A School Nurse-Delivered Intervention for Overweight and Obese Adolescents

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Abstract

BACKGROUND—Models are needed for implementing weight management interventions for adolescents through readily accessible venues. This study evaluated the feasibility and efficacy of a school nurse-delivered intervention in improving diet and activity and reducing BMI among overweight and obese adolescents.

METHODS—Six high schools were randomized to either a 6-session school nurse-delivered counseling intervention utilizing cognitive-behavioral techniques or nurse contact with provision of information. Eighty-four overweight or obese adolescents in grades 9 through 11 completed behavioral and physiological assessments at baseline and 2- and 6-month follow-ups.

RESULTS—At 2 months, intervention participants ate breakfast on more days/week (difference = 1.01 days; 95% CI 0.11, 1.92), and had a lower intake of total sugar (difference = –45.79g; 95% CI –88.34, –3.24) and added sugar (difference = –51.35g; 95% CI –92.45, –10.26) compared to control participants. At 6 months, they were more likely to drink soda ≤ one time/day (OR 4.10:

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95% CI 1.19, 16.93) and eat at fast food restaurants ≥ one time/week (OR 4.62: 95% CI 1.10, 23.76) compared to control participants. There were no significant differences in BMI, activity or caloric intake.

CONCLUSION—A brief school nurse-delivered intervention was feasible, acceptable, and improved selected obesogenic behaviors, but not BMI.

Adolescent obesity has increased dramatically over the past several decades, with 34% of adolescents and young adults, ages 12 to 19 currently overweight or obese.[1] Overweight or obese youth are at increased risk of becoming obese adults.[2] High BMI (Body Mass Index) in adolescents increases the risk of developing adult-onset diseases and health conditions such as type 2 diabetes, insulin resistance and the metabolic syndrome, and cardiovascular disease risk factors such as elevated blood pressure and serum lipids.[3] Obese youth also are more likely to suffer depression and low self-esteem.[4]

Adolescence is marked by the establishment of greater independence, and thus, provides an opportunity to promote lifelong healthy lifestyles that will affect physical and psychosocial outcomes both during adolescence and into adulthood. Yet adolescents have been understudied and underserved in obesity treatment compared to adults and pre-adolescents.[5] A recent systematic review for the US Preventive Services Task Force[6] found that comprehensive behavioral interventions consistent with expert committee recommendations[7] including healthy diet and physical activity counseling and behavioral management training are efficacious for decreasing BMI in youth. However, the mean age was between 11 and 12, and effective interventions were conducted in specialty health care settings such as pediatric obesity referral clinics that have limited reach.[6]

A tremendous need therefore exists to test models for implementing expert committee recommendations for weight management interventions[8] with adolescents through readily accessible venues such as school health clinics. As the primary health professional in the school setting, school nurses are uniquely positioned to deliver weight management interventions. School nurses have the skills and credibility to offer health-related assistance, can provide ongoing support within the school setting, and are easily accessed without parental involvement, without additional cost to the family, and without the student having to leave the school grounds (95% of adolescents attend school).[9] The majority of previous school-based studies have focused on obesity prevention and targeted pre-adolescents, and to our knowledge, there have been no randomized controlled school-based trials evaluating interventions targeting overweight or obese adolescents, nor any that have utilized the school nurse to deliver intervention.[10] The purpose of the present study was to test the feasibility and efficacy of a school nurse-delivered weight management intervention on BMI, diet, physical activity and sedentary behavior among overweight and obese adolescents.

METHODS

Study Design

A pair-matched cluster-randomized controlled school-based trial was conducted with a convenience sample of 6 public high schools in Massachusetts. School enrollment ranged from approximately 800 to 1500 students (mean enrollment 1055 and 1159 students in control and intervention schools, respectively); approximately half the student populations were female. Race and ethnicity was similar in 4 schools with 90% or more being white, non-Hispanic; one control and one intervention was 19% and 26% Hispanic, respectively. Rates of participation in reduced or free school lunch ranged from 4.6% to 34.1% (mean rates 16.6% and 24.4% in control and intervention schools, respectively). Schools were pair

matched on total enrollment, gender, race and ethnicity and percent receiving reduced or free lunch; one from each pair was then randomly assigned to either the school nurse counseling intervention group or the control group. Data were collected from October 2008 to October 2009.

