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# Characteristics of Active Duty Service Members Referred to the Navy's Weight-Management Program

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**ABSTRACT**

**Introduction:**

Rates of overweight and obesity have increased in the military, particularly in the U.S. Navy. While the Navy has implemented weight-management programs like ShipShape, findings on the effectiveness of these programs are mixed. Further knowledge on the characteristics of service members (SMs) who participate in these programs may help inform course curricula and improve outcomes. This study aimed to (1) examine characteristics of SMs referred to the Navy's ShipShape program at a large military treatment facility, (2) compare these characteristics among SMs who did and did not enroll in a randomized clinical trial of ShipShape (ShipShape study participants), and (3) compare demographic and health characteristics of ShipShape study participants to that of a random and similarly sized sample of Navy SMs who responded to the 2015 DoD Health-Related Behaviors Survey (HRBS).

**Materials and Methods:**

Data from active duty Navy SMs referred to the ShipShape program at a large military treatment facility were evaluated ($n = 225$). A subset of these SMs enrolled in the ShipShape study ($n = 187$). Among enrolled SMs, data from 147 who completed all measures were compared to that of HRBS respondents. Univariate ANOVA and chi-square analyses were used to examine (1) demographic and motivational differences between SMs who did and did not enroll in the ShipShape study and (2) differences in demographics and medical and mental health conditions between ShipShape study participants and Navy HRBS respondents.

**Results:**

The majority of SMs referred to ShipShape were female with an average age of 28.3 years. Compared to SMs who did not enroll in the ShipShape study ($n = 38$), ShipShape study participants were more likely to be female, less likely to be Hispanic, and had higher motivation and emotional eating scores. Compared to Navy HRBS respondents ($n = 164$), ShipShape study participants ($n = 147$) were younger, more likely to be female, non-Hispanic, enlisted, and obese. Further, ShipShape study participants reported significantly fewer medical health conditions but higher rates of probable depression, anxiety, and PTSD and were more likely to report receiving current mental health treatment than HRBS respondents.

**Conclusion:**

Overweight or obese SMs seeking weight loss in the ShipShape study were relatively young, female, non-Hispanic, motivated, but with greater emotional eating. ShipShape study participants endorsed few medical health conditions but had higher rates of probable mental health conditions compared to the HRBS sample. These findings suggest that SMs referred to Navy weight-management programs are likely experiencing comorbid mental health conditions which may interfere with the effectiveness of their weight loss efforts. The descriptive nature of this study and the focus on Navy SMs in only one ShipShape program may decrease the generalizability of our findings to participants at other locations. Nonetheless, these findings demonstrate the potential need for Navy weight-management programs that incorporate mental health treatment and address the specific needs of female and diverse SMs. A more comprehensive curriculum could improve the results of weight-management efforts, increase SM quality of life and fitness and thereby operational readiness.

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## INTRODUCTION

Between 2002 and 2015, the rate of obesity among U.S. active duty military service members (SMs) increased by 68% such that now nearly two-thirds of U.S. active duty SMs across all branches meet criteria for overweight or obesity.[1,2] Navy SMs have the third highest rate of overweight and obesity among all service branches (64.6%), with 48.9% overweight and 15.7% obese.[1] Overweight and obesity cause significant impairments in functioning, as well as increased morbidity and mortality due to associated diseases such as cardiovascular disease, hypertension, and diabetes.[3] Obesity among SMs and veterans has been associated with medical and mental health consequences including hypertension, diabetes, sleep apnea, coronary heart disease, increased life stressors, depression, PTSD, and lower levels of mental and physical functioning.[4] Additionally, obese SMs are more frequently diagnosed with hypertension, hyperlipidemia, and mental health conditions than those who are not obese.[4,5] These associated medical comorbidities lead to high healthcare utilization and costs.[6]

The increased incidence of overweight and obesity among Navy SMs and associated consequences present a challenge to the mission of the DoD, which is to promote a fit and healthy force. Each year approximately 1,200 enlistees are discharged from military service due to weight problems, costing over $60 million annually to recruit and train replacements.[6] Medical costs to the DoD associated with overweight and obesity are estimated to exceed 1 billion dollars annually.[6] In response to the rising prevalence and costs of overweight and obesity, and decreased Physical Readiness Test performance among obese SMs,[7] the DoD has taken branch-specific steps to provide physical fitness standards and weight-management programs.

