Journal of Consulting and Clinical Psychology
1998, Vol. 66, No. 5, 777–783

0022-006X/98/$3.00

Use of Personal Trainers and Financial Incentives to Increase Exercise in a Behavioral Weight-Loss Program

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Exercise is the best predictor of long-term weight loss. This study evaluated two strategies for improving exercise adherence and long-term weight loss in obese outpatients. Obese men and women (N = 193) were randomized to 1 of 5 treatment groups for 18 months: standard behavior therapy (SBT); SBT with supervised walks (SW) 3 times per week; SBT + SW with personal trainers (PT), who walked with participants, made phone reminders, and did make-up SW; SBT + SW with monetary incentives (I) for completing SW; and SBT + SW + PT + I. Both PT and I enhanced attendance at SWs, the combination producing the best adherence. Increased walk attendance did not result in higher overall energy expenditure, however, and long-term weight loss was also not improved. Post hoc analyses suggest that the level of exercise needed for successful long-term weight loss is much higher than that usually recommended in behavioral treatment programs.

Obesity is a major health problem in the United States (Van Itallie, 1985). About one third of adults are affected, and rates have risen dramatically in the past decade (Kuczmarski, Flegal, Campbell, & Johnson, 1994). Thus, methods for improving sustained weight loss in obese persons are clearly needed.

A great deal of research has been conducted in recent years in an effort to improve the long-term outcome of weight-loss interventions. This research has demonstrated that intensive approaches involving longer treatments and more stringent dietary recommendations can improve initial weight losses (Jeffery et al., 1993; Wadden & Stunkard, 1986). However, these improvements in short-term weight loss have not been associated with better long-term results, in part because larger initial weight losses have been followed by larger weight regains. These data suggest that improvements in long-term weight loss will require more attention to factors that specifically affect long-term weight loss as opposed to initial weight loss.

The strongest and most consistent predictor of long-term weight loss and maintenance has been physical activity. Correlational studies have found that obese individuals who are successful in initiating and maintaining exercise programs maintain weight losses better than those who do not (Colvin & Olson, 1983; Graham, Taylor, Hovell, & Siegel, 1983; Jeffery et al., 1984). Experimental studies have also demonstrated that programs with strong exercise components produce better long-term weight losses than those without (Pavlou, Krey, & Steffee, 1989; Perri et al., 1988; Wood, Stefanick, Williams, & Haskell, 1991). The main difficulty with exercise in weight control is that obese people have difficulty adhering to exercise advice (Dishman, Sallis, & Orenstein, 1985). Despite the overwhelming evidence that exercise is strongly associated with long-term weight loss, few studies have specifically focused on improving exercise adherence in this population nor have they directly compared various approaches with improving long-term exercise.

The present study examined two specific strategies for enhancing exercise adherence in obese individuals in a weight-loss program over a period of 18 months. These strategies were based on the hypothesis that interventions that more directly modify the antecedent cues and the consequences of behaviors would be more effective in changing and maintaining behavior than more traditional approaches that rely on education and therapist encouragement. The hypothesis has previously been tested in the area of eating behavior, where strengthening antecedent cues was shown to be successful (Jeffery et al., 1993). However, similar approaches have not been previously tested in the area of exercise. The procedure used in the present study for strengthening antecedent cues was to have a personal trainer call participants to schedule and cue exercise and to exercise with them in supervised sessions. The method for enhancing exercise consequences was to provide financial incentives based on attendance at supervised exercise sessions. It was hypothesized that obese individuals who were given personal trainers or those given financial incentives would attend more exercise sessions than those given standard treatment and that the highest

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This research was supported by Grants HL41332 and HL41330 from the National Heart, Lung and Blood Institute.

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exercise adherence would be achieved when both personal trainers and financial incentives were combined. Increased attendance at supervised exercise sessions was expected to increase overall energy expenditure in exercise and, consequently, to increase overall weight loss at 18 months.