Participants

Adolescents in grades 9 through 11 were eligible to participate if they had a BMI ≥ 85th percentile for age and gender, provided assent and had parental consent, and had at least one English-speaking parent. Exclusions included planning to move out of the area; having a medical condition that precluded adherence to the intervention; diagnosis of a serious psychiatric illness; genetic or endocrine cause of obesity; taking a medication associated with weight gain; or weighing ≥ 300 pounds. Exclusions were assessed via a screening form completed by a parent. Students were recruited through school announcements, flyers and posters, and health-related school nurse encounters. There was no racial or gender bias in the recruitment or selection of participants. Participants gave informed assent and had parental consent. Assessments were completed by a research assistant who was not blinded to school condition at baseline and 2 and 6 months following baseline in the school nurse office. All counseling sessions for a student were completed prior to their completing the 2-month survey. A $25 gift certificate was provided at each assessment. The study retained 100% of participants at each follow-up. Figure 1 shows the flow of participants. Eighty-two proceeded to randomization.

Treatment Groups

School nurse-delivered counseling intervention group—The intervention, "Lookin' Good Feelin' Good", consisted of 6 one-on-one counseling sessions conducted over 2 months during the school day during non-academic classes in the privacy of the school nurse office. The intervention used the 5-3-2-1-0 approach to support making five key behavior changes (Figure 2). It incorporated expert committee recommendations for the prevention and treatment of child and adolescent overweight and obesity,[11] along with the USDA 2005 Dietary Guidelines for Americans[12] and recommendations for physical activity.[13] The intervention was based on Social Cognitive Theory,[14] using cognitive behavioral techniques to facilitate changes in self-management behaviors through health knowledge and the development of positive outcome expectations, self-control and behavioral capacity skills, and self-efficacy. A patient-centered counseling approach allowed school nurses to tailor the intervention to the student's needs. Formative research conducted with focus groups of overweight and obese adolescents, parents, school nurses, and school staff informed development of the intervention protocol and accompanying booklet.[15] Such use of formative research to inform intervention design has been found to be valuable in other community-based obesity intervention development in the high school setting.[16] School nurses were trained through a daylong group training session which included: (1) a brief didactic presentation on the scope of the problem of adolescent obesity, effects of obesity on adolescents, and expert committee recommendations for the treatment of overweight and obesity in youth; (2) review of the counseling intervention protocol and accompanying student booklet while observing a demonstration of the intervention; and (3) the conduct of role play exercises in which the nurses practiced delivering the intervention protocol, received feedback from study investigators, and processed as a group after each exercise (this portion took the majority of the training time). We have used this training procedure successfully to train school nurses and other health care providers in delivering cognitive-behavioral health behavior change protocols.

Control group—Participants in the control schools had 6 one-on-one visits with the school nurse over 2 months to be weighed, review behavior changes, read 6 informational

pamphlets on weight management (selected from Journeyworks (http://www.journeyworks.com/) with appropriate content for adolescents), and have questions answered. School nurses received an individual orientation to the protocol and materials.

Instruments

All assessments were conducted by research assistants. Height and weight were measured using standard methodology, wearing light clothing and no shoes. BMI was calculated as weight (kg)/height squared (in meters) for age and gender using the CDC BMI charts. Blood pressure was measured by taking the average of 2 readings with the DINAMAP® PRO 100V2 Monitor. Waist circumference was measured as the average of two measurements midway between the rib cage and superior border of the iliac crest. A Tanita Scale measured body weight and body fat using the leg-to-leg BIA system.