Research demonstrating the efficacy of military weight-management programs has mixed findings. A systematic review examined dietary, physical activity, and weight-management interventions for active duty military personnel and concluded there is good evidence that military weight-management interventions effectively improve body composition for up to 12 months.[8] However, a narrative report examining eight interventions for overweight and obese military populations from 2006 to 2016 found that the majority of programs did not report significant weight loss at 6 months post-intervention.[9] Another systematic review of weight loss interventions targeting active duty SMs found insufficient evidence to determine if current interventions are effective.[10] There is even less evidence these programs result in improved long-term fitness.[8] For example, Wisbach et al. examined the effectiveness of two Navy weight-management programs, Fitness Enhancement Program (FEP) and ShipShape, finding that the majority of participants in both programs were likely to pass the next Physical Fitness Assessment (PFA)—a biannual assessment of body composition and physical performance. However, only 47% of those in FEP passed the next three PFA cycles, and no information was available regarding the effects of ShipShape on subsequent PFA results.[11]

Few studies have focused on weight management in active duty personnel, and there is still an urgent need for rigorously evaluated programs in the military.[7,8,10] Further, U.S. military personnel have unique and complicated health needs due to exposures and environmental conditions during their service.[12] Military-relevant research is critical to provide empirically supported interventions to address the healthcare needs of military personnel, yet it is difficult to conduct due to high rates of participant attrition and recruitment difficulties.[13] To our knowledge, only one study has compared the characteristics of screened and enrolled participants in a randomized control trial of a weight loss program in the U.S. military and did not examine medical and mental health information.[14] Thus, little is known about the characteristics of SMs who participate in weight-management programs so that course curricula could be designed for their specific needs. Having a greater understanding of the correlates of obesity in the military may guide the development of specific prevention and treatment interventions designed to improve weight management,[15] increase the efficacy of these programs, and improve mission readiness.

The Navy has taken branch-specific steps to provide physical fitness standards and weight-management programs. The Navy and Marine Corps Public Health Center and the Navy Bureau of Medicine and Surgery implemented the ShipShape program, an eight-session program promoting weight-management through nutritional, behavioral, and exercise education, with roots in the extant evidence base for weight management.[16] The existence of the Navy's ShipShape program provides an opportunity to learn more about the characteristics of ShipShape participants to inform weight-management strategies to improve SM health and readiness. Thus, the aims of the current study were to (1) examine characteristics of SMs referred to the Navy's ShipShape program at a large military treatment facility; (2) compare these characteristics among SMs who did and did not enroll in a randomized clinical trial of ShipShape (ShipShape study participants); and (3) compare demographic and health characteristics of ShipShape study participants to that of a random and similarly sized sample of Navy SMs who responded to the 2015 DoD Health-Related Behaviors Survey (HRBS), a population-level database of SMs from all military branches, roughly representative of the general military population.[1]

## METHODS

### *Participants and Procedures*

Navy SMs from various commands within Naval Medical Forces Pacific who were overweight or obese, or were failing, or at risk of failing their PFA were referred to the ShipShape program at a large military treatment facility in Southern California. SMs were self-referred, command-referred, or medically referred. Between December 2017 and January

2020, referred SMs were given the option to participate in a pragmatic randomized clinical trial comparing the traditional ShipShape program to ShipShape enhanced by acceptance and commitment therapy (ACT) principles.[17] ACT is a transdiagnostic cognitive behavioral approach that has been found effective in increasing physical activity[18] and improving weight management in overweight and obese adults.[19]

SMs were required to be between 18 and 69 years old, free of physical limitations that would prevent participation in physical fitness activities, and not pregnant or planning to become pregnant in the next 6 months. Referred SMs had a consultation with the ShipShape Coordinator, completed a brief set of screening questions, and those who were eligible and interested in the study underwent consenting for the randomized clinical trial. Those who consented and enrolled in the study completed a battery of questionnaires and were measured for height, weight, and body fat composition immediately prior to the first intervention session. All study procedures were approved by the Institutional Review Boards of VA San Diego Healthcare System, Navy Medicine Readiness and Training Command, San Diego, and the Research and Development Committee of VA San Diego Healthcare System. Study participants provided informed consent and HIPAA authorization.

