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ORIGINAL RESEARCH

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# Impact of the LIFESTEPS Weight Management Program on Measures of Adiposity, Self-Efficacy, and Lifestyle Behaviors

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Assessment of weight loss options can help consumers and practitioners determine the best way to manage weight. This quasi-experimental study evaluated outcomes for participants ( $n = 1592$ ; body mass index:  $35.7 \pm 7.5 \text{ kg/m}^2$ ) enrolled in the LIFESTEPS Weight Management Program. Body adiposity, self-efficacy, and lifestyle behaviors were assessed at program entry and exit. Body weight, body mass index, waist circumference, and waist-to-height ratio decreased and self-efficacy increased. More participants reported keeping food records, consuming fruits and vegetables, and participating in physical activity at program exit. Programs that emphasize nutrition, physical activity, and behavior therapy, such as LIFESTEPS, are appropriate options for weight loss. **Key words:** *behavior strategies, comprehensive lifestyle interventions, lifestyle behaviors, self-efficacy, weight management*

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Barbara K. Paulsen was an original author of the LIFESTEPS program and has retired from LIFESTEPS, Inc, a nonprofit corporation. She was a manager/employee of LIFESTEPS, Inc. during the time of the study. She is currently an independent RDN consultant and none of her current activities are related to LIFESTEPS, Inc, or weight management. Tracy Pfaffenberger serves as the treasurer on the board of LIFESTEPS, Inc, and is employed by LIFESTEPS, Inc, as a coordinator. Terri Verason serves as the secretary on the board of LIFESTEPS, Inc. Vicki Bourneuf serves as chair on the board of LIFESTEPS, Inc, and is employed

**O**BESITY is a serious public health problem in the United States, as more than two-thirds of adults are overweight or obese.<sup>1–4</sup> Excess adiposity is associated with several comorbid conditions, including type 2 diabetes, dyslipidemia, hypertension, coronary heart disease, stroke, gallbladder disease,

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by LIFESTEPS, Inc, as the program manager. For the remaining authors, none were declared.

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osteoarthritis, respiratory problems (ie, sleep apnea), and certain cancers (ie, endometrial, breast, prostate, and colon).<sup>5–9</sup> Excess adiposity also contributes indirectly to hundreds of thousands of deaths each year.<sup>6,10–14</sup> In 2008, the medical costs of obesity were estimated as high as \$147 billion.<sup>6,10–14</sup> Mortality, morbidity, and health care costs can be drastically reduced through achievement of a healthy weight or through significant weight loss with subsequent lifelong maintenance.

Currently, many weight loss methods are available, including pharmacological agents, diet and exercise programs, specialty food products, dietary supplements, bariatric surgery, and behavior-change programs.<sup>3,4</sup> However, adherence and long-term effectiveness for many of these weight loss methods are typically quite poor.<sup>3,4,15–18</sup> Furthermore, once the initial weight loss phase has ended, good weight maintenance techniques may not be practiced.<sup>19–23</sup>

The American College of Cardiology, the American Heart Association, and The Obesity Society have provided guidelines for the management of overweight and obesity in adults.<sup>24</sup> Comprehensive lifestyle interventions that include the intrapersonal factors of diet, physical activity, and behavior therapy show the greatest weight loss success.<sup>24–27</sup> An in-person, high-intensity ( $\geq 14$  sessions in 6 months) program, led by a trained interventionist, including registered dietitian nutritionists, was identified as the most effective approach.<sup>24</sup> Successful weight loss has been defined as a loss of 5% to 10% of initial body weight, with maintenance for at least 1 year.<sup>24,28</sup> However, a sustained weight loss of 3% to 5% of initial body weight in obese individuals provides clinically meaningful health outcomes, such as reduced risk for diabetes and heart disease, even though this moderate amount of weight loss may not result in a normal body mass index (BMI).<sup>2–4,24,28–32</sup>

The LIFESTEPS Weight Management Program (LIFESTEPS) is a comprehensive, non-profit, behavioral-based program that incorporates diet, physical activity, and behavior therapy. LIFESTEPS was developed by a team

of nutrition, health, and education professionals in the 1980s and is currently managed by 3 registered dietitian nutritionists. Because group dynamics can increase effectiveness in weight management, LIFESTEPS is delivered in small, closed groups (10–18 participants per group) in community-based settings. The weekly meetings are led by trained LIFESTEPS leaders, typically registered dietitian nutritionists or other health professionals with an approved academic nutrition background, who are certified to lead the program after completion of a 6-week comprehensive course. As part of the training, prospective leaders practice and refine cognitive-behavioral techniques, anthropometric measures, readiness screening, and program delivery to ensure consistency of program implementation across sites. LIFESTEPS is ongoing and continues to train qualified leaders to deliver the program to groups in a variety of community-based settings, including outpatient clinics, senior centers, and corporate wellness facilities.

