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EVALUATION OF THE NAVY'S OBESITY TREATMENT PROGRAM

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EXECUTIVE SUMMARY

Problem

Considerable evidence has established obesity as an independent risk factor for the development of a number of chronic diseases, yet the prevalence of obesity in the United States has increased during the last two decades. Approximately 10% of Navy personnel are either overfat or obese, which, in addition to posing health risks, carries serious career consequences for the overweight sailor. The Navy has developed a three-tiered obesity treatment program to assist overweight members in meeting the designated body composition standards, but the efficacy of this program is unknown.

Objective

The purpose of this study was to provide an evaluation of the effectiveness of the Navy's obesity treatment program at all three levels: Level I (command-directed remedial conditioning program), Level II (weight-management counseling provided by a Counseling and Assistance Center), and Level III (residential obesity treatment at an Alcohol Rehabilitation Center).

Approach

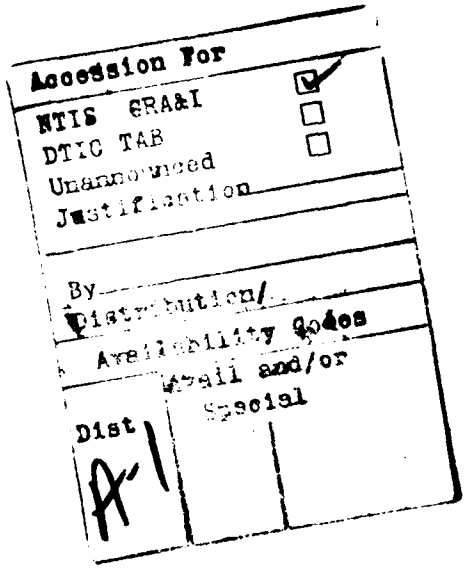
A total of 624 program enrollees agreed to participate in the evaluation (n = 358 in Level I, n = 51 in Level II, n = 215 in Level III). Program supervisors obtained height, weight, and body circumference measurements from study participants in accordance with Navy regulations. Measurements were taken at four points in time: at the beginning of the program (baseline), then at 6 weeks, 6 months, and 12 months after the start of the program. Data were adjusted to compensate for missing measurements from individuals discharged from naval service before the end of 12 months due to obesity.

Results

There was a significant reduction in percent body fat in all three treatment tiers at the end of 1 year. Measurements across the four time periods demonstrated a sustained downward trend through the 6-month data point, then a plateau between 6 months and 12 months. Most program enrollees succeeded in reducing their body fat during the treatment program, and the majority either maintained or increased their fat loss over the remainder of the year. The number of program participants falling within the Navy's body fat standards improved from 1% to 27% by the end of the year, and the percentage of personnel classified as obese dropped from 63% to 41%. Absolute losses (mean percent body fat) were small, however: -3.6% fat for men, -4.5% fat for women after 12 months. Although only 4.6% of the sample were discharged from the Navy for obesity during the year-long evaluation, many of those who were discharged for other reasons were obese at the time of their separation. Level III was the most effective of the three programs, even after differences in enrollees' initial percent body fat were taken into account.

Conclusions

Although program participants generally succeeded in losing body fat, the average losses were insufficient to meet the Navy's within-standards criteria. Two factors might be considered: First, mean body fat reduction during the first 6 weeks—which coincided with the end of treatment in Levels II and III—occurred at close to the recommended rate of 1% every 2 weeks. An aggressive and supportive aftercare program might enable overweight members to continue reducing at that rate until reaching standards. Second, Level III was the most effective tier for helping obese participants lose body fat; Level I was the least effective. Program coordinators at Level I might try incorporating some of the diverse treatment techniques employed in the Level III curricula to enhance the fat-reduction effectiveness of command remedial conditioning programs.



Evaluation of the Navy's Obesity Treatment Program

Linda K. Trent and Linda T. Stevens

Introduction

Considerable evidence has established obesity as an independent risk factor for the development of a number of chronic diseases, including atherosclerosis, premature myocardial infarction, gallbladder disease, hypertension, diabetes mellitus, cholecystitis, gout, elevated serum cholesterol, and certain cancers (Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990; Kissebah, Freedman, & Peiris, 1989; National Research Council, 1989). Yet the prevalence of obesity in the United States has increased during the last two decades, posing an important public health problem with associated economic, organizational, and social consequences (Atkinson, 1992; Colditz, 1992). More than one in four American adults is classified as overweight or obese (Kuczmarski, 1992). Faced with both health concerns and social stigma, most obese individuals have attempted to lose weight, often several times, but regaining weight is common (Bennett, 1986; Foreyt, 1987; Jeffery, 1987).

Recent interest in maintenance of weight following weight loss has prompted a number of studies that include post-weight-loss follow-up measures (Adams, Grady, Wolk, & Mukaida, 1986; Fatis, Weiner, Hawkins, & Dorsten, 1989; Fitzwater et al., 1991; Lavery et al., 1989; Westover & Lanyon, 1990; Wood, 1990). Results of these studies are inconsistent and largely incomparable, however, due to differing sample demographics, treatment strategies, follow-up time periods, criteria for success, and evaluation methods. In one of the more encouraging reports, patients who had lost weight in a hospital outpatient nutrition clinic were contacted by telephone 1 year later, and 74% of those reached said that they had either maintained or lost additional weight during the year post-treatment (Wood, 1990). However, self-reported body weight is subject to bias and is not considered sufficiently accurate for assessing weight-loss maintenance unless adjusted to compensate for the probable discrepancy (Brownell, 1982; Tell, Jeffery, Kramer, & Snell, 1987).