Method

Participants

Participants were 29 men and 167 women recruited by media advertisement from two urban communities (Pittsburgh, Pennsylvania, and Minneapolis–St. Paul, Minnesota). To participate in the study, individuals were required to be between 14 and 32 kg overweight according to 1983 insurance industry standards, 25 to 55 years of age, free of serious diseases, able to walk for exercise, and willing to be randomly assigned to treatment conditions. The study protocol was approved by the Institutional Review Boards of the University of Pittsburgh and the University of Minnesota. Study participants were randomized within each center to one of five treatment groups (as described below) and were followed for 18 months.

Treatment Groups

Standard behavior therapy (SBT). This group, which served as the reference, or control, group, received a state-of-the-art behavioral intervention program over a period of 18 months. Participants received behavioral counseling in groups of approximately 20 individuals. Groups met weekly for 24 weeks and once per month thereafter. Group sessions were led by trained interventionists with advanced degrees in nutrition or the behavioral sciences. Each session included a weigh-in, a presentation of information by the interventionist, group discussion, and a review of progress. Participants were assigned a caloric goal of 1,000 kcal/day if they weighed less than 91 kg and 1,500 kcal/day if they weighed 91 kg or more. Dietary instructions were to remain below these caloric goals and to restrict fat intake to 20% or less of calories (22 g/day for 1,000 kcal and 33 g/day for 1,500 kcal). Participants were given menus for five breakfasts and five dinners each week, along with corresponding grocery shopping lists, and were strongly encouraged to follow them as closely as possible. This recommendation was based on prior research showing that highly structured meal plans improve short-term weight losses (Wing et al., 1996). Participants were asked to record their calorie and fat intake every day for the first 24 weeks and 1 week per month thereafter.

Exercise recommendations for this group were to initiate and sustain a program of physical activity based primarily on walking and bicycling. Participants were initially instructed to walk or bike the equivalent of 250 kcal/week and to gradually increase to a minimum of 1,000 kcal/week. No maximum level was set. Participants recorded distances walked or duration of biking in their daily food records.

Behavioral techniques taught in the program targeted eating and exercise and included (a) stimulus control techniques (e.g., reducing the visibility of food in the home, increasing the cues for physical activity, and imposing limits on where, when, and with whom participants ate), (b) problem-solving strategies (e.g., problem definition, brainstorming solutions, selecting the best solution, and evaluating success), (c) social assertion (e.g., role-playing interpersonal situations most likely to lead to increased food intake and learning to ask for support for exercise), (d) short-term goal setting and techniques for enhancing motivation, (e) cognitive strategies for altering self-defeating thoughts (e.g., perfectionism, pessimism, and self-doubt), (f) relapse prevention (i.e., learning ways to recognize precursors and consequences of dietary lapses and to plan ways to deal with high-risk situations, and (g) social support (e.g., techniques for involving spouses and other members of the family in weight-loss efforts).

Supervised exercise. Participants in this treatment condition received the same dietary and behavioral counseling as the SBT group. Their exercise goal was also 1,000 kcal/week. To assist them in reaching this goal, however, we conducted a supervised walking session three times per week. One walk was held at the same time and day as their group session (i.e., after scheduled sessions or in lieu of group sessions on off-weeks after Week 24). The other two walks were scheduled on other days of the week but at the same time of day and at the same location. The initial walking distance was 0.5 miles (0.8 km). This was gradually increased over the first 3 months of the study to 2.5 miles (4.0 km) per session. Regular attendance at these sessions, therefore, would produce a calorie expenditure of approximately 750 kcal/week. Exercise sessions in Pittsburgh were held at a 0.25-mile (0.4-km) oval track. In Minneapolis, they were conducted on city streets in a low-traffic neighborhood. At each site, walking indoors in a gym was available on days with inclement weather (at a community center in Pittsburgh and at a church gym in Minneapolis–St. Paul).