Dietary intake was assessed with a 24-hour dietary recall interview[17] using the Interactive Nutrition Data System (NDS, Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN) conducted by phone on one randomly selected day of the week. An 8-item instrument[18] was used to assess healthful and unhealthful dietary behaviors targeted by the intervention. This instrument was designed to be completed independently by adolescents and was based on literature review, expert feedback and feasibility testing, which found it to be feasible in public health and primary care settings, similar to the performance of the longer Food Habits Questionnaire and Rate Your Plate.[19, 20] Physical activity was assessed by accelerometer using the ActiGraph Model GT1M for a 7-day period; average daily minutes of light, moderate and vigorous activity were calculated using published cut points.[21] Sedentary behavior, TV watching and playing computer or video games on an average school day was measured using 2 items from the Youth Risk Behavior Survey (YRBS).[22] Sociodemographic variables were assessed by student questionnaires. Self-efficacy or confidence in making weight related behavior changes was assessed with an 11-item questionnaire adapted from the Go Girls study (Cronbach alpha = .90).[23] Barriers to eating healthy and exercising was assessed by 5 items adapted from New Moves (Cronbach alpha = .84; test-retest r = .89)[24] and 2 items from Motl and colleagues.[25]

To assess intervention feasibility, defined as the ability of school nurses to deliver the counseling intervention as intended, the following were documented: (1) number of sessions attended by students, and (2) student report of degree to which the school nurse delivered each component of the intervention protocol (program fidelity) as assessed by the Patient Exit Interview Survey and school nurse report of intervention delivery (via a nurse checklist). To assess student acceptability of the counseling intervention, defined as their satisfaction with the intervention, participants rated the perceived helpfulness of the nurse intervention and level of comfort in discussing weight with the school nurse.

School nurses completed a self-administered survey at baseline (Fall) and follow-up (Spring) that documented their demographic information, levels of confidence and effectiveness and barriers and facilitators to assisting obese and overweight adolescents with weight-related behavior changes, as well as for intervention nurses only, their experience with implementing the intervention protocol.

Data Analysis

Baseline means were compared using t-tests or Wilcoxon rank sum tests if distributional assumptions were not met. Fisher's Exact tests were used to compare categorical variables. Continuous outcomes of physiologic measures, physical activity, diet, and psychosocial measures were compared using linear mixed models. Dichotomous outcomes for diet and activity behaviors were compared using exact logistic regression models. Percent of visits on

which students rated the nurse as very helpful or felt very comfortable were compared using mixed-effects logistic regression. To account for intra-class correlation, school was included as a random effect in the linear mixed models and mixed-effects logistic regression models. Models were also adjusted for baseline level of the outcome and for any baseline characteristics that differed significantly by group at baseline including participation in reduced or free school lunch program, confidence score, soda consumption, and barriers to exercise score. Physiologic variables were also adjusted for age and gender. All analyses were conducted at the student level and carried out using Stata 10.1. (Stata, version 10.1.). A two-sided $p < .05$ was considered statistically significant.

RESULTS

Baseline Participant and School Nurse Characteristics

Participants were 82 adolescents with a mean age of 15.8 (SD: 1.02) years who were predominately female (70%) and of white race (77%) (Table 1). Mean BMI was 32 kg/m2 (SD: 5.7); 69.5% (78.6% of intervention vs. 60.0% of controls; $p = .09$) were obese, with the remainder being overweight. The majority of factors associated with obesity were similar between groups at baseline with the exception of frequency of drinking soda, proportion of students participating in reduced/free lunch, perceived barriers to exercise, and levels of confidence to make changes in healthier eating and food choices. Approximately 60% of students in both intervention and control groups felt very confident that they could lose weight.

Seven school nurses (4 intervention and 3 control nurses) participated in the study; one intervention school had 2 nurses due to staff turnover. All nurses were female; mean age was 46.2 (SD=14.1) and 50.1 (SD=11.8) years in intervention and control schools respectively. The mean number of years working as a school nurse in any school was somewhat higher for nurses in intervention compared to control schools (10.8 years (SD=8.7) vs. 8.3 years (SD=2.9), respectively); whereas the mean number of years working in their current school was somewhat higher for nurses in control compared to intervention schools (5.0 years (SD=3.6) vs. 4.0 years (SD=4.6), respectively). None of the nurses reported having received prior training on how to counsel overweight or obese students to improve diet and physical activity to reduce their BMI.

Intervention Effects at 2 and 6 Months

Students in the intervention compared to control schools showed small, more favorable changes in various physiologic measures including waist circumference and systolic blood pressure at 6 months (Table 2). However, there were no statistically significant differences in anthropometric variables or blood pressure between groups at 2 or 6 months.