Other reports indicate a wide range of weight-loss maintenance success at follow-up. One study found that 60% of the participants in several group weight-loss programs had either maintained their weight loss or continued to lose weight 1 year after treatment (Adams, Grady, Wolk, & Mukaida, 1986); another reported that 53% of the obese patients studied had either maintained or enhanced their weight loss an average of 25 months post-treatment (Fitzwater et al., 1991). On the other hand, only 37% of the subjects that Lavery et al. (1989) contacted after 2 years had either maintained or increased their end-of-treatment weight loss, while Fatis and his colleagues (Fatis, Weiner, Hawkins, & Dorsten, 1989) reported that just 28% of their participants remained within 5 pounds of their initial weight loss after 20 months.

Westover and Lanyon (1990) recently reviewed 22 studies of behavioral interventions for obesity. Of the six studies that included a 12-month follow-up component, only two found a

mean weight loss at follow-up that was equal to or greater than the mean weight lost during treatment; results from the remaining four studies exhibited a rebound in weight following treatment, though weight remained below baseline measures.

Navy Obesity Treatment Program

Weight management is particularly salient to members of the armed services. All of the services employ weight or body composition standards to screen members into military service as well as to determine their fitness for continued duty (Marriott & Grumstrup-Scott, 1992). Health, performance, and appearance are the criteria on which these standards are based. But body weight reflects a person's bone, muscle mass, and water composition as well as body fat, and as such it is not a true measure of obesity (i.e., excess body fat). Body mass indices, which are based on a person's height as well as weight, are commonly used instead, but while they facilitate cross-study comparisons, body mass indices have not proven to be good estimates of obesity (Smalley, Knerr, Kendrick, Colliver, & Owen, 1990). In the U.S. Navy, percent body fat was established as the basis for weight-control decisions, replacing standard height/weight tables (Hodgdon & Beckett, 1984a, 1984b).

Although it is the goal of the Chief of Naval Operations that all Navy members meet the body composition standards, nearly 10% of Navy personnel are either overfat or obese, according to the following criteria (Conway, Trent, & Conway, 1989):

Navy's Percent Body Fat Cutpoints

	Acceptable	*Overfat*	*Obese*
Men	*22% or less*	*23% - 25%*	*26% and higher*
Women	*30% or less*	*31% - 35%*	*36% and higher*

Personnel who exceed these standards are subject to specific administrative actions, ranging from ineligibility for promotion to separation from naval service (Department of the Navy, 1990). In April 1993, the criteria were made more stringent by eliminating the distinction between "overfat" and "obese" for administrative actions (Chief of Naval Operations, 1993); for the purposes of this report, however, the distinction will be retained. Also for this report, the term "overweight" is used broadly to refer to excess body fat (overfat or obese), rather than weight per se. Given both the importance of maintaining a fit and healthy fighting force and the serious career consequences for failing to meet body composition standards, the Navy has developed a three-tiered remedial obesity treatment program to assist overweight members in meeting the designated standards (see Trent & Stevens, 1993).

Level I (Command). Level I is the basic command-directed remedial conditioning program, supervised by a command-appointed Command Fitness Coordinator (CFC) who is certified in cardiopulmonary resuscitation (CPR) and trained to perform anthropometric measurements. The program consists primarily of supervised group exercise sessions, although some programs

include nutrition education, behavior modification techniques, and other related educational elements. Sessions are conducted 3-4 times per week on average and last 45-60 minutes per session. The program usually continues for about 6 months. Attendance is mandatory for anyone exceeding the body fat standards, as well as for individuals who fail any portion of the Navy's biannual physical fitness test (1.5-mile run, sit-ups, and push-ups). Overweight members constitute about two thirds of Level I enrollment (Trent & Stevens, 1993).

Level II (CAAC). Individuals who have been identified as overfat or obese and who have been unable to meet the required body fat standards within the Level I program may be recommended by a medical officer to participate in a more intensive Level II counseling program. Level II provides approximately 80 hours of weight-management counseling and education on an outpatient basis and is offered under auspices of a Navy Counseling and Assistance Center (CAAC). Participants are generally issued TAD orders ("temporary additional duty") to attend the sessions, which are conducted over a period of 2 to 6 weeks, depending on the CAAC.

Level III (ARC). Members who are medically diagnosed as obese and who meet time-in-service and career-level criteria may be referred to a Level III residential obesity rehabilitation program. Level III programs entail 6 weeks of inpatient therapy with trained counselors and medical supervision. They are conducted in the Navy's Alcohol Rehabilitation Centers (ARCs) and generally follow a 12-step treatment protocol based on Overeaters Anonymous.

Although program guidelines (in the form of Navy Instructions) are available, treatment protocols are not standardized across similar Navy agencies or programs. Neither are there program-wide, standardized reporting systems or follow-up procedures for tracking caseloads or evaluating program effectiveness. The purpose of this study, therefore, is to provide an overall evaluation of the effectiveness of the Navy's obesity treatment program at all three levels.

Method

Sample

Because of wide variation in program start dates, enrollment, and running length, the obesity treatment programs at all Level III ARCs ($N = 4$), all Level II CAACs ($N = 87$), and a random sample of 925 Level I Navy commands were surveyed to determine which programs would be operative and able to participate during the data collection time frame. After processing results from this initial survey, a sampling pool of four ARCs, nine CAACs, and 20 individual commands was selected for the evaluation. Program directors and CFCs were contacted and asked to enlist their weight-loss program enrollees in the evaluation. Enrollees were eligible for the study if they were active-duty Navy personnel who exceeded the body fat standards. Participation in the evaluation was voluntary.