## Measures

### ShipShape screening

All SMs referred to the ShipShape program, regardless of study participation, self-reported basic demographic information (age, sex, race/ethnicity, and referral source) and completed the Weight Loss Readiness Test-II (WLRT-II), a 27-item questionnaire assessing six domains related to weight loss: motivation, confidence, hunger and eating cues, binge eating and purging, and emotional eating.[20] Following informed consent, research study participants self-reported additional demographic, medical, and mental health information.

### ShipShape baseline

Height and weight measurements for ShipShape study participants were obtained by a Navy-trained health professional and were used to calculate body mass index (BMI). ShipShape study participants completed a battery of questionnaires including standardized and validated screening measures for depression, anxiety, and PTSD symptoms. The Patient Health Questionnaire 4-item (PHQ-4)[21] scale was used to screen for probable depression and anxiety. The PHQ-4 is a brief and valid tool consisting of a two-item depression (PHQ-2)[22] scale and a Generalized Anxiety Disorder 2-item (GAD-2) scale.[23] Participants scoring 3 or greater on the PHQ-2 were classified as positive for probable depression.[22] Those scoring 3 or more on the GAD-2 were classified as positive for probable anxiety.[23] The Primary Care PTSD Screen (PC-PTSD)[24] was used to screen for PTSD symptoms. The PC-PTSD is a four-item screen designed for use in primary care and other medical settings. This screener includes an introductory sentence to cue respondents to traumatic events but does not include a list of potentially traumatic events. Endorsement of 3 or more items was classified as positive for probable PTSD.[24]

### HRBS measures

Complete details of the 2015 HRBS can be found elsewhere.[1] The following subset of measures from the 2015 HRBS survey were used for the present study. HRBS respondents self-reported demographics (age, gender, race/ethnicity, marital status, pay grade, and living situation), medical conditions, and height and weight which were used to calculate BMI. They also completed standardized and validated screening measures for depression, anxiety, and PTSD symptoms including PHQ-9,[25] GAD-7,[26] and Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C).[27] The first two items of the PHQ-9 and GAD-7 were summed to create the PHQ-2 and GAD-2, respectively. Participants scoring 3 or greater on the PHQ-2 were classified as positive for probable depression.[22] Those scoring 3 or more on the GAD-2 were classified as positive for probable anxiety.[23] Scores of 50 or more on the PCL-C were classified as positive for probable PTSD, which is a commonly used cutoff for military surveillance studies.[28]

## Statistical Analyses

Descriptive statistics were computed to characterize the samples. Data distributions were examined, and univariate ANOVA (for continuous outcomes) and chi-square tests (for categorical outcomes) were used to compare the demographic and other characteristics of those referred to ShipShape to those who enrolled in the study, and examine differences in demographics and health conditions between those who enrolled in the study and HRBS respondents. Navy HRBS respondents were randomly selected to be compared with ShipShape study participants using the SPSS random selection function. Approximately 3% of all cases from the HRBS Navy group were selected. All records with valid data for the key outcomes of interest were included in this random selection. The format of some of the data points from ShipShape participants and HRBS respondents was not consistent and was recoded and converted to a compatible format (i.e., demographic variables; age, age categories, and rank). All statistical tests were two-tailed. Significance level was set at $P \leq .05$. Data analysis was performed in SPSS version 27.

