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Adolescent obesity intervention: Validation of the SHAPEDOWN program[1]

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The effectiveness of the adolescent obesity intervention SHAPEDOWN was evaluated for 15 months through a ran-domized experimental design study. Test groups (no.= 37) participating in the intervention were compared with a no-treatment control group (no.=29) at four sites in nor-thern California. The program employs a variety of cognitive, behavioral, and affective techniques adapted to make successive small modifications in diet, exercise, communication, and affect that are sustainable. Very-low-calorie or restrictive diets are avoided in the program. Parents are instructed on strategies for supporting their adolescents' weight-loss efforts. Participation in the group application of the program was associated with significant improvement in relative weight, weight-related behavior, depression, and knowledge of weight management concepts at post-treatment and at 1-year follow-up. Self-esteem increased significantly regardless of condition. Change in relative weight for the test group was -9.9 ± 14.9% (mean ± standard deviation) and for the control group was -0.10 ± 13.2%. At month 15 of the study period, weight change in the test group compared with the controls was -5.15 kg. For all subject variables examined in the test group, mean change in relative weight at 1-year follow-up was negative, suggesting that none of the characteristics examined contraindicate pro-gram participation among obese adolescents seeking care. Drop-out rate was 16%. The study suggests that the program produces significant long-term outcomes in obese adolescents and is transferable to a variety of settings. Recognition of the refractory nature of adult obesity and appreciation of the somatic and psychosocial disadvantages of excessive adiposity during the pubertal period have contributed to increased interest in the secondary prevention of obesity during adolescence (1). Recent data reflecting an increase in adiposity among youths (2) are likely to intensify this concern.

Despite the concern about adolescent obesity, the literature reveals little success (3-9) with its treatment. Comprehensive clinical interventions for the problem re-main relatively rare, and most interventions reporting some success fail to provide evidence of maintained or continued weight losses (10-16). Further, some treat-ments that demonstrate beneficial effects in the long-term (17-20) use methodologies not clearly distinguish-able from those treatments associated with poor long-term outcomes. Although a combined approach of nu-trition, exercise, behavioral techniques, cognitive restruc-turing, and social support (3,21) has been suggested, only parental participation (13,18,22), stimulus control (17), frequent therapeutic contact (20), and individualized treatment (23) are supported by controlled clinical trials.

No researcher participating in the interventions show-ing long-term effectiveness has published materials that facilitate accurate program replication for either research or service purposes, although a manual adaptable to ado-

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lescents has been developed by one researcher (24). The observation by health care providers of the preponderance of unsuccessful interventions and the seemingly idiosyncratic effectiveness of others contributes to the relative lack of clinical care for obese youth.

The development of the SHAPEDOWN program (25,26) began in 1979 in response to the need for adolescent obesity interventions that are transferable to a wide range of clinical and geographic sites and that produce significant long-term outcomes. The current study evaluates the effectiveness and transferability of the group application of the program. Study hypotheses were that participation in SHAPEDOWN would be associated with reduced relative weight, decreased frequency of obesity-related behavior, improved self-esteem and weight management knowledge, and less depression and that the positive outcomes would not be affected by site.

The program was developed within the context of an adolescent health training program at the University of California, San Francisco, Division of Adolescent Medicine. The program comprises a leader's guide (25) and two workbooks (26), one for parents and another for ado-lescents, that are suitable for self-instruction, individual counseling, and group intervention. The program em-ploys a variety of cognitive, behavioral, affective, and interactional techniques adapted to the needs of adolescents.

Using a self-directed change format, the program encourages adolescents to make successive, sustainable, small modifications in diet, exercise, relationships, lifestyle, communications, and attitudes. Very-low-calorie or restrictive diets are avoided in the program. Parents are instructed on strategies for supporting their adoles-cents' weight-loss efforts, including altering family dietary and activity patterns and improving parenting and communication skills.