Data Collection

Program supervisors were instructed to obtain height, weight, and body circumference measurements in accordance with Navy regulations (Department of the Navy, 1990). Per these

regulations, participants wear standard gym gear (shorts and shirt); height and weight are taken without shoes; girth measurements require a nonelastic tape measure applied to specified body landmarks on bare skin or over very light clothing. For men, girth measurements are taken around the neck, just below the larynx, and around the abdomen at the navel. For women, the the sites are the neck, the natural waist (minimum abdominal circumference, located about halfway between the navel and the lower end of the sternum), and the hip, taken at the greatest protrusion of the gluteal muscles. To ensure accuracy, each measurement was taken twice, and the average of the two was recorded. Percent body fat was computed using equations developed by Hodgdon and Beckett (1984, 1984a).

Body fat measurements were obtained at four points in time: at entry into the remedial program (baseline), 6 weeks after the start of the program, 6 months after the start of the program, and 1 year after the start of the program. Computerized Navy personnel tapes were used to obtain current Navy addresses for the participants at each data point. Follow-up letters and measurements forms were then mailed to the individual's current command with the request that they be completed by the CFC "on or about" the date specified and returned to the Naval Health Research Center, San Diego, California. Courtesy reminders were mailed to nonrespondents.

Obesity Discharges

Participants who were discharged from the Navy for obesity must be considered program failures, yet they were poorly represented at 1 year (some individuals were able to provide 12-month data prior to their discharge, but most had left the Navy before the final mailout). To reduce bias favoring program "successes," the last body fat measurement obtained after the baseline measurement for a given individual was substituted for the missing 12-month data for all obesity discharges. In the same manner, the last body weight measurement obtained for obesity discharges was substituted for their missing 12-month weight data.

Inspection of the 6-week and 6-month interim measurements for discharged members whose official discharge codes were *not* obesity-related revealed that many were, nevertheless, obese when discharged. This suggested that all discharges, and perhaps all nonrespondents, might have been fatter as a group at the 1-year follow-up than the respondent sample. The data were therefore examined for bias in three ways. First, the 12-month respondent sample (including obesity discharges, as explained above) was compared to nonrespondents (including all other discharges) on demographic characteristics. No differences were found for sex, race, education, or paygrade; however, respondents were approximately 1 year older as a group than nonrespondents. Second, respondents were compared to nonrespondents on both initial percent body fat and the last available body fat measurement after baseline. There were no differences on either measurement. Third, respondents were compared to those nonrespondents who were still on active duty. Again, no differences were found on either initial percent body fat or last reported body fat. Thus, the final respondent sample, adjusted to include data from obesity discharges, was adequately representative of the baseline sample and therefore of all overweight Navy personnel.

Maintenance of Body Fat Loss

Program effectiveness is commonly assessed at two principal data points: once at the end of treatment, and again after a specified length of time post-treatment (e.g., after 1 year). End of treatment for the present sample differed across programs. Level I remedial conditioning programs usually lasted 6 months; Level II counseling programs ranged between 2 and 6 weeks in length; Level III inpatient treatment ran for 6 weeks. Therefore, the end of treatment measurement was computed as the 6-month measurement for Level I and as the 6-week score for Levels II and III. However, to maintain consistent time intervals between measurements for the sample as a whole, the three follow-up data collection points (6 weeks, 6 months, and 12 months) were specified relative to the beginning of the program rather than the end of treatment. Thus, maintenance of fat loss, computed as the difference in percent body fat between the end of treatment and the end of the 1-year evaluation, reflects a 6-month maintenance period for Level I participants but a 10.5-month time period for Levels II and III.

Body Fat Reduction Index

It is well known that simply attending to the absolute amount of weight or body fat lost biases results in favor of the more obese individual or group. An alternative approach is to consider the percentage of excess weight or body fat lost, "excess" being determined relative to each individual's target weight or percent body fat. But this exerts bias in favor of the less obese participants (e.g., a person who is 100 lbs overweight and loses 70 lbs—a 70% reduction of excess weight—would be considered less successful than one who is only 10 lbs overweight but loses 8 lbs—an 80% reduction). Feinstein (1959) developed an effective solution to this problem in the form of an index that relates the actual amount of weight or body fat lost to both the initial measurement and the target measurement. The index compensates an obese person who must lose more fat than a less obese person in order to attain the same percentage of the target goal. Furthermore, because the index is standardized, it allows males and females to be combined in the analyses.

The index is computed in two steps. First, a reduction coefficient is calculated; then, the Reduction Index is computed by multiplying the actual amount of fat lost (or gained) by the reduction coefficient. Logically formulated, the expression for the coefficient is $rc = [i / (e \times t)] \times 100$, where rc is the reduction coefficient, i is the initial percent body fat, e is the amount of excess fat (determined by subtracting the target amount from the initial amount), and t is the target percent body fat. The target for this sample was 22% for all men and 30% for all women (specified as 22.49 and 30.49 in the computerized calculations). Then, $RI = l \times rc$, where RI is the Reduction Index, l is the actual amount of fat either lost (a positive number) or gained (a negative number), determined by subtracting the percent body fat at 12 months from the baseline measurement, and rc is the reduction coefficient.

The Reduction Index cannot stand alone as an intrinsically meaningful score; rather, it is used to compare individuals or groups. The higher the Reduction Index, the more "successful" an individual has been in losing body fat, relative to another individual with a lower index. Program

differences in body fat reduction success were analyzed by examining both changes in absolute percent body fat and changes in the Reduction Index. Percent body fat scores are more readily interpretable, while Reduction Index scores provide the least biased estimate of relative success in body fat reduction.