Trainer. Participants in this treatment condition received the SBT intervention and had three supervised walking sessions scheduled each week. To encourage attendance at supervised walks, we assigned a personal trainer (a student or staff assistant) to specifically work with 3 to 4 participants. The personal trainer walked with participants on their scheduled walks, made reminder phone calls before each walking session, and scheduled make-up walking sessions at times not originally scheduled to accommodate participants with scheduling problems. Trainers worked with the same small groups of participants throughout the study.

Incentive. Participants in this condition received SBT and had three scheduled walks per week as in the previous two groups. To encourage attendance at exercise sessions, we gave participants a financial award based on the number of walks attended at the end of each month. The awards were modest and increased in value with increments in cumulative attendance. Participants were paid $1 per walk for their first 25 walks, $1.50 per walk for the next 50 walks, $2 per walk for the next 50 walks, and $3 per walk for any remaining walks.

Trainer + incentive. Participants in this group received all of the procedures described above. They received SBT, supervised walks with personal trainers, and financial awards based on their attendance at walks.

Dependent Measures

Study participants were evaluated at baseline, 6 months, and 18 months. The primary outcomes of interest in the study were exercise behaviors and body weight. Weight was measured on a balance beam scale with participants wearing light clothing without shoes. We assessed exercise using the Paffenbarger Physical Activity Questionnaire (Paffenbarger, Wing, & Hyde, 1978), which provides an estimate of energy expenditure per week in kilocalories. Although subject to considerable error in estimating energy expenditure when compared with more accurate criterion measures (Jacobs, Ainsworth, Hartman, & Leon, 1993), this self-report measure has been used in many prior studies of exercise and weight loss, has been shown to be able to detect changes in exercise produced by treatment (Wing et al., 1988), and has been found to be correlated with weight changes over time (Harris, French, Jeffery, McGovern, & Wing, 1994). For participants in the four groups with supervised walks, attendance at walks was also recorded. Other data collected and presented in this report were as follows.

Information obtained from participants at baseline included age, gender, education, marital status, ethnicity, and participation in a prior organized weight-control program (yes or no). Information about habitual energy and fat intake, depression, binge eating, and perceived barriers

to adherence was obtained at baseline, 6 months, and 18 months. These variables were defined as follows.

Block Food Frequency Questionnaire (Block et al., 1986). Nutrient intake was assessed by the 60-item version of the Block Food Frequency Questionnaire developed by the National Cancer Institute. This instrument tends to underestimate energy intake but has been shown to be correlated with weight changes over time in treatment studies (Harris et al., 1994). Variables used in the present analyses were estimated energy intake per day (kcal) and percentage of energy from dietary fat.

Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Depressive symptomatology was assessed with the BDI, a well-established instrument that is commonly used as an index of psychological well-being in weight-control research.

Gormally Binge Eating Questionnaire (Gormally, Black, Daston, & Rardin, 1982). Binge eating was assessed by the Gormally Binge Eating Questionnaire, a 16-item instrument designed to assess binge eating tendencies. Although interview methods are thought to be superior to questionnaires for assessment of binge eating (Greeno, Marcus, & Wing, 1995), binge eating was a secondary outcome in this study.

Barriers to Adherence Questionnaire. Barriers to adherence were assessed by a 15-item questionnaire devised to assess participants' perceptions of practical, social, and interpersonal barriers to successful behavior change (Jeffery et al., 1993).

Design and Analysis

The study was comprised of five treatment groups. Four of these (i.e., supervised exercise, trainer, incentive, and trainer + incentive) were structured as a 2 × 2 design to evaluate the effects of personal trainers and incentives, both singly and in combination as methods to enhance attendance at supervised exercise sessions and long-term weight loss. The fifth group, SBT, was a usual-care reference group. Analyses were conducted to assess changes in the study dependent variables for two time intervals, baseline to 6 months (representing short-term change) and baseline to 18 months (representing long-term change). Statistical evaluation used the general linear modeling programs of the SAS Institute (1989). Factors included in the change analyses were the baseline value of each dependent variable, treatment group, center, and gender. Planned orthogonal contrasts were also included to specifically test for effects that were due to trainers, incentives, the interaction between trainers and incentives, and all four treatments involving supervised exercise versus the SBT reference group.