Although LIFESTEPS adheres to the recent guidelines of the American College of Cardiology, the American Heart Association, and The Obesity Society for the management of overweight and obesity, research has not evaluated the outcomes of this community-based weight management program. Assessment of available weight loss solutions can assist consumers and practitioners in making choices about the best way to manage weight. Therefore, the purpose of this study was to evaluate outcome measures, including adiposity, self-efficacy, and lifestyle behaviors, for participants of LIFESTEPS.

## METHODS

### Sample and study design

Using a quasi-experimental research design, outcomes of LIFESTEPS were evaluated, including measures of adiposity (body weight, BMI, waist circumference, and waist-to-height ratio), self-efficacy (weight management and physical activity), and lifestyle

behaviors (dietary self-monitoring, fruit and vegetable consumption, and physical activity). Enrollment occurred between 2003 and 2009 at LIFESTEPS programs from 13 different states within the United States and 1592 individuals were included as the participants. The study outcome measures were examined as part of a collection of de-identified data and records. Prior to the secondary data analysis, the Arizona State University Institutional Review Board approved the study using the Application for Exempt Research.

### Intervention

The LIFESTEPS program consisted of 16 weekly, 1-hour meetings, led by trained LIFESTEPS leaders. The leaders served as facilitators during the program, providing information, support, and guidance. During each meeting, the LIFESTEPS leaders introduced a new concept and key behavior for weight loss, addressing themes related to diet, physical activity, and behavior therapy (ie, self-monitoring, goal setting, cognitive behavior strategies, social support, relapse prevention, and personal choice). The *Dietary Guidelines for Americans* was used as the model for the individual diet plans.<sup>33</sup> Physical activity goals adhered to the recommendations of the American College of Sports Medicine.<sup>34</sup> After the new concept and key behavior were introduced, the typical meeting format consisted of completing a self-assessment, participating in hands-on practice, and finishing with individualized action planning. The weekly meetings were interactive and incorporated group discussion, role playing, and problem solving. Throughout the program, the participants were encouraged to participate in at least 30 minutes of moderate-intensity physical activity on most days of the week. The participants were required to self-monitor by recording dietary intake and physical activity and received weekly focused feedback from the LIFESTEPS leaders. The participants adjusted their goals and action plans throughout the program as they gained new insights and adopted new behaviors.

### Measures

LIFESTEPS leaders conducted initial individual interviews with the participants, reporting the age and measuring the weight, height, and waist circumference of participants at program entry. LIFESTEPS leaders were trained and followed a standardized protocol, which included detailed instructions on completing the weight, height, and waist circumference assessments. Leaders were asked to measure participants at approximately the same time of day throughout the program. Before completing the anthropometric measurements, the participants were asked to remove their shoes and any heavy clothing. Waist circumference was measured in triplicate at the level of the iliac crest. Because the anthropometric measures were completed from multiple facilities across the United States, the leaders were instructed to use the same scale, stadiometer, and tape measure at their facility for the participants throughout the program.

The participants completed a questionnaire both at entry (preassessment) and exit (postassessment) from the program that included demographic information, self-efficacy (weight management, physical activity), and lifestyle behaviors (dietary self-monitoring, fruit and vegetable consumption, and physical activity). Prior to data collection, the questionnaire was assessed for face and content validity by nutrition professionals and individuals participating in LIFESTEPS and was revised as recommended. As part of the questionnaire, the participants reported their level of confidence to follow a healthy eating plan for weight management by responding to 5 statements describing challenging weight management situations: (1) "You are with family and friends in a social setting where food is highly visible and available"; (2) "Another person urges you to eat outside your plan"; (3) "You are angry, anxious, depressed or bored"; (4) "You are in a situation where others have prepared or have control over the foods that are available"; and (5) "You are not in your usual routine, ie, weekends, holidays, or traveling" using a 4-point Likert scale (1 = "not

at all confident" and 4 = "highly confident"). A total score for weight management self-efficacy was determined as the sum of the responses. Similarly, the participants reported their level of confidence to adopt a program of regular, daily physical activity by responding to 5 statements describing challenging physical activity situations: (1) "You are not in your usual routine, ie, weekends, holidays or traveling"; (2) "You are tired"; (3) "Your family or friends are not physically active"; (4) "Your family or friends are not encouraging you to be active"; (5) "You are angry, anxious, depressed, or bored") using a 4-point Likert scale (1 = "not at all confident" and 4 = "highly confident"). The total score for physical activity self-efficacy was determined as the sum of the responses.