Results

Sample Demographics

A total of 624 program enrollees (499 men, 125 women) agreed to participate in the study: n = 358 from Level I, n = 51 from Level II, and n = 215 from Level III. The majority of Navy personnel with weight problems are sent to either Level I or Level III for remediation (Trent & Stevens, 1993), which explains the relatively low number of Level II enrollees in the sample.

Table 1
Demographic Characteristics of Three Navy Obesity Treatment Program Subsamples

Variable	Level I	Level II	Level III	Overall
***N* of Cases**	358	51	215	**624**
Mean Age (yrs)	29.2	30.9	31.9	**30.3**
Sex (%)				
Male	77.4	72.5	86.0	**80.0**
Female	22.6	27.5	14.0	**20.0**
Rank (%)				
Officer	3.1	2.0	5.6	**3.8**
Enlisted	96.9	98.0	94.4	**96.2**
Race (%)				
White	83.8	80.4	85.6	**84.1**
Black	13.1	13.7	11.6	**12.7**
Other	3.1	5.9	2.8	**3.2**
Education (%)				
< 12 yrs	3.4	2.0	5.6	**4.1**
12 yrs	76.7	78.4	75.6	**76.5**
> 12 yrs	19.9	19.6	18.8	**19.4**
Body Fat Category (%)				
Within standards	1.4	2.0	0.0	**1.0**
Overfat	59.2	17.6	2.8	**36.4**
Obese	39.4	80.4	97.2	**62.7**

Table 1 presents the demographic characteristics for the sample as a whole and for each of the three treatment programs. Program enrollment did not differ in terms of race, paygrade, or education; however, there were significantly more men in the Level III program, and more younger personnel (ages 19-24) and fewer obese personnel in Level I.

Discharge and Response Rates

More than one fourth of the sample had left the Navy by the time of the 1-year follow-up. Approximately 4.6% had been discharged for obesity; another 21.5% had left for other reasons (e.g., end of obligated service). The 1-year response rate among those who were still available for follow-up at the end of 12 months was 66.5%; no contact was attempted with members who were no longer on active duty.

Table 2 presents the percentage of each program subsample who were discharged before the end of the year, along with their obesity status (known or estimated, using the last available body fat measurement) at the time of discharge. The three programs were very similar in their overall discharge rates. A higher percentage of Level II and III discharges were obese at their last available body fat measurement; however, the numbers were not disproportionate, given the correspondingly higher percentage of obese enrollees in Levels II and III at baseline (Table 1). In fact, although Level III had the highest proportion of obese participants enrolled in the program (97.2%) and Level I had the lowest (39.4%), the proportion of obese enrollees who were later discharged from service in an obese condition was highest for Level I participants (25.5% of obese enrollees), versus 19.5% and 20.1% for Levels II and III, respectively.

Table 2

Percentage of Sample Discharged From Naval Service by Treatment Program and Obesity Status

Variable	Level I	Level II	Level III	Overall
Total Discharges (%) (all reasons)	26.8	21.6	26.0	26.1
Discharged for Obesity (%) (obesity discharge code)	3.1	11.8	5.6	4.6
Percent of Obese Enrollees	7.8	14.6	5.7	7.4
Obese at Last Available Body Fat Measurement (%) (discharged for all reasons)	10.1	15.7	19.5	13.8
Percent of Obese Enrollees	25.5	19.5	20.1	22.0

Post-treatment Maintenance of Body Fat Loss

Overall, 83.1% of the participants had lost body fat (ranging from .5% to 13.3% fat lost) by the end of their treatment program, 6.0% showed no change, and 10.9% had increased their body fat during treatment (ranging from .6% to 4.9% fat gained). The success rate was highest for Level III, in which 94.2% of the enrollees reduced their body fat during treatment, followed by Level II (83.4% reduced their fat) and Level I (71.2% reduced their fat). Of those who had succeeded in reducing their body fat during treatment, 66.7% had either maintained the amount lost or had lost an additional amount (ranging from .6% to 15% more fat lost) by the time of the 12-month measurement. Again, maintenance success was highest for Level III (76.2% maintained or enhanced their fat loss), followed by Level II (58.3%) and Level I (56.5%).

Changes in Body Composition Over 1 Year

Table 3 presents the mean percent body fat, lean body mass, total body weight, and body mass index (BMI) for men and women at each time interval. The data are based on the longitudinal cohort (n = 190) who provided data at all four time periods (cross-sectional results at each time period were essentially the same). To reduce bias, all obesity discharges who initially did not qualify for the cohort because of missing 6-week or 6-month data were included in the longitudinal group by assigning their last available percent body fat and body weight values to the missing 6-week or 6-month measurements.

As shown in Table 3, percent body fat decreased between baseline and 6 weeks, decreased again between 6 weeks and 6 months, then remained essentially unchanged between 6 months and 12 months. Paired t-tests between baseline and 1-year measurements demonstrated a significant reduction in body fat for both men (28.8% vs. 25.1%, t = 11.17, $p < .001$) and women (38.5% vs. 34.0%, t = 5.85, $p < .001$). The average amount of fat lost between entry into the program and 12 months was somewhat greater for women (4.5%) than for men (3.7%), but not significantly so. Both sexes were within .2% (mean) of their maximum body fat loss by the time of the 6-month measurement and remained at a virtual plateau until the end of the year.

As body fat decreased, lean body mass increased over the course of the year. Paired t-tests for lean body mass between baseline and 1 year were significant for both men (161.5 lbs vs. 163.9 lbs, t = -3.07, $p < .01$) and women (108.0 lbs vs. 111.9 lbs, t = -4.64, $p < .001$). The average amount of muscle mass gained between the beginning of the program and the end of 12 months was somewhat greater for women (3.9 lbs) than for men (2.4 lbs), but not significantly so.