Results

Table 1 presents characteristics of study participants at baseline as a function of treatment group. Participants averaged about 40 years of age and were highly educated (≥college). Over 80% were women, most were White, and a majority had participated in a formal weight-control program in the past. Average body mass index was about 31. Treatment groups did not differ significantly on any of these baseline variables.

Attrition of participants from the study over 18 months was modest. On average, 87% of those enrolling completed the 6-month evaluations and 78% completed the 18-month evaluations. Attrition did not differ by treatment group. In an effort to maximize completeness of follow-up at 18 months, we asked participants who were unwilling to attend clinic visits at this time to report their weight by phone, and 15 did so. Outcome analyses (described below) were performed with and without these 15 individuals, and there were no differences in the pattern of results. Analyses based on measured weights only are presented below.

Table 2 shows the effects of the trainer and incentive interventions on attendance at supervised walking sessions over the 18 months of the study. Data are presented for three time periods, Weeks 1 to 26, Weeks 27 to 78, and Weeks 1 to 78. Attendance at supervised exercise sessions decreased significantly in all treatment groups ($p < .001$). For each time period, however, intervention groups differed significantly in walk attendance (all $ps < .001$), and the pattern of effects was the same. Main

Table 1
Mean and Standard Error of Measurement Baseline Characteristics of Study Participants by Treatment Group

	Treatment group									
	SBT (n = 40)		Supervised exercise (n = 41)		Trainer (n = 42)		Incentive (n = 37)		Trainer + incentive (n = 36)	
Variable	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*
Age (years)	40.0	1.3	41.5	1.3	41.0	1.3	42.6	1.4	40.7	1.4
Gender (% female)	82		83		79		86		86	
Education (% ≥college)	78		80		81		65		83	
Marital status (% married)	55		68		52		57		53	
Ethnicity (% White)	82		71		88		73		86	
Ever in a weight program (%)	45		71		62		68		58	
Body weight (kg)	85.6	1.7	87.1	1.6	84.7	1.6	87.7	1.7	85.7	1.7
BMI (kg/m^2)	31.4	0.3	31.5	0.3	31.4	0.3	31.5	0.4	30.6	0.4
Energy intake (kcal/day)	1,632	176	2,087	174	2,043	172	1,760	183	1,898	186
Fat intake (% of energy)	36	1	36	1	34	1	36	1	38	1
Exercise (kcal/week)	681	103	725	113	699	108	768	128	628	99
Beck Depression Inventory	5.3	0.7	4.9	0.7	4.5	0.7	5.2	0.7	3.8	0.7
Binge eating score	16.0	1.3	15.7	1.3	18.3	1.3	17.7	1.3	14.2	1.3
Perceived barriers to adherence	36.9	1.3	38.1	1.2	36.3	1.2	35.2	1.3	38.1	1.3

Note. SBT = standard behavior therapy; BMI = body mass index.

Table 2
No. of Walk Sessions Attended by Treatment Group

No. of walks completed	Treatment group: Supervised exercise	Trainer	Incentive	Trainer + incentive
Weeks 1–26[a]				
M	26.0	43.8	33.3	51.8
SEM	3.2	3.2	3.4	3.4
Weeks 27–28[b]				
M	9.0	36.6	32.5	51.6
SEM	6.0	5.9	6.3	6.4
Total				
M	35.0	80.4	65.8	103.4
SEM	8.4	8.3	8.8	9.0

Note. For all analyses, $p = .001$.
[a] 75 total possible walks. [b] 147 total possible walks. [c] 222 total possible walks.

effects were observed for the trainer intervention (all $ps < .001$) and for the incentive intervention (ps ranged from .02 to .001). Interactions between the two were not significant. Used singly, the trainer and incentive interventions each approximately doubled the number of walks attended over 18 months. When used together, the number of walks attended was increased threefold. Total attendance at supervised walking sessions over 18 months, collapsing across treatment groups, was modestly correlated with overall weight change ($r = -.35$, $p < .0001$). Walk attendance was also marginally associated with long-term dietary fat reduction and with long-term increase in total exercise as measured by the Paffenbarger Questionnaire ($rs = .15$, $ps < .10$). Thus, walk attendance appears to have provided an index of behaviors that were conducive to weight loss, including both dietary and exercise adherence.