Nutritionists volunteered as group leaders in this study, in response to notices in professional nutrition publications and letters to all public health nutritionists in California. Four were selected on the basis of professional qualifications and the geographic settings, socioecono-mic groups, and types of facilities they served. Three of the group leaders were registered dietitians; three had master's-level degrees; all were women. None had conducted adolescent obesity group interventions previously or had significant clinical experience with obese adolescents. Sites included a rural health depart-ment, a rural nutrition private practice, a suburban medical clinic, and an urban medical center outpatient clinic. All sites were located in northern California. Group leaders participated in brief training that involved 7 hours of instruction on adolescence, adolescent obesity, and adolescent weight management according to specific objectives and 3 hours on study methodology.

Group leaders recruited subjects through announce-ments in local papers and notices to physicians and school personnel. All of the 66 subjects who sought to enroll in the intervention agreed to participate in the study and were randomly assigned to the test group (no. = 37) or the control group (no. = 29).

Test group subjects were enrolled in a group weight management program in which group leaders conducted 14 weekly sessions for test group subjects and two parent sessions utilizing the materials of the SHAPEDOWN program. Each 90-minute session included voluntary weigh-in, leader-facilitated group interaction, and an exercise period. All test group subjects provided group leaders with medical approval forms executed by their physicians. Fees for the intervention were consistent with each site's normal charges for such services. Control group subjects received no treatment initially and were charged no fees but were informed that they could enroll in the next program that would commence in 6 months. Height and weight measurements were taken and questionnaires were presented at baseline, 3 months (end of test group intervention), and 15 months (1 year after termination of the intervention). Only height and weight data were collected at 6 months.

The following measures and instruments were used:

Relative weight was determined by first evaluating height and weight using standard methods. Each sub-ject's age, sex, and height were compared with nationally representative height and weight data (27) to identify mean or expected weight. Relative weight was deter-mined by dividing actual weight by expected weight and multiplying by 100. Thus a subject whose relative weight is 120 exhibits an actual weight that is 20% greater than mean weight for his or her age, sex, and height.

Weight-related behavior was measured by the Habit Inventory (26), a 44-item questionnaire comprising 11 subscales. Each subscale includes four items describing behaviors representative of one weight-related behav-ioral area. Respondents identify the frequency with which they engaged in each behavior during the preceding week. For instance, the subscale regarding quantity of food consumed requests respondents to identify whether they rarely, sometimes, or often had second helpings of food, ate a lot when snacking, had small amounts of food, and ate more than friends during the preceding week. The subscales of the Habit Inventory are: caloric density

of the diet, frequency of ingestion, quantity of food consumed, exercise, activity, internal/ external cue responsivity, hyperemotional state eating, compulsive eating pattern, eating style, eating environ-ment, and assertiveness. The Habit Inventory demon-strated sufficient reliability (28) and has been shown to discriminate between obese and normal weight groups of adolescents (28), an indication of its validity. In addition, changes in Habit Inventory scores have also been shown to be related to weight loss (15).

Affect was evaluated with respect to two factors. Self-esteem was measured by Rosenberg's Self-Esteem Scale (29), a 10-item questionnaire. Depression was measured with Rosenberg's Depressive Affect Scale (29), a 6-item questionnaire. Both instruments have been used exten-sively with adolescents and have demonstrated sufficient reliability (29). Lengthier psychometric instruments were

Table 1. Description of subjects: Selected means values, ranges, and significance (*t*-tests)

parameters	*SHAPEDOWN group*		*no-treatment group*		t-*tests*
	mean value	*range*	*mean value*	*range*	
gender (no.)					
all	37		29		
girls	30		22		
boys	7		7		*p*=.05
age (yr)	15.6	12-18	15.6	14-18	NS*
school performance†	3.6	1-5	3.7	1-5	NS
onset of obesity‡	2.97	1-4	3.14	1-4	NS
actual weight (kg)	79.2	58.05-134.55	76.95	59.40-121.95	NS
relative weight (%)	136.5	113-213	129.5	114-202	NS

*NS = not significant.
†Scoring relates to current school performance: 1 = As and Bs, 5 = Ds and Fs.
‡Scoring relates to age groups: 1 = birth to 2 years, 4 = 12 years and older.

excluded from use because of their prohibitive administration time.