Overall changes in total body weight followed the same pattern as changes in percent body fat, decreasing from baseline to 6 weeks and again from 6 weeks to 6 months, then no change between 6 months and 12 months. The total reduction in weight between entering the program and the 12-month measurement was significant for both men (228.2 lbs vs. 220.3 lbs, t = 5.14, $p < .001$) and women (177.7 lbs vs 170.1 lbs, t = 3.01, $p < .01$). The average weight loss for men (7.9 lbs) was not significantly different from that for women (7.6 lbs).

Table 3

Mean Anthropometric Measurements by Sex for Navy Obesity Treatment Participants at Program Entry and After 6 Weeks, 6 Months, and 12 Months

	Baseline	6 Weeks	6 Months	12 Months
PERCENT BODY FAT (%)				
Men	28.8 (3.9)*	27.1 (3.8)	25.3 (4.1)	25.1 (4.3)
Women	38.5 (4.5)	35.8 (4.0)	34.2 (5.0)	34.0 (5.0)
Overall	**30.9 (5.7)**	**29.0 (5.2)**	**27.3 (5.7)**	**27.1 (5.8)**
LEAN BODY MASS (lbs)†				
Men	161.5 (17.5)	161.0 (16.9)	163.4 (17.8)	163.9 (18.2)
Women	108.0 (11.5)	109.7 (11.9)	111.5 (10.9)	111.9 (11.5)
Overall	**150.9 (27.0)**	**150.8 (26.1)**	**153.1 (26.6)**	**153.6 (26.9)**
WEIGHT (lbs)				
Men	228.2 (29.8)	222.0 (26.5)	220.3 (28.8)	220.3 (28.7)
Women	177.7 (23.5)	172.2 (20.4)	170.2 (21.1)	170.1 (21.0)
Overall	**218.2 (35.1)**	**212.1 (32.3)**	**210.3 (33.9)**	**210.3 (33.9)**
BODY MASS INDEX (BMI)‡				
Men	32.5 (3.5)	31.6 (3.1)	31.3 (3.3)	31.4 (3.3)
Women	29.5 (2.8)	28.6 (2.2)	28.3 (2.3)	28.3 (2.4)
Overall	**31.9 (3.6)**	**31.0 (3.2)**	**30.7 (3.4)**	**30.7 (3.4)**

* Standard deviations are in parentheses.

† Lean Body Mass = Weight × (100 - % Body Fat) ÷ 100

‡ BMI = Weight/Height^2

Changes in body mass index (BMI) were small but statistically significant between baseline and 12 months for both men (32.4 vs. 31.3, $t = 5.18$, $p < .001$) and women (29.5 vs. 28.3, $t = 2.91$, $p < .01$). The decrease in BMI was not significantly different between men (-1.1) and women (-1.2).

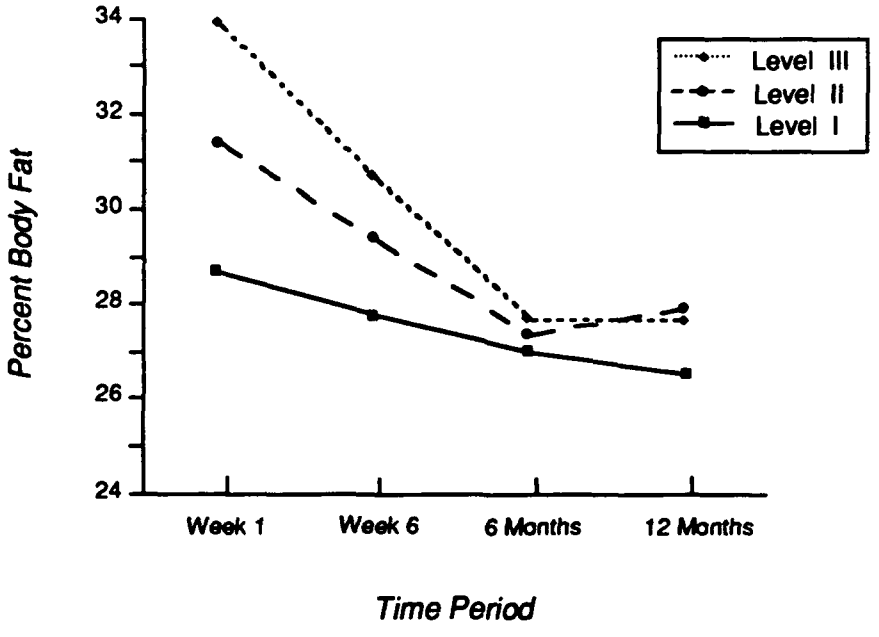
Differences Across Treatment Programs

Figure 1 depicts the change in percent body fat over a 1-year period for participants in each of the three treatment programs. Again, results are based on the longitudinal cohort and include the last available measurements for all obesity discharges. The average percent body fat differed across the three treatment levels at the beginning of the program, with Level III enrollees exhibiting the highest percent body fat (33.8%) and Level I participants the lowest (28.7%). By the end of 6 months, following a general decrease in percent body fat among participants in all three programs, the means had converged. Means then remained at or near their 6-month values until the end of the year. Multivariate analysis of variance (MANOVA) demonstrated a significant multivariate effect of Program on Percent Body Fat over time (Pillai's approximate $F[8,370] = 10.23$, $p < .001$), and univariate tests revealed significant differences across programs at program entry ($F[2,187] = 26.80$, $p < .001$) and at 6 weeks ($F[2,187] = 6.92$, $p < .001$); by 6 months the differences were no longer significant.

Dissimilarities in demographic characteristics of the three program subsamples at baseline could account for some of the observed differences in body fat change by program. There were about 5% fewer men in Level I than in the other two groups (Level I = 75.3% male, II = 80.0%,

Figure 1.

