship to performance on the PRT, chronic disease conditions, and outpatient medical costs among active duty personnel. In our analysis, the BCA method classified 296 personnel as within acceptable weight limits, despite the fact that epidemiological evidence demonstrated that these personnel were at significantly higher risk of morbidity and death resulting from chronic diseases and all-cause death. Furthermore, BMI was the single most important factor in predicting PRT failure at this command, as evidenced by the fact that almost 80% of the PRT failing scores were attributable to overweight and obese personnel. The disparity in age in comparison with PRT performance underscores the importance of acting swiftly to change the trend. High priority must be placed on targeting these overweight members early, before obesity interferes with their job performance and health, as well as their ability to safely engage in physical activity for weight loss.<sup>8</sup>

Moreover, despite the existence of several evidence-based, consensus reports on the health risks of obesity and the health benefits of even moderate amounts of weight loss, many patients do not receive advice from their health care providers to lose weight or guidance on how to do so effectively.<sup>9</sup> Data from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System in 2001 showed that only 42.8% of obese persons who had a routine checkup in the past year had been advised by health care professionals to lose weight.<sup>10</sup> The analysis of this command's data showed that only 10.7% of the obese active duty staff members were actually diagnosed with obesity, and only 10.1% had been seen by a nutritionist for dietary counseling. Every health care encounter represents an opportunity to identify the need for and to provide brief weight-related intervention. Positive behavioral and lifestyle changes can be achieved through a brief 3- to 5-minute intervention that provides encouragement and guidance on physical activity, diet, and/or weight management during an office visit in a primary care setting.<sup>11</sup>

The recommendation from the NHLBI and the U.S. Preventive Services Task Force on Screening for Obesity in Adults<sup>12</sup> states that there is fair to good evidence that high-intensity counseling about diet, exercise, or both, together with behavioral interventions aimed at skill development, motivation, and support strategies, produces modest sustained weight loss (typically 3–5 kg for  $\geq 1$  year) in adults who are obese (BMI of  $\geq 30$  kg/m<sup>2</sup>). The average number of visits per patient who received counseling at our nutrition clinic was 1.5; therefore, according to these guidelines, most obese patients were inadequately treated to expect sustained weight loss.

The results of this initial analysis also highlighted the increased average cost of health care associated with obesity

in a MTF. An obese PFA participant's average cost was \$24.54 higher than the average cost of an outpatient visit made by a person with a normal BMI. Multiplied on a large scale across multiple MTFs, with the addition of line personnel, the cost of outpatient treatment for obese active duty personnel is substantial.

## CONCLUSIONS AND RECOMMENDATIONS

This study highlights significant limitations of the weight management program currently being used in the U.S. Navy. The Navy's present system based on BCA results does not accurately identify the population at risk for obesity and its attendant comorbid conditions, thus preventing effective, evidence-based intervention. Early identification would allow interruption of weight gain and associated poor performance on the PRT. The Navy's policy states that performance on the PFA is a leadership issue.<sup>13</sup> Pursuant to this guidance, directors, department heads, division officers, and leading chief petty officers must be given better information so that they can exercise leadership in promoting and enforcing a culture that provides opportunities and perhaps incentives for weight loss and increased physical activity. For individual military professionals, weight loss must be viewed as a career-choice element, especially because commanding officers now have the authority to administratively separate personnel who fail the BCA and/or PRT more than three times in a 4-year period. Navy medicine must play a significant role in assisting with this system-wide cultural change effort. Much greater attention must be paid to recognizing abnormal weight gain, diagnosing obese and overweight conditions, addressing weight loss and physical inactivity in the health care setting, and communicating the need for proven, evidence-based interventions to individuals' direct supervisors and leaders. The NHLBI Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults<sup>3</sup> can be used to guide the accurate early identification of the population at risk and to develop effective weight management programs. The tools used in this analysis (i.e., PRT, BCA, and PARFQ results in the PRIMs database) are available to all Navy commands, to facilitate a standardized approach to identifying at-risk personnel who are overweight and obese. The intensity of current treatment and maintenance program phases must be redesigned in light of current evidence, to have positive effects on sustained weight loss. Weight management programs currently in place at Navy commands can be tailored to align more closely with the NHLBI recommendations that advocate early identification and focus on a combined regimen of behavior, nutrition, and physical fitness counseling and activities. Moreover, emphasis must be placed on the establishment of goals and measures of success, so that the effectiveness of targeted interventions can be evaluated and disseminated across populations in the military. Weight loss measured as reduction of BMI is the primary outcome metric required to evaluate program effectiveness.

A Navy-wide, electronic, tracking system that provides a consistent approach to the treatment of overweight and obese personnel would benefit our program by allowing tracking of individuals across commands and throughout their careers, with viewing access for the service members as well as their supervisors. Navy medicine must train health care providers to regard BMI as an important vital sign and to proactively address weight issues, with timely referral to an effective weight management program.

Obesity is a reversible condition resulting from personal choices that are in opposition to existing Navy directives, which require individual service members to maintain weight and fitness standards. Early identification and effective intervention can break the cycle and stop the progression of weight gain. Without intervention, overweight active component members retire or are discharged to become obese beneficiaries, with the attendant comorbid conditions and health care costs related to obesity. Navy commands and Navy medicine must intervene effectively if the course of health and health care is to be changed; delay is unaffordable at all levels.

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