Dietary self-monitoring was assessed by 2 questions that asked the participants to report the number of days during the past week that they kept a food record (none, 1-2 days, 3-4 days, 5-6 days, and every day) and the number of times during the past week that they measured the amount of food they ate using measuring cups/spoons and/or a food scale (none, once a week, 2-3 times a week, at least 1 time daily, every meal or snack). As part of the questionnaire, the participants reported the number of servings of both fruits and vegetables on a typical day (none, 1 serving, 2-3 servings, 4 servings,  $\geq 5$  servings). The participants also reported the amount of time spent during the past week engaging in both aerobic exercise and strength training (none, <30 minutes, 30-60 minutes, 1-3 hours, >3 hours).

Upon completion of the program, the participants' weight and waist circumference were measured and reported by LIFESTEPS leaders. The same scale and tape measure were used as in the initial assessment. The postassessment questionnaire was the same as the preassessment questionnaire, with the addition of 15 statements related to behavioral strategies emphasized in LIFESTEPS (ie, keep food records, write in my food record before starting to eat, do aerobic exercise, do strength training, measure serving

sizes, eat a variety of foods, record calories, limit the visibility and availability of food in my environment, use positive self-talk, develop and rehearse a plan before entering a high-risk situation, develop a plan for dealing with emotional eating, practice visualization, enlist the help of another in my weight management efforts, take time to review my accomplishments, and establish goals for behavior changes). The participants were asked to select the 3 behaviors they felt were the most helpful in weight management.

The study participants were included in this analysis if they had documentation of a body weight (initial or final) and/or had completed a preassessment or postassessment questionnaire. Missing data did not exclude participants from being included in the analysis. The participants were excluded only if they had enrolled in the program but had no record of an initial or final body weight or a preassessment or postassessment questionnaire.

### Statistical analyses

Data were analyzed using IBM SPSS Statistics, version 22.0 (2013, Armonk, New York). Tests of normality using histograms and the Kolmogorov-Smirnov statistic determined the distribution of the data. Because of the presence of outliers for body weight and BMI, the data in this study were not normally distributed. Transformation of the data by logarithm or square root did not result in a normal distribution and neither did removal of the outliers. Upon consultation with a statistician, analyses were performed using nontransformed data with the entire data set included. To confirm this decision, the results from parametric and nonparametric (Wilcoxon signed rank test) statistical analyses were compared. Parametric statistics were ultimately reported because both statistical approaches (parametric and nonparametric) yielded similar results. Descriptive data for the study participants were summarized utilizing mean  $\pm$  standard deviation, range, median, and percentiles (25th, 75th). Sex, race/ethnicity, education, lifestyle behaviors,

and postassessment behavior strategies were summarized using frequencies.

Paired-samples *t* tests determined changes between the initial and final measures of adiposity and self-efficacy (weight management, physical activity) for participants who completed the program. For participants who did not have a final measure, the initial measure was carried over as the final measure using the Last Observation Carried Forward method. The McNemar test was utilized to assess marginal homogeneity of the responses to the lifestyle behavior questions before and after participation in the program. The Bonferroni adjustment was appointed to the  $\alpha$  level (0.05/12) and significance was determined if the *P* value was  $<.004$ .

To determine factors affecting success during the program, the participants were stratified into 3 groups on the basis of their percent weight-change (low =  $\leq 4.99\%$  [ $n = 433$ ], medium =  $5.00\%$ – $9.99\%$  [ $n = 254$ ], high =  $\geq 10.00\%$  [ $n = 55$ ]). For those participants who did not have a final body weight measure, the initial measure was carried over as the final measure. For each of the 15 behavioral strategies included on the postassessment questionnaire, a new variable was created to note whether a participant reported that behavior as 1 of the 3 most helpful for weight management. Chi-square tests for independence explored the relationship between weight-change group and helpful weight management behavior strategies. The Bonferroni adjustment was applied to the  $\alpha$  level for the 15 behavior strategies (0.05/15). Significance was determined if the *P* value was  $<.003$ . When significant, standardized residuals were examined to identify those cells making the greatest contribution to the  $\chi^2$  result. The relationship between percent weight change and the final self-efficacy measures (weight management, physical activity) was also investigated using Pearson product-moment correlation coefficients.