Change in Percent Body Fat by Program



III = 80.3%, longitudinal cohort), but a difference this small would not substantially affect this analysis. However, Level III enrollees were almost all obese (as opposed to overfat), were slightly older, and had more time in service. The analysis was therefore restricted to obese enrollees in each program. Within this more homogenous subgroup, a significant overall effect of Program on Percent Body Fat was again observed (Pillai's approximate $F[8,266] = 5.43$, $p < .001$), though univariate tests revealed that the effect was present only at baseline; by 6 weeks, significant program differences had disappeared.

A Kruskall-Wallis test for nonparametric data was conducted using the Reduction Index of successful body fat reduction, which is computed on measurements taken at baseline and at 1 year. Results showed a significant effect of Program on the Reduction Index, with mean ranks of 167.4, 159.6, and 206.3 for Levels I, II, and III, respectively ($\chi^2 = 12.34$, $p < .002$). Level III was found to be more effective than both Level I ($p < .001$) and Level II ($p < .03$), but Levels I and II were not significantly different from each other. When the analysis was repeated using obese participants only, program differences remained significant (mean ranks of 98.8, 122.1, and 141.0 for Levels I, II, and III, respectively, $\chi^2 = 19.40$, $p < .0001$), though only Levels I and III were found to differ significantly from one another.

Comparison of Level III Residential Programs

The Level III programs are of special interest to the Navy. In addition to being expensive to conduct, they require an enrollee to be away from his or her regular job for an uninterrupted period of 6 weeks. They also represent a "last chance" for obese personnel to salvage their military careers, for the efficacy of treatment partly determines whether the individual will remain in the Navy. Within broad guidelines, each of the ARC residential treatment facilities has developed and implemented its own treatment program. As a result, the programs differ in their therapeutic emphases, particularly in the role that physical exercise plays in the treatment regimen. The four ARCs were therefore compared using the Reduction Index, but no significant differences among the facilities were found.

Changes in Body Fat Classification

The final criterion for both Navy administrators and Navy personnel enrolled in the weight-management programs is whether the participants succeed in reaching the within-standards body fat cutpoint. Figure 2 depicts the overall changes in body fat classification between baseline and 12 months. At the beginning of the program, 62.7% of the entire sample were obese, 36.4% were overfat, and 1.0% were within standards (the six individuals who were within standards were enrolled in the program based on their official measurements prior to their biannual PRT; all were within 1% of the Overfat category at the baseline measurement and were retained in the evaluation). By the end of 12 months, the percentages had changed significantly to 40.7% obese, 32.0% overfat, and 27.3% within standards ($\chi^2 = 45.21$, $p < .0001$). Nearly half of the female participants (49.6%) and two thirds of the males (65.9%) were obese at program entry; these percentages had dropped to 27.3% of the women and 43.7% of the men by the end of 1 year.

Figure 2.

Changes in Body Fat Classification After One Year

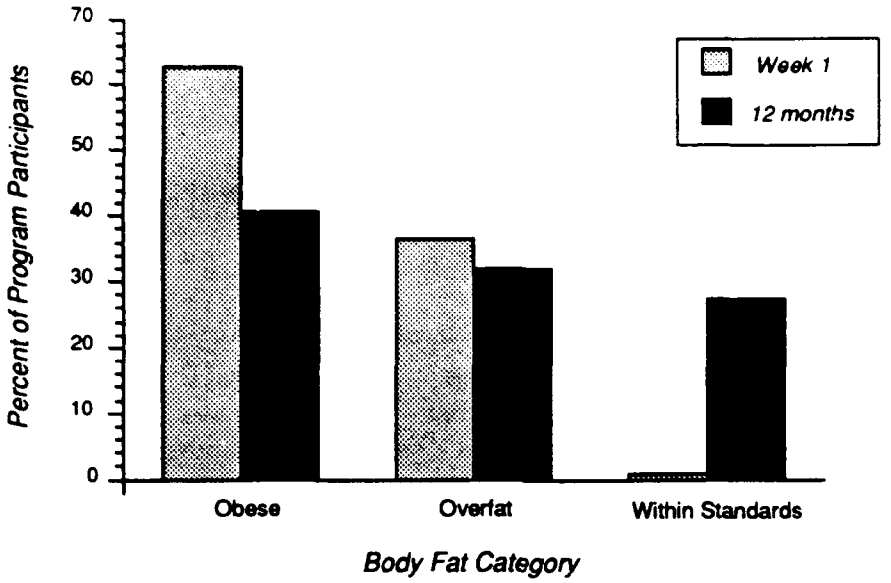


Table 4 presents the body fat category percentages by treatment level. Percentages were computed at baseline, at 12 months, and then again using the last available body fat measurement after baseline for everyone in the initial sample. (Although the last available measurement is the most conservative estimate of final percent body fat and includes provisional measurements for members who either dropped out of the study or were separated from the Navy, the proportion of individuals in each of the three body fat categories was not significantly different for the last available measurement than for the 12-month data.) Chi-square analysis indicated a significant difference in body fat category by program at baseline ($\chi^2 = 200.7$, $p < .001$) but not at 12 months. At program entry, 39.4% of Level I enrollees were obese, versus 97.2% of Level III enrollees. Yet after 1 year, the percentage of obese participants in Level I had decreased by only 3.5% (from 39.4% to 35.9%), compared to a decrease of 50.1% (from 97.2% to 47.1%) in Level III.