Weight management knowledge was determined by the SHAPEDOWN Knowledge Test (30). This instrument consists of 20 true/false items pertaining to instructional objectives common to obesity interventions, such as objectives related to exercise, nutrition, and weight management information.

At the initial meeting, subjects completed a registration form that included demographic and other items. At 15 months they completed a questionnaire probing their weight management activities during the study period. Controls were notified at 6 months of a subsequent program offering. Group leaders' perceptions of program content, process, and outcomes were elicited at the conclusion of the intervention.

Data were analyzed using paired *t*-tests of the test and control groups' mean scores at baseline and 3 months, and at baseline and 15 months. The dependent variables were relative weight, obesity-related behavior, self-esteem, depression, and knowledge. Paired *t*-tests were also applied to mean scores at baseline and 6 months for relative weight only. Analyses were based on data from all subjects entering the study, regardless of their level of participation in the intervention. To examine site and group differences, *t*-tests were used, comparing initial mean scores for subject characteristics and dependent variables among the four sites and between test and control groups. To determine participation, number of sessions attended and drop-out rate were calculated. Dropout was defined as intent to discontinue participa-tion, regardless of actual number of sessions missed, a cri-terion likely to overestimate rather than underestimate this rate. Determination of drop-out rate was based on all test group subjects. Three test group participants were excluded from the analysis of dependent variables and one from the analysis of selected variables and relative weight because of missing data.

Results

Subjects (Table 1) differed widely in age, relative weight, age at onset of obesity, obesity, school performance, num-

Table 2. Changes in dependent variables for test and control groups at 3* and 15† months compared with baseline

variable‡	***month of study***	***SHAPEDOWN group (no. = 34)***	***p value***	***no-treatment group (no. = 29)***	***p value***
knowledge	3		<.001	0.63±2.28	
	15	2.94±2.68#	<.001	0.53±2.19	NS
self-esteem	3	3.73±2.84	<.005	0.52±1.34	¶
	15	0.88±1.50	<.001	0.47±1.02	NS
depression	3	1.50±1.71	<.005	0.62±1.67	<.005
	15	0.78±1.29	<.005	0.70±2.81	
behavior	3	1.06±3.10	<.005	6.82±9.24	<.01
	15	12.37±10.49	<.05	8.85±12.80	NS
relative	3	12.85±15.25	<.001	–0.3±6.61	NS
weight	15	–5.9±6.75	<.01	–0.1±13.20	NS
		–9.9±14.98			NS
					NS
					NS

*End of treatment for SHAPEDOWN group.
†One year post-intervention for SHAPEDOWN group.
‡Higher scores indicate: greater knowledge of weight management principles, higher self-esteem, less depressive affect, greater frequency of behavior associated with weight loss or normal weight, and greater deviation above mean for height, age, and sex.
#Mean ± standard deviation
¶NS = not significant.

ber of life changes, and individual initiating care. Yet there were no significant differences between groups or among sites in mean values for those variables or for initial values of weight, behavior, depression, self-esteem, or knowledge. There were significantly more boys in the control group. Subjects were from a wide range of socioeconomic groups. Race of subjects, as identified by group leaders, was predominantly Caucasian (88%), with 5 subjects identified as Hispanic, 1 as Asian, and 2 as black. Non-Caucasian subjects were distributed equally between test and control groups.

At 3 months and 15 months (Table 2), the test group demonstrated significant improvement in relative weight, weight-related behavior, self-esteem, and weight man-agement knowledge and less depression, whereas the control group significantly improved in self-esteem only. At 6 months, both the test and the control group had de-creased their mean relative weight significantly. There were no significant differences among sites in changes in these variables.

Relative weight (Figure 1) for the test group decreased significantly during the initial 3 months of the study period, whereas that of the control group was static. Dur-ing the following 3 months, which were summer months, both groups decreased their relative weights in compari-son with initial values. However, by month 15 of the study period, mean relative weights of test and control groups had diverged substantially.