# RESULTS

A total of 225 referred SMs were screened for the ShipShape program. Screened SMs were primarily referred by their Command Fitness Leaders ($n = 115$; 51%), medical providers ($n = 28$; 12.4%), FEP ($n = 15$; 6.7%), or self-referred ($n = 52$; 23%). Screened SMs were 28.3 years old

**TABLE I.** Characteristics of ShipShape Program Participants Who Were Screened and Those Who Were Enrolled and Not Enrolled in the ShipShape Study

| | All screened $n = 225$ | Enrolled $n = 187$ | Not enrolled $n = 38$ | *P* value |
|---|---|---|---|---|
| Age, *M* (SD) | 28.31 (6.7) | 28.25 (6.6) | 28.71 (7.5) | .734 |
| Female, *n* (%) | 131 (58.2) | 118 (63.1) | 13 (34.2) | <.001 |
| Race & ethnicity, *n* (%)[a] | | | | |
| Hispanic | 65 (29.1) | 53 (28.3) | 12 (33.3) | .004 |
| American Indian | 9 (4.0) | 9 (4.8) | 0 | .183 |
| Asian | 19 (8.4) | 14 (7.5) | 5 (13.2) | .199 |
| Black | 60 (26.7) | 52 (27.8) | 8 (21.1) | .391 |
| Pacific Islander | 7 (3.1) | 7 (3.7) | 0 | .269 |
| White | 119 (53.1) | 103 (55.4) | 16 (42.1) | .135 |
| Weight Loss Readiness Test-II, *M* (SD) | | | | |
| Motivation | 16.01 (3.38) | 16.23 (3.20) | 14.92 (4.04) | .029 |
| Expectations | 12.18 (2.94) | 12.19 (2.81) | 12.14 (3.55) | .929 |
| Confidence | 22.53 (4.92) | 22.61 (4.93) | 22.18 (4.91) | .624 |
| Hunger and eating cues | 5.45 (1.77) | 5.55 (1.73) | 4.98 (1.90) | .067 |
| Binge eating and purging[b] | 1.73 (1.66) | 1.76 (1.74) | 1.49 (0.88) | .537 |
| Emotional eating | 5.07 (2.96) | 5.34 (2.99) | 3.72 (2.41) | .002 |

Abbreviations: *M* = mean; SD = standard deviation; WLRT-II = Weight Loss Readiness Test-II.
[a]Participants were able to select multiple options;
[b]$n = 149$ for all screened due to skip-out on WLRT-II.

on average (SD = 6.7), and the majority (58%) were female. Overall, 29% of screened SMs identified as Hispanic, 26.7% African American, 53% White, 8.4% Asian, 4% American Indian, and 3% Pacific Islander. Average scores on WLRT-II categories indicated that screened SMs were motivated to begin a weight loss program (motivation), had an appropriate level of weight loss expectations (expectations), and were moderately confident in their weight loss efforts (confidence). WLRT-II average scores also indicated that screened SMs had a moderate tendency to eat just because food was available (hunger and eating cues) and did not have problems with binge eating (binge eating and purging) or emotional eating (emotional eating).

Table I presents the demographic and WLRT-II characteristics of all screened SMs, as well as comparisons between those who were enrolled in the ShipShape study ($n = 187$) and those who were not interested or eligible to enroll ($n = 38$). SMs who enrolled in the ShipShape study were more likely to be female ($X^2(1, n = 225) = 10.838$, $P = .001$) and less likely to be Hispanic ($X^2(2, n = 225) = 10.282$, $P = .006$). Additionally, those who enrolled in the study had significantly higher WLRT-II motivation ($F(1,223) = 4.842$, $P = .029$) and emotional eating scores ($F(1,223) = 9.875$, $P = .002$) than those who did not enroll.

Of the 187 SMs who enrolled in the ShipShape study, 40 Navy SMs had missing data on the key outcomes of interest and were excluded from analyses for comparison with the HRBS sample. There were no significant demographic or WLRT-II differences between those with and without complete data. Table II presents the demographic characteristics of ShipShape study participants ($n = 147$) compared to that of the random HRBS sample of Navy SMs ($n = 164$). ShipShape study participants were younger ($X^2(3, n = 300) = 37.401$, $P = .000$) and more likely to be female ($X^2(2, n = 311) = 8.656$, $P = .013$) than the HRBS sample. Given how race and ethnicity were categorized in the HRBS data, only the Hispanic versus Non-Hispanic categories could be compared between the ShipShape and the HRBS samples, showing that ShipShape study participants were less likely to identify as Hispanic ($X^2(1, n = 310) = 12.747$, $P = .000$). Furthermore, ShipShape study participants were more likely to be enlisted than HRBS respondents, with the majority of ShipShape study participants ranked E-1 through E-9 ($X^2(1, n = 311) = 75.211$, $P = .000$) and a minority reported living on base ($X^2(2, n = 311) = 31.431$, $P = .000$). As expected, there was a statistically significant difference between the ShipShape study and HRBS samples on BMI ($X^2(3, n = 308) = 136.210$, $P = .000$), with ShipShape study participants significantly more likely to be in the obese category (79.3%) compared to HRBS respondents (14.1%).