## RESULTS

During 2003–2009, LIFESTEPS leaders enrolled participants from multiple states

in this weight management program. Data were available for 1592 of these participants. Table 1 shows descriptive characteristics of these participants. For those participants who reported age, mean age was  $53.2 \pm 11.5$  years. Initial BMI was  $35.7 \pm 7.5$  kg/m<sup>2</sup>. Initial waist circumference was  $108.8 \pm 15.3$  cm and was used to calculate waist-to-height ratio ( $0.66 \pm 0.09$ ). Of enrolled participants who reported their sex ( $n = 1357$ ), 194 (14.3%) were male and 1163 (85.7%) were female. Of participants who reported their race/ethnicity ( $n = 1374$ ), 1181 (86.0%) indicated white/Caucasian. Participants who selected more than 1 racial/ethnic group were categorized as other race/ethnicity. Participants ( $n = 1371$ ) reported their highest completed level of education; 404 (29.5%) reported being a college graduate and 300 (21.9%) reported completing postgraduate work.

Table 2 summarizes the initial and final anthropometric, self-efficacy, and lifestyle behavior measures. Mean weight (initial  $98.2 \pm 23.3$  kg, final  $95.0 \pm 23.0$  kg,  $t_{1561} = 34.1$ ,  $P < .001$ ), BMI (initial  $35.7 \pm 7.5$  kg/m<sup>2</sup>, final  $34.5 \pm 7.5$  kg/m<sup>2</sup>,  $t_{1553} = 34.5$ ,  $P < .001$ ), waist circumference (initial  $108.8 \pm 15.3$  cm, final  $104.7 \pm 15.1$  cm,  $t_{155} = 10.3$ ,  $P < .001$ ), and waist-to-height ratio (initial  $0.66 \pm 0.09$ , final  $0.63 \pm 0.09$ ,  $t_{155} = 10.4$ ,  $P < .001$ ) decreased significantly after completing the program. The  $\eta^2$  statistic (weight = 0.43; BMI = 0.43; waist circumference = 0.41; waist-to-height ratio = 0.41) indicated a large effect size for these anthropometric measures. Reported self-efficacy for both weight management and physical activity increased after completion of the program (initial weight management self-efficacy:  $12.9 \pm 3.1$ , final weight management self-efficacy:  $14.0 \pm 3.1$ ,  $t_{1350} = -16.2$ ,  $P < .001$ ; initial physical activity self-efficacy:  $13.5 \pm 3.3$ , final physical activity self-efficacy:  $14.1 \pm 3.4$ ,  $t_{1346} = -8.4$ ,  $P < .001$ ). The  $\eta^2$  statistic for weight management self-efficacy (0.16) indicated a large effect size while the  $\eta^2$  statistic for physical activity self-efficacy (0.05) indicated a small to moderate effect size.

The distribution of responses to the lifestyle behavior questions was significantly

**Table 1.** Descriptive Data of Participants (n = 1592) Enrolled in the LIFESTEPS Weight Management Program

	n	Mean ± SD	Median	25th Percentile	75th Percentile	Range
Age, y	811	53.2 ± 11.5	54.0	46.0	61.0	16-82
Height, cm	1555	165.7 ± 8.3	165.1	160.0	170.2	144.8-198.1
Weight, kg	1562	98.2 ± 23.3	93.2	81.8	109.5	52.3-251.4
Body mass index, kg/m <sup>2</sup>	1554	35.7 ± 7.5	34.4	30.1	39.4	21.0-82.9
Waist circumference, cm	156	108.8 ± 15.3	107.3	96.8	116.8	78.7-160.0
Waist-to-height ratio	156	0.66 ± .09	0.65	0.60	0.70	0.48-0.94
	n				n (%)	
Sex	1357					
Male					194 (14.3)	
Female					1163 (85.7)	
Race/ethnicity	1374					
White/Caucasian					1181 (86.0)	
Black/African American					141 (10.3)	
Hispanic					22 (1.6)	
Asian/Pacific Islander					10 (0.7)	
American Indian					2 (0.1)	
Other					18 (1.3)	
Highest level of education completed	1371					
Some high school or less					17 (1.2)	
High school graduate or equivalent					198 (14.4)	
Some college					452 (33.0)	
College graduate					404 (29.5)	
Postgraduate					300 (21.9)	