Table 3 shows the average level of total exercise achieved by each treatment group at 6 and 18 months as measured by the Paffenbarger Questionnaire and mean change from baseline in total exercise after adjustment for baseline values, center, and gender. Two points are noteworthy in this table. First, participants in all five treatment groups achieved the study goal of 1,000 kcal/week at both 6 and 18 months. Second, despite highly significant group differences in attendance at supervised exercise sessions, no differences were observed between the treatment groups in overall exercise level at either time point.

Table 4 shows mean weight changes in the five treatment conditions from baseline to 6 months, from 6 to 18 months, and from baseline to 18 months. Analyses controlled for gender and center. Baseline weight was included as a covariate for the analyses of weight changes from baseline to 6 months and from baseline to 18 months. Weight change from baseline to 6 months was included as a covariate in the analysis of weight change from 6 to 18 months. Weight changes from baseline to 6 months did not differ by treatment group. The overall test for treatment group differences for weight changes from 6 to 18 months was also not significant. However, the overall test for treatment group differences was significant for weight change from baseline to 18 months, $F(4, 145) = 2.97$, $p < .03$. Examination of the planned contrasts showed that this effect was due to the fact that participants receiving standard treatment had greater weight losses at 18 months (7.5 kg) than the four groups receiving supervised exercise (4.2 kg). Weight-change analysis from baseline to 18 months also revealed a main effect for center, $F(1, 145) = 5.37$, $p < .03$. Study participants in Minneapolis–St. Paul lost more weight through 18 months on average (5.9 kg) than those in Pittsburgh (3.7 kg). However, no Treatment Group × Center interaction was observed, and the pattern of between-groups differences in weight loss was the same in both centers; that is, in both centers, the SBT group had greater weight losses than any of the other treatment conditions.

Secondary outcome measures for the study were energy intake and fat intake as measured by the Block Food Frequency Ques-

Table 3
Achieved Level of Total Exercise at 6 and 18 Months and Change From Baseline as Measured by the Paffenbarger Questionnaire

Exercise (kcal/week)	Treatment group: SBT	Supervised exercise	Trainer	Incentive	Trainer + incentive
Achieved at 6 months					
M	1,203	1,331	1,531	1,105	1,258
SEM	158	160	149	163	167
Change from baseline to 6 months[a]					
M	522	606	832	337	630
SEM	158	160	149	163	167
Achieved at 18 months					
M	1,119	1,063	1,294	1,426	1,272
SEM	169	179	164	180	182
Change from baseline to 18 months[a]					
M	438	338	595	658	644
SEM	169	179	164	180	182

Note. SBT = standard behavior therapy.
[a] Change scores adjusted for baseline value, center, and gender.

Table 4
Mean and Standard Error of Measurement Weight Change by Treatment Group

	Weight change in kilograms					
	Baseline to 6 months[a]		6 months to 18 months[b]		Baseline to 18 months[a]	
Treatment group	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*
SBT	−8.3	1.0	0.9	0.8	−7.6	1.1
Supervised exercise	−6.0	1.1	2.9	0.9	−3.8	1.3
Trainer	−5.6	1.0	3.4	0.8	−2.9	1.1
Incentive	−6.7	1.1	2.1	0.8	−4.5	1.2
Trainer + incentive	−7.9	1.1	2.2	0.9	−5.1	1.3

Note. For both baseline to 6 months and 6 months to 18 months, p was nonsignificant. For baseline to 18 months, $p = .03$. SBT = standard behavior therapy.
[a] Adjusted for baseline weight, gender, and center. [b] Adjusted for weight change from baseline to 6 months, gender, and center.