ShipShape study participants reported significantly lower rates of chronic medical conditions including high cholesterol ($X^2(1, n = 309) = 14.571$, $P = .000$) and heart disease ($X^2(1, n = 309) = 6.332$, $P = .012$) compared to the HRBS sample (Fig. 1). Although rates of diabetes ($X^2(1, n = 309) = 1.769$, $P = .184$), hypertension ($X^2(1, n = 308) = 0.770$, $P = .380$), and arthritis ($X^2(1, n = 309) = 3.023$, $P = .082$) were consistently lower among ShipShape study participants compared to the HRBS sample, the differences were not statistically significant. Nearly half of the HRBS sample reported having at

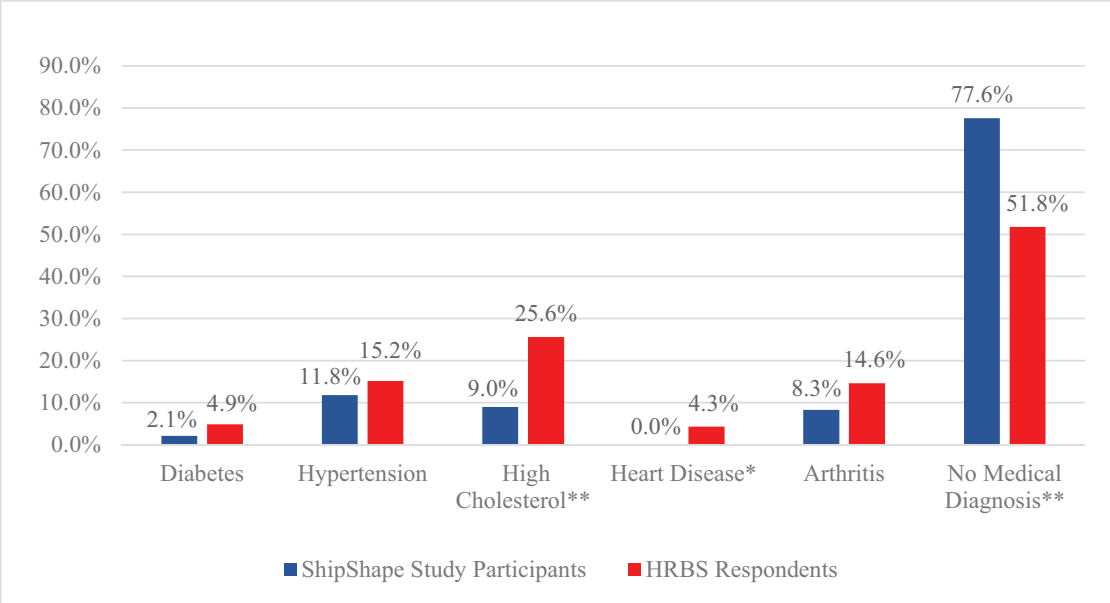


**FIGURE 1.** Percentage of self-reported medical diagnoses among ShipShape study participants and Health-Related Behaviors Survey (HRBS) respondents. Notes. *$P < .012$; **$P < .001$.