Absolute weight changes showed the same trends. Mean weight changes at 3, 6, and 15 months were –3.11 kg, -1.40 kg, and –3.88 kg, respectively, for the test group and +0.13 kg, -1.05 kg, and +1.27 kg for the control group. At the conclusion of the study the test group demon-strated a mean absolute weight loss of 5.15 kg in comparison with controls. Absolute weight data are considered less valid (19) than relative weight data in as-

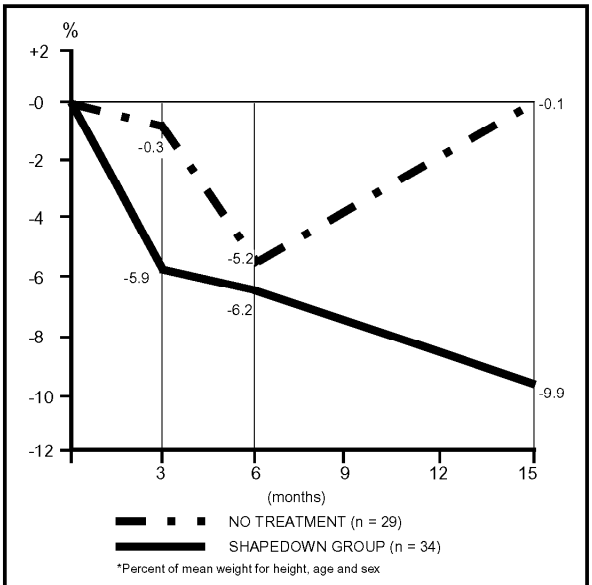

FIG. 1. *Mean changes in relative weight (percent of mean weight for height, age, and sex).*

Table 3. Changes in relative weight at 15 months for SHAPEDOWN participants (no.=33) grouped by selected variables

variable	*no.*	*mean change in weight (%)*
age (yr)		
14	7	-3.14
15	6	-17.66
16	12	-8.66
17	6	-9.00
18	2	-21.00
gender		
girls	26	-11.42
boys	7	-4.43
relative weight		
less than 125%	15	-3.93
125% to 149%	10	-7.50
150% or more	8	-24.25
age of onset of obesity		
infancy to 11 yr	17	-8.76
12 yr or more	16	-11.18
school performance*		
lower	16	-9.00
higher	17	-10.82
number of recent life changes†		
0	11	-12.28
1 to 3	22	-8.77
idea to seek intervention		
own	9	-11.22
own and parent	8	-4.71
parent	11	-9.91
teacher/health care provider	5	-16.25
number of parent sessions attended		
0 or 1	24	-7.67
2	9	-16.00

*Lower indicates school performance of satisfactory or poor; higher indicates school performance of good or excellent.
†Indicates number of life changes in previous year

sessing change in adiposity during adolescence because they do not account for differences in growth. In the current study and in others (17), growth was found to be highly variable. Stature increased as much as 6 in. during the 15 month study period. However, since short-term growth factors during the 3 months of the intervention period were calculated to amount to less than the standard measurement error, the data may be sufficiently valid.

In all the subsets of the test group examined, mean relative weight change was negative (Table 3). There were no groups in which mean relative weight increased. In the test group, mean number of sessions attended were 11.4 of the 14 offered. Seven of the 14 sessions were attended by 97% of the subjects. Drop-out rate was 16%. Extent of parental participation varied, with one or more parents attending two sessions for 19.1% of subjects and one session for 68.1 % of subjects. For 12.8% of subjects, parents attended none of the sessions offered.

Group leaders rated the process, content, and outcomes of the program highly, with all evaluating those aspects as good or excellent. Through post-intervention interviews and questionnaires, group leaders made nu-merous recommendations for minor content and process changes, many of which were subsequently incorporated into program materials. At the end of the study, all of the groups' leaders indicated that they intended to deliver the program again.