different after completing the program. When asked, “During the past week, how many days did you keep a record of your eating patterns?,” more participants selected “every day” and less selected “none” after completing the program ( $P < .001$ ). When asked, “During the past week, how many times did you use measuring cups/spoons and/or a scale to measure the amount of food you ate?,” more participants selected “every meal or snack” and fewer selected “none” after completing the program ( $P < .001$ ). When asked, “During a typical day, how many servings from the fruit group do you eat?,” more participants responded “2 to 3” and fewer responded “none” after completing the program ( $P < .001$ ). When asked, “During a typical day, how

many servings from the vegetable group do you eat?,” more participants responded “2 to 3” and fewer responded “none” after completing the program ( $P < .001$ ). When asked, “During the past week, how much total time did you spend doing aerobic exercise?,” more participants responded “more than 3 hours” and fewer responded “none” after completing the program ( $P < .001$ ). When asked, “During the past week, how much total time did you spend doing strength training exercises?,” more participants responded “1 to 3 hours” and fewer responded “none” after completing the program ( $P < .001$ ).

After completing LIFESTEPS, 754 participants filled out the postassessment

**Table 2.** Initial and Final Measures of Body Adiposity, Self-Efficacy, and Lifestyle Behaviors for LIFESTEPS Participants<sup>a</sup>

		Initial Value	Final Value				
	n	Mean ± SD		t Statistic	η <sup>2</sup>	df	P
Weight, kg	1562	98.2 ± 23.3	95.0 ± 23.0	34.1	0.43	1561	<.001 <sup>b</sup>
Body mass index, kg/m <sup>2</sup>	1554	35.7 ± 7.5	34.5 ± 7.5	34.5	0.43	1553	<.001 <sup>b</sup>
Waist circumference, cm	156	108.8 ± 15.3	104.7 ± 15.1	10.3	0.41	155	<.001 <sup>b</sup>
Waist-to-height ratio	156	0.66 ± 0.09	0.63 ± 0.09	10.4	0.41	155	<.001 <sup>b</sup>
Weight management self-efficacy	1351	12.9 ± 3.1	14.0 ± 3.1	− 16.2	0.16	1350	<.001 <sup>b</sup>
Physical activity self-efficacy	1347	13.5 ± 3.3	14.1 ± 3.4	− 8.4	0.05	1346	<.001 <sup>b</sup>
n (%)							
Number of days of food recording per week	1368						<.001 <sup>b</sup>
None		642 (46.9)	400 (29.2)				
1-2		391 (28.6)	258 (18.9)				
3-4		121 (8.8)	145 (10.6)				
5-6		69 (5.0)	120 (8.8)				
Every day		145 (10.6)	445 (32.5)				
Number of times per week measured food	1368						<.001 <sup>b</sup>
None		996 (72.8)	602 (44.0)				
Once a week		83 (6.1)	83 (6.1)				
2-3 times a week		144 (10.5)	270 (19.7)				
At least 1 time daily		115 (8.4)	296 (21.6)				
Every meal or snack		30 (2.2)	117 (8.6)				
Fruit servings per day	1368						<.001 <sup>b</sup>
None		175 (12.8)	95 (6.9)				
1		470 (34.4)	381 (27.9)				
2-3		619 (45.2)	753 (55.0)				
4		80 (5.8)	117 (8.6)				
≥5		24 (1.8)	22 (1.6)				
Vegetable servings per day	1365						<.001 <sup>b</sup>
None		48 (3.5)	29 (2.1)				
1		398 (29.2)	255 (18.7)				
2-3		763 (55.9)	834 (61.1)				
4		117 (8.6)	180 (13.2)				
≥5		39 (2.9)	67 (4.9)				
Time spent doing aerobic exercise per week	1357						<.001 <sup>b</sup>
None		334 (24.6)	217 (16.0)				
<30 min		290 (21.4)	223 (16.4)				
30-60 min		316 (23.3)	296 (21.8)				
1-3 h		276 (20.3)	336 (24.8)				
>3 h		141 (10.4)	285 (21.0)				
Time spent doing strength training per week	1363						<.001 <sup>b</sup>
None		989 (72.6)	750 (55.0)				
<30 min		171 (12.5)	275 (20.2)				
30-60 min		123 (9.0)	196 (14.4)				
1-3 h		66 (4.8)	127 (9.3)				
>3 h		14 (1.0)	15 (1.1)				

<sup>a</sup>Initial values carried over as final values for those that did not have final values. Paired-samples *t* tests determined changes between the initial and final measures for the continuous variables, and the McNemar test assessed the marginal homogeneity of the initial and final measures for the categorical variables. The Bonferroni adjustment was applied to the  $\alpha$  level (.05/12 = .004).