**TABLE II.** Demographic Characteristics of ShipShape Study Participants and a Random Sample of Navy Health Related Behaviors Survey (HRBS) Respondents

| | ShipShape study participants (%) $n = 147$ | HRBS respondents (%) $n = 164$[a] | $P$ value |
|---|---|---|---|
| Age (years) | | | <.001 |
| ≤24 | 28.7 | 13.4 | |
| 25-34 | 51.5 | 34.8 | |
| 35-44 | 16.9 | 32.3 | |
| ≥45 | 2.9 | 19.5 | |
| Female | 63.3 | 48.2 | .013 |
| Race/ethnicity | | | [b] |
| White | 37.5 | 63.4 | |
| Hispanic | 27.1 | 36.6 | |
| Married | 70.7 | 67.7 | .559 |
| Pay grade | | | <.001 |
| E1-E9 | 93.9 | 48.8 | |
| W1-O10 | 6.1 | 51.2 | |
| Housing | | | <.001 |
| On base | 6.1 | 10.4 | |
| Off base | 72.1 | 87.8 | |
| BMI (kg/m$^2$) | | | <.001 |
| 18.5-24.9 | 2.8 | 33.1 | |
| 25-29.9 | 17.9 | 52.1 | |
| ≥30 | 79.3 | 14.1 | |

Abbreviations: BMI = body mass index; HRBS = Health-Related Behaviors Survey; E = enlisted; O = officer; W = warrant officer.
[a]Random sample from larger dataset;
[b]unable to calculate due to differences in reporting.

least one of the medical conditions, but only 22.5% of ShipShape study participants reported having at least one of these conditions ($X^2(1, n = 311) = 22.256$, $P = .000$).

A significantly greater proportion of ShipShape study participants screened positive for probable depression (PHQ-2; $X^2(1, n = 311) = 47.245$, $P = .000$), anxiety (GAD-2; $X^2(1, n = 311) = 59.985$, $P = .000$), and PTSD (ShipShape = PC-PTSD; HRBS = PCL-5; $X^2(1, n = 311) = 42.466$, $P = .000$) (Fig. 2). Compared to HRBS respondents, ShipShape study participants were significantly more likely to screen positive for all three mental health conditions than for no mental health conditions ($X^2(1, n = 234) = 53.897$, $P = .000$). HRBS respondents were significantly more likely than ShipShape study participants to screen positive for no mental health screens ($X^2(1, n = 311) = 65.954$, $P = .000$). While 42.2% of ShipShape study participants reported receiving current mental health treatment, only 15.8% of HRBS respondents reported receiving current mental health treatment ($X^2(1, n = 311) = 26.474$, $P = .000$).

Finally, 15 ShipShape study participants (16.5% of female participants; 10.2% of the sample) were women who reported having given birth in the previous 2 years. In order to examine whether the study findings were driven by post-pregnancy weight, sensitivity analyses were conducted excluding these 15 participants. The differences between the ShipShape study sample and the random HRBS sample remained essentially the same other than the difference in the proportion of women in each sample was no longer significant ($P = .062$).

## DISCUSSION

Findings on the efficacy of military weight-management and physical fitness programs are mixed, and little is known about the characteristics of SMs who are referred to these programs, resulting in a lack of knowledge and understanding for how to