tionnaire and psychological status as assessed by the BDI, the Binge Eating Questionnaire, and the Barriers to Adherence Questionnaire. Analyses of differential changes over time in these variables by treatment group were done in the same way as analyses involving exercise and weight changes. Of the 10 analyses thus generated, 2 indicated treatment group differences with p values less than .05. At 6 months, participants in the 2 incentive conditions reported greater reductions in energy intake than those in the nonincentive groups, $F(1, 151) = 9.66$, $p < .003$, and at 18 months, participants in the SBT group reported less reduction in fat intake than those in the 4 supervised exercise groups, $F(1, 146) = 5.10$, $p < .03$.

A final set of analyses was done to further explore the relationship between the levels of exercise that participants were able to achieve in the long term and weight losses over time. These analyses collapsed across treatment group and examined weight losses at 6 months and at 18 months as a function of self-reported exercise at 18 months. Analyses were first done using linear regression analyses, treating exercise as a continuous variable. These analyses indicated that exercise level at 18 months was not significantly related to initial weight loss but was strongly related to long-term weight loss, $F(1, 141) = 13.6$, $p < .001$. Nonlinear models (e.g., quadratic) did not fit the data better than a linear model, suggesting that the influence of exercise on long-term weight was directly proportional to calorie expenditure over the entire exercise range. To better display the long-term exercise effects at 18 months, we computed weight change at 18 months as a function of quartile of exercise. These results, displayed in Table 5, show that the levels of total exercise reported by participants at 18 months covered a wide range. Those in the lowest quartile of exercise reported an average exercise level of only 257 kcal/week, the equivalent of about 45 min of walking per week, whereas those in the highest quartile reported an average exercise level of 2,550 kcal/week, the equivalent of over 1 hr of walking per day. It is especially noteworthy that the dose of exercise that was associated with long-term weight-loss success seems to be considerably higher than the 1,000 kcal/week target in this and many other weight-loss studies. Little long-term benefit was associated with 1,000 kcal/week, whereas 2.5 times this amount was associated with near-perfect weight maintenance.

Discussion

Exercise has been shown to be the best overall predictor of long-term weight maintenance in obese patients. This study evaluated two methods for increasing physical activity in this population with the expectation that increasing physical activity would enhance long-term weight loss. The interventions investigated emphasized enhancing cues for exercise through a personal trainer and enhancing the consequences of exercise by providing modest material rewards for attendance at exercise sessions. Results indicated that both interventions had a positive effect on the targeted exercise behaviors (i.e., attendance at supervised walking sessions). Used singly, personal trainers and incentives each doubled attendance at these sessions. When both

Table 5
Long-Term Weight Loss as a Function of Self-Reported Exercise Level (Paffenbarger Questionnaire) at 18 Months

	Weight change in kilograms	
Quartile (range)	Baseline to 6 months	Baseline to 18 months
Q1 (0–486 kcal/week)		
M	−6.0	−2.9
SEM	0.9	0.9
Q2 (504–965 kcal/week)		
M	−8.0	−3.6
SEM	0.9	0.9
Q3 (980–1,618 kcal/week)		
M	−6.7	−4.8
SEM	0.9	0.9
Q4 (1,624–4,616 kcal/week)		
M	−8.1	−7.7
SEM	0.9	0.9

Note. Q = Quartile.

techniques were used in combination, attendance at exercise sessions was approximately tripled.

These results extend the findings of a previous study in which more direct manipulations of the environment were used to modify eating behavior (Jeffery et al., 1993). In that study, it was found that direct provision of food to participants, an approach used to increase antecedent cues for appropriate eating behavior, was effective in increasing weight loss over 18 months. This result is comparable with the present finding that cuing of exercise behavior with the use of a personal trainer increased exercise compliance. The results of the two studies in regard to interventions to directly manipulate behavioral consequences, however, were discrepant. In the previous study, the approach used to directly manipulate consequences was to provide financial incentives for weight loss and maintenance. This intervention had no benefit for eating behavior or weight loss. In the present study, consequences for exercise were manipulated by directly paying participants small sums contingent on attending exercise sessions. This intervention had a significant positive effect on exercise session attendance. The fact that the reward in the previous study was contingent on a distal consequence of behavior (i.e., weight), whereas the reward in the present study was contingent on an immediate and directly observable behavior may account for the difference.