<sup>b</sup>*P* < .004.

questionnaire and identified 3 behavior strategies most helpful for weight management from a potential list of 15. The top 5 selected overall were “keep food records” (n = 480 [63.7%]), “measure serving sizes” (n = 303 [40.2%]), “do aerobic exercise” (n = 300 [39.8%]), “record calories” (n = 297 [39.4%]), and “eat a variety of foods” (n = 192 [25.5%]).

Table 3 summarizes the frequency (number and percentage) of participants selecting a behavior as 1 of the 3 most helpful within each weight-change group. Chi-square tests for independence identified a significant association between weight-change group and “do aerobic exercise” ( $\chi^2$  [2, n = 742] = 13.01,  $P$  = .001). Upon review of the standardized

**Table 3.** Number and Percentage of Participants Stating a Behavior Was 1 of the 3 Most Helpful for Weight Management Among Those Participants Completing a Postassessment Questionnaire (n = 742) in the 3 Weight-Change Groups<sup>a</sup>

	Low (≤4.99%), n = 433	Medium (5.00%-9.99%), n = 254	High (≥10.00%), n = 55			P
	n = (%)			$\chi^2$ Statistic	df	
Keep food records	266 (61.4)	167 (65.7)	39 (70.9)	2.65	2	.265
Write in my food record before starting to eat	23 (5.3)	16 (6.3)	4 (7.3)	0.52	2	.770
Do aerobic exercise <sup>b</sup>	154 (35.6)	106 (41.7)	33 (60.0)	13.01	2	.001 <sup>c</sup>
Do strength training	41 (9.5)	13 (5.1)	8 (14.5)	6.93	2	.031
Measure serving sizes	170 (39.3)	107 (42.1)	22 (40.0)	0.55	2	.760
Eat a variety of foods	114 (26.3)	70 (27.6)	7 (12.7)	5.39	2	.068
Record calories	155 (35.8)	112 (44.1)	27 (49.1)	6.83	2	.033
Limit the visibility and availability of food in my environment	73 (16.9)	31 (12.2)	6 (10.9)	3.47	2	.177
Use positive self-talk	59 (13.6)	23 (9.1)	3 (5.5)	5.41	2	.067
Develop and rehearse a plan before entering a high-risk situation	24 (5.5)	19 (7.5)	6 (10.9)	2.76	2	.252
Develop a plan for dealing with emotional eating	46 (10.6)	17 (6.7)	1 (1.8)	6.63	2	.036
Practice visualization	13 (3.0)	2 (0.8)	1 (1.8)	3.76	2	.153
Enlist the help of another in my weight management efforts	44 (10.2)	19 (7.5)	3 (5.5)	2.29	2	.319
Take time to review my accomplishments	24 (5.5)	10 (3.9)	1 (1.8)	2.03	2	.363
Establish goals for behavior changes	91 (21.0)	48 (18.9)	4 (7.3)	5.96	2	.051

<sup>a</sup>Chi-square tests for independence explored the relationship between weight-change group and helpful weight management behavior strategies. The Bonferroni adjustment was applied to the  $\alpha$  level (.05/15 = .003). When significant, standardized residuals were examined to identify those cells making the greatest contribution to the  $\chi^2$  result.

<sup>b</sup>Among the high weight-change group, more participants selected “do aerobic exercise” than would be expected.

<sup>c</sup> $P$  < .003.



residuals, more participants in the high weight-change group selected “do aerobic exercise” as a helpful behavior strategy for weight management than would be expected.

There was a small, positive correlation between percent weight change and the final self-efficacy measure for weight management ( $r = 0.295$ ,  $P < .001$ ). Similarly, there was also a small, positive correlation between percent weight change and the final self-efficacy measure for physical activity ( $r = 0.234$ ,  $P < .001$ ).