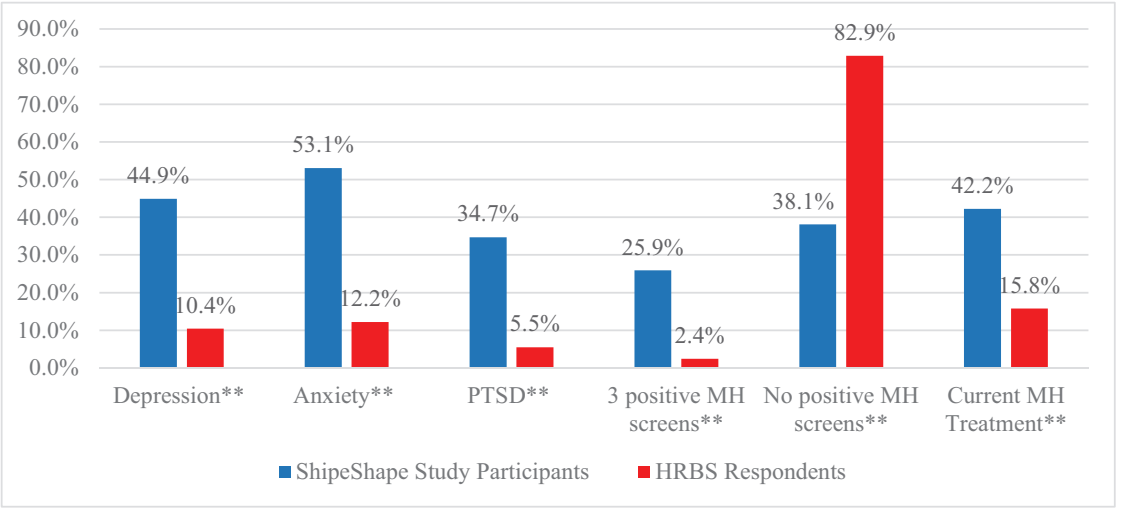


**FIGURE 2.** Percentage of positive screens for mental health (MH) conditions and receipt of MH treatment among ShipShape study participants and Health-Related Behaviors Survey (HRBS) respondents. Notes. Depression = PHQ-2 score >3 for both samples; anxiety = GAD-2 >3 for both samples; PTSD = PC-PTSD >3 for ShipShape sample, and PCL-C >50 for HRBS sample. $^{**}P < .001$.

build more effective interventions. In this study, we examined the characteristics of SMs referred to the Navy's ShipShape program at a large military treatment facility. Further, we compared the demographic and health characteristics of the Navy SMs who enrolled in the ShipShape randomized clinical trial to a random and similarly sized sample of Navy SMs who responded to the 2015 HRBS.

Our findings that SMs referred to ShipShape were relatively young and female add to the very limited literature on the characteristics of SMs referred to Navy weight-management programs. A total of 15 enrolled female SMs reported they had given birth in the prior 2 years, suggesting they may be seeking post-partum weight loss. However, results remained essentially the same after removing these participants from analyses, suggesting that differences between the ShipShape study participants and the HRBS sample were not due to post-partum women. Our finding that ShipShape study participants were more likely to be female is consistent with previous research that found obese women were more likely than obese men to participate in weight loss treatment,[29] and female SMs were over-represented in weight loss studies of active duty SMs.[10] While results may suggest a greater level of weight stigma for women, little research on this topic has been conducted among active duty SMs, and the limited research has not found significant sex differences in levels of weight stigma.[30] Finally, the lower participation of male SMs could be due to males more often than females reporting the use of their own weight loss regimens.[29] Future research is needed to examine differences in weight stigma between male and female SMs, as well as other factors that may explain the over-representation of female and under-representation of male SMs in weight loss interventions.

We found that those who enrolled in the ShipShape study (and provided complete data) were generally representative of SMs referred to the ShipShape program, with the exception of increased emotional eating, which might explain their increased motivation to participate in the study. The lower proportion of Hispanic individuals enrolling in the study could be related to a reluctance to participate in research or a failure to effectively recruit SMs identifying as Hispanic.[31] Given that little is known about sex and ethnicity differences in SMs referred to ShipShape or other military weight-management programs, future research should examine potential differential efficacy of these programs for women and ethnically diverse SMs.

Despite increased rates of obesity, we found that ShipShape study participants, compared to HRBS respondents, had lower rates of self-reported medical conditions with significantly lower rates of high cholesterol and heart disease, which are known to be associated with obesity.[32] The rate of high cholesterol among ShipShape participants was similar to that found in the 2015-2018 National Health and Nutrition Examination Survey report, where the prevalence of high cholesterol among U.S. adults was 11.4%, with no significant difference between men and women, and was highest among adults ages 40-59 (15.7%).[33] Similarly, the 2015 HRBS study found that high cholesterol was positively correlated with age.[1] Thus, the significantly older age of HRBS respondents may, in part, explain this group's significantly higher rate of high cholesterol compared to that of ShipShape study participants. Our findings on heart disease also are in line with that of the CDC report,[34] which found the overall rate of coronary heart disease (CHD) in the USA was 6.0% and that prevalence increased with age, with 1.2% of those 18-44 years old and 7.1% of those 45-64 years old reporting a diagnosis of

CHD. The CDC also reported a greater prevalence among men (7.8%) than women (4.6%), which is consistent with the sex and age differences found between the ShipShape and HRBS samples.