The intervention had a positive impact on some nutrition and lifestyle factors. Dietary composition showed significant differences initially (Table 3). On average, students in intervention compared to control schools consumed a significantly lower amount of total sugar (difference = −45.79g/day; 95% CI −88.34, −3.24) and added sugar (difference = −51.35g/day; 95% CI −92.45, −10.26) at 2 months; but this was not maintained at 6 months. Caloric intake and calories from fat did not change significantly between groups. Students in intervention compared to control schools ate breakfast on significantly more days per week at 2 months, adjusted mean 4.66 days vs. 3.65 days, respectively (adjusted mean difference 1.01 days; 95% CI 0.11,1.92), but not at 6 months. The intervention had no effect on time spent in moderate to vigorous physical activity (MVPA).

In addition, students in intervention compared to control schools were over 4 times more likely to drink soda 1 or fewer times per day (87.2% vs. 62.1%, respectively; adjusted OR

4.20; 95% CI 1.19,16.93) at 6 months. The percent of students who reported eating at fast food restaurants 1 time per week was significantly greater in intervention compared to control schools (86.2% vs. 57.4%, respectively, adjusted OR 4.62: 95% CI 1.10, 23.76) at 6 months. However, comparison of the two conditions by each of the component parts of the 5-3-2-1-0 approach targeted in the intervention indicated no differences in the number of participants reporting consuming 5 servings of fruits and vegetables per day, eating 3 meals per day, getting less than 2 hours of screen time per day, being active for at least an hour a day on at least 5 days per week, or consuming no soda/sugary drinks (Table 4).

Treatment Fidelity and Acceptability

School nurses reported that the majority of students attended one or more visits (81% vs. 93% of students attended all 6 visits in intervention vs. control schools, respectively). Mean time to conduct each session ranged from 18 to 29 minutes in intervention schools and 8.5 to 9 minutes in control schools. Students in the counseling intervention reported that nurses delivered the intervention with a high level of fidelity to the protocol (on average, 97% of protocol items were covered at each visit). Students receiving the counseling intervention reported that the school nurse was very helpful in their learning how to eat healthy and be physically active, and this was significantly higher in the intervention compared to control schools (98% vs. 71% of visits, respectively; p = .003). Students who received the counseling intervention more often reported feeling very comfortable in discussing their weight-related behaviors with the nurse (88% vs. 62% of visits in intervention vs. control schools respectively; p = .01).

School nurses in the intervention schools reported generally high levels of confidence and effectiveness in their ability to counsel obese adolescents to improve diet and physical activity to reduce their BMI (mean scores 3.50 (0.58) on a 4 point response scale ranging from 1=not at all to 4=very). Nurses did not report needing to work extra hours in order to fit the intervention into their schedule; although two nurses reported hiring additional staff to cover while they delivered the intervention. Nurses did not report that lack of time was a barrier to assisting adolescents in making changes in their diet and physical activity (mean score 2.00 (SD 0.82) on a 4 point response scale ranging from 1=strongly disagree to 4=strongly agree). The majority of nurses (75%) found that it was not at all difficult to incorporate the intervention in their daily work. All nurses found the intervention protocol and materials very helpful in talking to adolescents about improving diet and physical activity and 75% reported that the adolescents were very receptive to the intervention.

DISCUSSION

A brief weight management counseling intervention was feasible for school nurses to deliver within the school health office setting and acceptable to overweight and obese adolescents. School nurses were able to deliver the 6-session treatment protocol with high fidelity and with high levels of student participation. The counseling intervention produced a number of positive changes in adolescents' self-reported obesogenic behaviors, including eating breakfast on more days per week, drinking soda 1 time per day, and eating at fast food restaurants 1 time per week. However, screen time, time spent in MVPA, and physiologic variables were not significantly affected during this short term and low intensity intervention.

Other pediatric weight management programs have found reductions in sedentary behaviors when targeted as part of the intervention, in contrast to the findings of the present study. Results of a meta-analysis of interventions targeting screen time reduction found that such interventions had a statistically significant albeit small effect in children, including adolescents.[26] It appears the problem-solving conducted as part of the counseling

intervention was not more effective in helping teens reduce their screen time than provision of written information, as adolescents in both groups received information about the recommended amount of screen time. This may be related to students being unable to effectively strategize to overcome barriers to physical activity, which might serve as a replacement for time spent in sedentary activity.