Unfortunately, the exercise interventions tested in this investigation did not achieve their primary objectives, which were to enhance overall exercise levels and long-term weight loss. Despite highly significant group differences in the targeted exercise (i.e., supervised walking), overall energy expenditure as assessed by the Paffenbarger Questionnaire did not differ by treatment group. All groups achieved the 1,000 kcal/week study goal with no differences between them. Moreover, whereas short-term weight losses in the five treatment groups did not differ significantly, long-term weight losses were actually significantly better in the standard therapy group than in any of the treatments that included a supervised exercise program. The finding of better long-term weight loss in the SBT was unexpected and difficult to explain. The fact that the SBT group was the most successful at each of the study centers strengthens this finding and its perplexing quality. No differences were observed in exercise or diet that would explain better weight losses in the SBT group. The groups also did not differ in attendance at treatment sessions or in dropout rate. It is possible that the emphasis placed on exercise in the supervised exercise conditions tended to undermine participants' commitment to following their diet plan or that participants attending supervised walks inadvertently or intentionally reduced their activity in other domains, an effect that has been observed in other studies (Goran, Allison, & Poehlman, 1995). However, such effects were not captured by the self-report diet and exercise measures used, perhaps because of their insensitivity to such subtle changes.

In our view, there are two likely reasons for the failure of the exercise interventions in our study to improve overall exercise level and weight loss. The first is that supervised exercise at a clinic site may not be an optimal exercise target for obese patients. The interventions used in our study clearly affected attendance at supervised exercise sessions. Over 18 months, however, attendance at these sessions was modest. Even the best treatment group averaged less than 50% attendance. Thus, even though attendance at exercise sessions predicted weight loss, the achieved levels of exercise in the enhanced exercise groups may have been too small to produce detectable between-group differences in weight loss. Wadden et al. (1997) have recently reported similar declines in attendance at exercise sessions scheduled two times per week between Weeks 25 and 40 of a long-term exercise intervention with obese patients. The decision to focus on supervised exercise in our study was dictated in part by the desire to target an exercise regimen that could be objectively verified. Moreover, previous research had suggested that it was an effective exercise modality (Pronk & Wing, 1994). However, two recent randomized studies, published after ours was initiated, have now shown that adherence to clinic-based exercise regimens is poorer than to home-based exercise programs (King, Haskell, Young, Oka, & Stefanick, 1995; Perri, Martin, Leermakers, Sears, & Notelovitz, 1997).

A second, and perhaps the most important, possible reason for weak results in this study is that the targeted energy expenditure level was too low. The level chosen was the same for all groups in the study, 1,000 kcal/week, and is the level typically used in behavioral weight-loss programs. By self-report, participants in all groups actually exceeded this level on average at both 6 and 18 months. Post hoc analyses examining the relationship between amount of exercise achieved by participants and their long-term success in weight loss reinforces the idea that 1,000 kcal/week is an ineffective exercise target for weight loss. Study participants reporting exercise levels at or slightly above the 1,000 kcal/week study goal experienced only slight benefit with respect to long-term weight loss compared with those whose long-term exercise levels were at or below 1,000 kcal/week. However, study participants who spontaneously adopted exercise levels more than twice of that recommended for them had excellent long-term weight losses and little or no weight regain between 6 and 18 months. These findings suggest that future research aimed at examining the most appropriate dose of exercise for promoting long-term weight loss and the feasibility of achieving such levels in obese patients is warranted.

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Received June 10, 1997
Revision received October 7, 1997
Accepted April 8, 1998 ■