Unlike medical conditions, we found that ShipShape study participants had significantly higher rates of positive screens for probable depression, anxiety, and PTSD than the HRBS sample. Several factors may contribute to the elevated positive mental health screens in ShipShape study participants. As expected, nearly 80% of ShipShape study participants were classified as obese, which is known to be associated with increased risk of depression and PTSD[4] in general, as well as among active duty SMs and veterans. Additionally, weight-related mental health concerns have been found to vary by sex, with female SMs with obesity nearly twice as likely as normal-weight female SMs to have depressive symptoms[4] as well as increased symptoms of serious psychological distress and PTSD.[35] A recent prospective cohort study of SMs also found that female SMs had higher rates of depression, anxiety, and PTSD.[36] Further, SMs were referred to the ShipShape program if they failed or were at risk of failing their physical readiness or body composition tests, which has previously been shown to be associated with significantly higher odds of scores consistent with mild depression in Army SMs.[37] The increased rate of multiple positive mental health screens among ShipShape study participants is consistent with the research on co-occurrence of depression, anxiety, and PTSD in SMs.[36,38] Thus, the increased reports of current mental health treatment in ShipShape participants are not surprising in light of the increased rate and multiplicity of positive mental health screens.

Together, our findings suggest that more research is needed to examine demographic and health factors that might predispose, support, and maintain weight problems among SMs.[39] A better understanding of these characteristics can facilitate building military weight-management and physical fitness programs that address the specific needs of SMs. For example, special attention can be paid to assist female SMs who might be struggling with post-partum weight loss or address the needs of diverse SMs from a culturally appropriate perspective. Weight-management programs, especially for younger SMs, may need to focus on the link between overweight and obesity with emotional eating and mental health conditions as opposed to the seemingly remote risks of cardiovascular and other health conditions. Our findings also suggest that SMs who are referred for Navy weight-management programs are likely experiencing comorbid mental health conditions which may interfere with the effectiveness of their weight loss efforts. Thus, additional trials are necessary to evaluate the benefits of weight loss programs that integrate weight-management, emotional eating, and mental health treatments.

This study has several limitations. First, our findings are based on cross-sectional data and are primarily descriptive. Future studies with prospective data and multivariate analyses are needed to extend our findings. Second, although SMs who were enrolled in the ShipShape study were generally similar to those who were screened but declined to participate in the study, our sample may not be representative of the general ShipShape population at this medical treatment facility, or elsewhere. Third, although the HRBS sampling and analytic strategy was meant to create a representative sample of each military branch for the survey, it is possible that the 2015 HRBS sample may not be representative of the current Navy population. Finally, matching the two samples on age, sex, BMI, and other key demographic characteristics was not feasible, and the comparison between data from ShipShape study participants and that of the HRBS sample was conducted post-hoc. This prevented a comprehensive comparison and required the use of results from different measures of PTSD symptoms. Nonetheless, both PTSD symptom measures and their relevant cutoffs have been validated and can be used in military settings.[40]

## CONCLUSIONS

This study identified demographic and motivational characteristics of SMs referred to, and enrolled in, the Navy's ShipShape program at a large military treatment facility and found differences between ShipShape study participants and a random sample of Navy HRBS respondents representing the general U.S. active duty Navy population. Overweight or obese SMs seeking weight loss and physical fitness from the ShipShape program were relatively young, female, non-Hispanic, and motivated, yet those who enrolled in the randomized trial endorsed greater emotional eating. ShipShape study participants endorsed significantly fewer medical health conditions, but higher rates of probable mental health conditions compared to the HRBS sample. These findings add to the very limited research on the characteristics of SMs referred to and enrolled in the ShipShape program at large military treatment facilities, and speak to the need to design and evaluate military programs that more comprehensively address weight-management, emotional eating, and mental health concerns. Further, a more comprehensive and/or tailored curriculum better suited to the needs of female and diverse SMs could lead to more effective weight-management efforts, increase SM quality of life and fitness, and thereby operational readiness.

## FUNDING

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## CONFLICT OF INTEREST STATEMENT

None of the authors have any conflicts of interest to declare.

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