## DISCUSSION

In this study, the participants of LIFESTEPS improved outcome measures of adiposity, self-efficacy, and lifestyle behaviors. Of the 1562 participants with initial body weight measures at the beginning of the program, 72.4% (1131) had final weight measures at the conclusion of the program, indicating relatively low attrition. Completion of the program was associated with significant decreases in 4 anthropometric measures (body weight, BMI, waist circumference, and waist-to-height ratio). The participants increased self-efficacy for weight management and physical activity, and percent weight change was positively associated with the final self-efficacy measures. The proportion of participants who reported engaging in self-monitoring behaviors and adopting additional positive lifestyle behaviors (fruit and vegetable consumption, physical activity) increased after completing the program. The 3 behavior strategies identified as the most helpful for weight management included “keep food records,” “do aerobic exercise,” and “measure serving sizes.”

The participants at the beginning of the program were above clinical recommendations for BMI, waist circumference, and waist-to-height ratio measures. While mean values for anthropometric measures of adiposity did not decrease to recommended values, small decreases in waist circumference and losses of 3% to 5% of body weight are associated

with health improvements, such as improved insulin sensitivity and lipid profiles.<sup>2–4, 24, 28–32</sup> Unfortunately, measures for comorbid conditions were not included in this study. Furthermore, many individuals who begin a weight loss program have weight loss goals that are often not realistic.<sup>35</sup> Individuals should seek more modest weight loss goals and recognize that clinically significant benefits may accompany these smaller losses.

Weight change during the LIFESTEPS program ranged from a loss of 16.9% to a gain of 4.5% of initial body weight. Mean percent weight loss for all participants was  $3.3 \pm 3.6\%$ . The results from the current study are similar to the findings in research examining weight loss from other commercial diets.<sup>36–38</sup> For example, a recent systematic review reported that individuals who regularly attended Weight Watchers lost approximately 5.0% of initial body weight over 3 to 6 months and maintained a loss of 3.2% at 2 years.<sup>38</sup> In another systematic review, weight loss among individuals enrolled in commercial weight loss programs (ie, Weight Watchers, Jenny Craig, or Nutrisystem) was compared with control/education conditions (no intervention or <3 sessions with a provider).<sup>37</sup> The commercial weight loss programs resulted in greater weight loss (ranging from 2.6% to 4.9%) compared with the control/education condition. In the long term, weight loss is enhanced when behavior-based programs include both diet and physical activity.<sup>39</sup> More restrictive programs tend to show larger initial weight loss but with subsequent regain greater than that seen in more moderate programs.<sup>37, 38</sup> Furthermore, both low carbohydrate and low fat dietary prescriptions are associated with significant weight loss compared with no intervention, thus, supporting the importance of recommending a diet that an individual can easily follow.<sup>36, 40</sup>

Self-efficacy, an individual's belief in his or her own ability to succeed in challenging situations, has been linked to the adoption of positive health behaviors.<sup>41</sup> However, the research literature is inconsistent in the role self-efficacy plays in weight management,

possibly due to a limited number of studies and the use of different scales to assess this behavioral construct. For instance, Fontaine and Cheskin<sup>42</sup> reported that self-efficacy was not predictive of short-term obesity treatment outcomes. However, other cross-sectional and prospective research suggests that self-efficacy predicts weight change during weight management programs.<sup>43–45</sup> Teixeira et al<sup>46</sup> also demonstrated the importance of self-efficacy for sustained weight loss. Participants in the current study reported greater self-efficacy for weight management and physical activity upon completion of the program. Self-efficacy at the end of the program was positively associated with percent weight change. These results support the importance of incorporating strategies to increase self-efficacy in weight management programs.

Participants in the current study reported a greater frequency of dietary self-monitoring upon completion of the program. Participants also selected “keep food records” and “measure serving sizes” as behavior strategies helpful in weight management. The research literature also documents the importance of dietary self-monitoring to successful weight management.<sup>47</sup> Kruger et al<sup>48</sup> showed that successful weight losers were more likely to track dietary intake and monitor weight regularly than those unsuccessful with weight loss. In another study, completing more weekly food journals was associated with a greater percent weight loss.<sup>49</sup> Recently, the combination of frequency (ie, total number of food recording days) and consistency (ie, total number of weeks completing  $\geq 3$  food recording days) of self-monitoring was shown to be associated with long-term success in weight management.<sup>50</sup> Research is also needed to identify the most optimal self-monitoring approach (ie, paper diary, electronic diary).<sup>47</sup>

After completing the program, more participants reported consuming fruits and vegetables. Research has shown that the consumption of low energy density foods (ie, fruits and vegetables) is associated with weight loss.<sup>51–53</sup> Furthermore, “eat plenty of fruits

and vegetables” was recently identified as a specific weight control practice successful for both weight loss and weight maintenance.<sup>54</sup> Thus, weight loss programs should emphasize fruit and vegetable consumption as part of the dietary intervention.