Although reaching the designated cutpoint for acceptable percent body fat is, ultimately, the measure of success for this Navy sample, individuals achieve success in stages. Individual changes in body fat classification were therefore computed for the longitudinal cohort at each time period, with "success" being defined as having attained or maintained a lower body fat category than one's baseline classification. By the time of the 6-week measurement, 27.7% of the sample had reached a lower body fat category than their designation at the beginning of the program. After 6 months, 44.2% were in a lower category than at baseline. And after 12 months, the success rate had increased only slightly, with 47.9% of the sample in a lower category than at entry into the program (cross-sectional results at each time period were very similar).

Table 4
Percentage of Sample Within in Each Body Fat Category by Treatment Level at Baseline, 12 Months, and Last Available Measurement

	Treatment Program			
Body Fat Category	**Level I**	**Level II**	**Level III**	**Overall**
Baseline				
Within standards	1.4	2.0	0.0	1.0
Overfat	59.2	17.6	2.8	36.4
Obese	39.4	80.4	97.2	62.7
12 Months				
Within standards	32.0	20.8	21.3	27.3
Overfat	32.0	33.3	31.6	32.0
Obese	35.9	45.8	47.1	40.7
Last Available Measurement				
Within standards	31.8	25.0	19.0	26.4
Overfat	35.4	31.8	31.3	33.6
Obese	32.8	43.2	49.8	40.0

Discussion

The Navy's three-tiered obesity treatment program was demonstrably successful in some ways but only marginally effective in others. The percentage of participants who succeeded in losing body fat during their weight-loss program was high (83%), and the proportion of "losers" who had either maintained or enhanced their loss by the end of the follow-up period (67%) was as high as some of the most favorable results reported in the literature (Adams et al., 1986; Fitzwater et al., 1991; Wood, 1990). The reduction in mean percent body fat and weight between baseline and 1 year was statistically significant for both male and female participants. More importantly, the downward trend in body fat and weight was sustained over a period of 1 year and did not evidence the significant rebound that is often seen after treatment ends (Bennett, 1986; Fatis et al., 1989; Foreyt, 1987; Jeffery, 1987; Lavery et al., 1989).

It is possible, of course, that the plateau noted between 6 months and 12 months signified the nadir of a gain/loss cycle, and that a significant regain in body fat would have been observed had the study continued longer. Research involving long-term follow-up over several years offers evidence that most subjects eventually return to their pre-treatment weights (Kramer, Jeffery,

Forster, & Snell, 1989; Wadden, Sternberg, Letizia, Stunkard, & Foster, 1989). On the other hand, it is well recognized that such plateaus occur naturally in long-term weight-loss regimens as the body adjusts to new metabolic conditions, and they do not necessarily signal an end to, or a reversal of, weight or fat loss.

In terms of the absolute amount of body fat lost over the course of the study, results were less encouraging. After the first 6 weeks, males had lost an average of almost 2% body fat and females had lost almost 3%—a reasonable improvement in terms of the Navy's own recommendation that program enrollees lose approximately 1% body fat every 2 weeks (Department of the Navy, 1990). But by the end of 12 months, the mean total body fat loss was only 3.6% for males and 4.5% for females, despite the need of the average participant to lose almost twice these amounts to meet the Navy's acceptable body fat level.

Certainly the number of personnel passing the body fat criteria had improved substantially after 1 year, from 1% of the sample in the "acceptable" category at baseline to more than 27% within standards at the end of 1 year. At the same time, the number of individuals in the obese category had decreased 22%, and almost one half of the entire sample had shown improvement in their body fat classification. Unfortunately, a number of those who remained in the obese category after treatment were administratively separated from military service as a direct result of their excess body fat; many others who were obese at the time of their discharge had probably not been recommended for reenlistment. Although only 4.6% of the sample were officially separated for obesity, if "other" discharges who were obese at the time of their discharge were included in the calculation, the total would be almost 16% of the initial sample who were processed out of the Navy in an obese condition within 1 year of entering the obesity treatment program.

Navy standards are based on percent body fat, but results based on body weight afford comparisons with other weight-loss programs. Mean total weight loss for those with both baseline and 12-month data was less than 5 lbs (less than 8 lbs for the longitudinal cohort), yet most obese individuals need to lose more than 20 lbs (Perri, Nezu, Patti, & McCann, 1989). When analyzed by program, mean losses again proved to be significantly different across the three programs: 3.4 lbs *gained* in Level I, 4.0 lbs lost in Level II, and 16.7 lbs lost in Level III. Mean weight loss among only those members who succeeded in losing weight ("losers") was higher but still significantly different across programs: 10.0 lbs, 11.7 lbs, and 21.9 lbs lost in Levels I, II, and III, respectively. Because Navy policy mandates participation in a remedial weight-loss program for all personnel failing to meet body fat standards, a no-treatment control group was not possible in the research design. This is unfortunate, for weight and body fat reductions of the magnitude observed in Level I (and perhaps Level II as well) could have been the result of normal weight fluctuations in the population rather than a consequence of participation in the treatment program. Williamson and Levy (1988) found that after 1 year, the mean amount of weight lost by "losers" in a treatment group (about 8 lbs) was not significantly different than that lost by "losers" in a no-treatment control group (about 9 lbs), prompting the authors to caution that a control group is essential in research on long-term effects of weight-loss programs.

Bennett (1986) found that the single most important success factor in a weight-loss program was duration of treatment. However, when examined by program level, the present results consistently favored the Level III tier, which was only 6 weeks in length, rather than the Level I program, which lasted for 6 months. Nearly all of the Level III enrollees succeeded in reducing their percent body fat (94% vs. 71% in Level I), and three fourths of those who did either maintained or enhanced their fat loss over the course of the year (vs. about half of those in Level I). Between program entry and the end of 1 year, graduates of the Level III program had lost an average of four times as much body fat as those in Level I (three times as much in the longitudinal cohort), and Level III demonstrated a much greater reduction in the percentage of participants classified as obese after 1 year. Even after taking each individual's initial percent body fat into account with the Reduction Index, Level III proved to be more effective than Level I.