As predicted, program participation was associated with significant improvement at post-treatment and 1-year follow-up in relative weight, weight-related behavior, depression, and knowledge of weight manage-ment concepts.

Contrary to our prediction, both groups at 3 and 15 months of the study period showed significantly im-proved self-esteem, although the increase was greater in the test group. Program participation may have produced improved self-esteem in the test group subjects. Controls may have participated in other activities that improved their self-esteem, or the observed improvement in self-esteem may be secondary to maturation, since age and self-esteem are positively correlated during adolescence.

Mean change in relative weight of the test group was comparable with or greater than the change during other low-risk interventions. The cohort in the Coates et al. study (20), receiving daily therapeutic contact and rewards, showed a greater mean reduction in relative weight (12%) than the current study at post-treatment; however, at 6 months, mean losses decreased (8%). Only Brownell et al. (18) reported a greater long-term reduction in relative weight. Their intervention, methodologically similar to the SHAPEDOWN program, differed in parental involvement, requiring participation in 16 rather than 2 sessions. One interpretation of the data is that the program could benefit from more extensive parent participation. Another is that the required parent participation in Brownell's study elicited self-selection of adolescents with supportive parents, a predictor of success in adolescent weight management (13,18, 22). Post-treatment weight loss in our study was also less than that shown during higher risk interventions. Very-low-calorie diets may cause significant losses in lean body mass (31), decrease growth velocity (32), and be ineffective in the long term (33). Surgical approaches in the pediatric population (34) have shown excessive morbidity and mortality.

The test group changes in mean relative weight and weight-related behavior were consistent with moderate weight reduction. SHAPEDOWN participants may have been successful in incorporating into their life-styles behavioral changes affecting energy balance. Control group subjects, in contrast, appear to have accomplished only transient changes in weight. Their weight loss during the summer months (months 4 through 6 of the study period) may have reflected behavioral factors associated with the season or with school attendance. However, control group subjects did not sustain such changes and achieved no significant changes in behavioral or weight variables in the long term.

In contrast to interventions that produce beneficial changes primarily during the interventions, the data corroborate the finding of others (17-19) that weight loss may continue during the post-intervention period. The observation is particularly important since initial weight loss from life-style change interventions is modest. An approach emphasizing such interventions minimizes the risk of negative somatic and psychological consequences and appears to be capable of producing long-term beneficial effects.

All of the subgroups examined demonstrated weight loss (Table 3). None of the variables appears to contraindicate participation, although sample size limits confidence in several of the observed trends. Consistent with the findings of others, increased age (6,18), parental participation (13,18, 22), and greater overweight (11,18) were associated with weight loss. Contrary to the findings of some (17,19), weight outcomes were similar, regardless of level of school performance, perhaps due to the emphasis during development on participant mastery of core instructional objectives. Gender-related differ-ences in adolescent obesity treatment outcomes have received little research attention. Later onset of obesity and absence of recent life changes were associated with greater decreases in relative weight. Weight loss was similar when the adolescents perceived themselves, their parents, or a teacher/health care provider to have initiated care. However, when the adolescent reported that the decision was shared, weight reduction outcomes were lower, perhaps indicating that emancipation struggles may thwart weight loss attempts.

The 16% drop-out rate in this study is among the lowest reported by non-school integrated treatments.

Drop-out rates typically exceed 50% and range, according to Dietz (4), from 24% to 78%.

The transferability of the intervention is suggested by the finding of no significant site differences in program effectiveness. In addition, a study (15) of the program's application to group summer day camp produced short-term outcomes similar to those depicted in the current study. The program has been revised (35) since comple-tion of this study to include more extensive parental involvement and supportive family education materials.

This study supports the effectiveness and transferability of the group application of the SHAPEDOWN program for adolescents. Data on subjects' changes at 2 to 5 years, and further investigation of program effectiveness with specific segments of the obese adolescent population, such as boys, the early-onset obese, and specific ethnocultural groups, would provide useful further validations for the study.

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