Participants identified “do aerobic exercise” as 1 of the top 3 behavior strategies selected as helpful in weight management. Among the weight-change groups, more of the participants in the high weight-change group selected “do aerobic exercise” than would be expected. Regular physical activity has been shown to help with both weight loss and weight maintenance.<sup>54–58</sup> Furthermore, the latest Position Stand of the American College of Sports Medicine reported that moderate-intensity physical activity of 150 to 250 minutes per week is associated with modest weight loss while greater amounts of physical activity ( $>250$  minutes per week) are associated with clinically significant weight loss.<sup>58</sup>

The current study has several limitations that should be discussed. First, the main limitation was the quasi-experimental research design, which lacks a control group and randomization. Because the participants were not randomly assigned to treatment and control groups, confounding variables other than the weight loss program could have impacted the study outcome measures. The lack of a random assignment also impacts the generalizability of the study results. Conclusions about causal inferences are less definitive with quasi-experimental designs. Second, the study participants included 1592 individuals who had enrolled in this weight loss program, thus introducing selection bias. The study sample predominantly included middle-aged, educated, white/Caucasian women. Thus, the study results may not be generalizable to other populations. Third, the study was conducted using secondary data analysis, and outcome measures were not available for all participants. For instance, waist circumference was available for only 156 participants. The Last Observation Carried Forward method was used to handle missing data in the statistical

analyses. This technique has the underlying assumption that the status of the individual has not changed over time.<sup>59</sup> Furthermore, measures for comorbid conditions were not included in the study. Fourth, the adiposity measures were reported by LIFESTEPS leaders. Fifth, social desirability might influence responses on the study questionnaires, particularly for behaviors that were promoted in the program. Although the preassessment and postassessment questionnaires were assessed for face and content validity, they did not undergo extensive psychometric testing prior to being used in the study, another limitation of the study. Sixth, the dietary intake and physical activity records from the participants were not available for use in the secondary data analysis. Furthermore, the participants were not asked about the frequency of self-weighing, another important type of self-monitoring in weight management. Finally, because follow-up data were not collected after completion of the LIFESTEPS program, the study is unable to assess whether the weight loss was maintained.

The current study also has several strengths. This study is the first to evaluate the outcomes of LIFESTEPS, a weight loss option available throughout the United States. The study examined multiple outcome measures associated with weight management including body adiposity, self-efficacy (weight, physical activity), and lifestyle behaviors (dietary self-monitoring, fruit and vegetable consumption, physical activity). In addition, the sample size was sufficiently large, providing adequate statistical power to assess accurately the outcome measures included in the analysis of the program.<sup>60</sup>

## CLINICAL APPLICATIONS

Participants of LIFESTEPS significantly decreased measures of adiposity, increased self-efficacy, and reported improvements of lifestyle behaviors. The participants reported that “keep food records,” “measure serving sizes,” “record calories,” and “do aerobic exercise” were the most helpful behavior strategies in weight loss. Clinicians and practitioners need program evaluation of available weight loss solutions to guide consumers in making choices about the best way to lose weight. LIFESTEPS follows the recent guidelines of the American College of Cardiology, the American Heart Association, and The Obesity Society for the management of overweight and obesity, recommending an in-person, high-intensity ( $\geq 14$  sessions in 6 months) program, led by a trained interventionist, including registered dietitian nutritionists. Assessment of the outcomes in this study suggests that LIFESTEPS is a feasible option for weight management. Furthermore, the longevity of this program and the ability to deliver the program in a variety of community-based settings make LIFESTEPS an ideal program for nutrition practitioners to incorporate into their programming or practice. Future randomized controlled trials should be conducted to identify specific programs and strategies most effective in weight management. Long-term follow-up should be included to examine whether the weight loss is maintained. Identification of comprehensive lifestyle interventions that emphasize intrapersonal factors, such as nutrition, physical activity, and behavior therapy, will yield the greatest success in weight management.

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