A likely explanation for the apparent superiority of 6 weeks' treatment duration is that the programs differ on many dimensions other than treatment length. Level I remedial conditioning programs rely almost entirely on group exercise sessions conducted three or four times per week. The Level II and III programs are more diversified, modeled for the most part on the Overeater's Anonymous 12-step program. They incorporate elements of individual counseling, group discussion, nutrition education, stress management, and behavior modification as well as group exercise into their curricula. Studies have shown that exercise alone is seldom effective for treating obesity (Pacy, Webster, & Garrow, 1986; Segal & Pi-Sunyer, 1989), but multidimensional behavioral programs that include dieting and behavior modification in addition to exercise have produced positive results (Brownell & Kramer, 1989; Council on Scientific Affairs, 1988).

Perhaps the most important difference among the Navy's three treatment tiers is that Level III is an inpatient program. The residential milieu alters the patient's entire lifestyle for the program's 6-week duration. Dietary choices are limited to those offered by the program's dining facilities, and exercise regimens are prescribed and closely monitored. Individual and group counseling sessions explore psychological problems underlying compulsive overeating. The participant's time is structured, with workshops and meetings scheduled throughout the day and evening, and help and support are continuously available from counselors and peers, with whom participants frequently form close bonds. By the end of this intensive, 6-week program, Level III participants in the longitudinal cohort had lost an average of 3.2% body fat, versus 2.8% for Level II and only 1.0% for Level I during the same period. Yet despite the apparent efficacy of the residential program, at the end of 12 months, the Level III men remained an average of 4% above the gender-based cutpoint for acceptable percent body fat, and the Level III women remained 5% above. Why?

The answer must lie in what happens—or does not happen—after treatment. The skills and behaviors required to lose weight, which are learned during the Level III program, are different from the skills and behaviors needed to maintain weight loss (Abrams & Follick, 1983; Bandura, 1977). Maintenance requires practice in recognizing and dealing with "slips" and the cognitive fatalism they often engender ("Since I've already blown it, I might as well just keep eating").

Learning to use relapse-prevention skills in day-to-day situations takes time, practice, and support. While Navy policy makers recognize the need for aftercare and have prescribed such care for Level III graduates, the aftercare prescribed is mandatory participation in a Level I physical conditioning program (Department of the Navy, 1990), which does not meet the needs of individuals with a chronic weight problem.

Most Level I programs are little more than exercise classes. They serve an important function in improving strength, aerobic capacity, and general fitness, but the present results confirm earlier findings (Woodruff, Conway, & Linenger, 1992) that they are largely ineffective in reducing body fat. Obese participants often feel persecuted and resentful of the demands of the command-directed remedial conditioning program, especially when positive results are not forthcoming. For a number of reasons, says Brownell (1984), "obese patients are not likely to respond to simple exhortations to 'get more exercise'" (p. 412). What they do respond to, and what emerges as one of the critical factors for continued weight loss and successful weight-loss maintenance, is long-term social support, whether in the form of extended or follow-up contact with a professional or therapy group, or interpersonal support from the individual's social milieu (Brownell, 1984; Foreyt, Goodrick, & Gotto, 1981; Lavery & Loewy, 1993; Perri, McAdoo, McAllister, Lauer, & Yancey, 1986; Perri et al., 1988; Perri, Nezu, Patti, & McCann, 1989). Brownell (1982) made the somewhat startling observation that if "curing" obesity were to mean successfully reducing to one's ideal weight and maintaining that weight for at least 5 years, a person is more likely to recover from many forms of cancer than from obesity. Obesity should be viewed as a serious, chronic, and difficult-to-manage condition requiring a comprehensive approach to treatment and an appropriate post-treatment maintenance program.

The Navy's recent policy revision regarding body fat standards requires that "overfat" individuals be subject to the same punitive administrative actions as obese personnel. Arguments for or against this new policy are not in the purview of this report; however, the ramification, based on results of this study, is that almost 75% of the men and women enrolled in the Navy's obesity treatment programs could forfeit their Navy careers for being unable to reach and maintain the officially acceptable level of percent body fat. In larger terms, these individuals risk a number of chronic health problems associated with obesity. Development of a supportive, long-term, behaviorally-based aftercare program could prove to be a cost-effective alternative. It is certainly worth exploring.

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13. ABSTRACT *(Maximum 200 words)*

This study provided an evaluation of the effectiveness of the Navy's three-tiered obesity treatment program: Level I (command-directed remedial conditioning program), Level II (weight-management counseling), and Level III (inpatient obesity treatment). Height, weight, and body circumference measurements were obtained from 624 program participants at the beginning of the program, then at 6 weeks, 6 months, and 12 months after the start of the program. There was a significant reduction in percent body fat after 1 year in all three program tiers. Results demonstrated a sustained downward trend through the 6-month data point, then a plateau between 6 and 12 months. The number of participants meeting the Navy's body fat criteria improved from 1% to 27%, and the number of participants classified as obese dropped from 63% to 43%. However, absolute losses (mean percent body fat) were small: -3.6% fat for men, -4.5% fat for women after 1 year. Approximately 4.6% of the sample were discharged from the Navy for obesity. Level III, which employs diverse treatment techniques, was the most effective program in helping participants to reduce body fat. Level I, which is primarily an exercise program, was the least effective. An aggressive and supportive aftercare program is recommended to enhance weight loss among program graduates.

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