It is possible that the reduction in soda intake observed in our study could explain the reduction in total and added sugar, as there are on average 16 teaspoons of sugar in a 20-ounce soda. Whereas one clinical trial reported positive changes in sugar intake among obese adolescent patients in a multi-component clinic based intervention,[27] no previous behavioral intervention has shown positive changes in soda consumption or breakfast consumption among overweight or obese teens. Again, teens in the control group received recommendations regarding these dietary factors and there were no differences in change in knowledge between the 2 groups. This suggests adolescents in both groups were aware of the recommendations, but counseling by the school nurse was more effective in assisting teens in making these key dietary changes. Although many of these changes were short-term, these findings suggest the potential of a more intensive intervention to have a longer-lasting impact on these mediators of BMI change. No changes were found in physical activity, suggesting that counseling alone may not be sufficient to produce changes in this behavior.

Though not statistically significant, students in the counseling intervention schools experienced modest favorable improvements in their BMI when compared to students in the control schools. This finding is consistent with a review of behavioral intervention trials[6] that found weight management programs produced modest, but often non significant reductions in BMI and/or adiposity in overweight and obese youth. The largest intervention effects were found in more comprehensive, moderate- to high-intensity weight management programs (26–75 to over 75 hours of contact time) that included a structured exercise program and were conducted within specialty clinics. Less comprehensive and intensive programs, similar to our counseling intervention, showed more mixed results.[6] The promising results in weight-related behavior change and trend toward modest favorable anthropometric outcomes suggests the potential for a more intensive school nurse intervention to have an impact on BMI.

Significant strengths of the current study are the randomized design, relatively large sample of students, and very high retention rate (98%). In addition, our comparison group controlled for contact with the school nurse and access to information about recommended dietary, physical activity and sedentary behaviors for weight management. Additional strengths include the carefully designed intervention based on current recommendations tailored for adolescents and extensive formative work, and use of real-world providers to deliver the intervention.

Limitations

Although both conditions involved 6 one-on-one sessions with the school nurse, variable student contact time with the nurse between school conditions could have accounted for some of the positive impact of the intervention. In addition, whereas the strong control condition was a strength in some regards, it also can be viewed as a limitation as it served in many ways as another intervention. The intensity of the control intervention may have made it difficult to identify a statistically significant improvement from the intervention condition. Had we tested the intervention against usual care for the school health clinic, which may be only BMI screening and parent notification of results, we may have been able to see statistically significant differences in improvements in anthropometric measures and/or behavioral measures. Another limitation is reliance on self-report of behavior change

inherent in weight management trials, which may have affected the reliability of student responses. Although we used a cluster randomized design, the small number of schools located in one geographical area limits the generalizability of our findings.

Conclusions

This study found that a school nurse-delivered counseling intervention for overweight and obese adolescents is feasible for school nurses to deliver, acceptable to teens, and improves selected self-reported obesogenic behaviors, but not BMI. The delivery of weight management counseling to overweight and obese adolescents by school nurses has tremendous potential, leveraging existing resources by capitalizing on the placement of skilled health care providers in the school setting and reducing barriers to adolescents seeking and receiving treatment. Recent findings suggest that fairly high-intensity interventions providing substantial contact time are needed to effect weight loss.[6] Future research should explore expanding the counseling intervention to include additional visits extended over a longer period of time, as well as opportunities to engage in physical activity within the school setting to enhance the impact of this innovative treatment approach.

IMPLICATIONS FOR SCHOOL HEALTH

School nurses in the school health setting are in an excellent position to tackle the growing problem of adolescent obesity, given the well-documented need for feasible, cost-effective behavioral interventions that can be delivered in readily-accessible settings. School nurses are well-positioned to contribute to this effort as they have the skills to provide counseling to support weight-related behavior change, and are easily accessible to adolescents without transportation or cost. Most adolescents in the US (95%) attend school;[9] approximately half of high schools have a full-time registered nurse and another one third have a part-time nurse.[28] Importantly, it is the position of the National Association of School Nurses (NASN) that "school nurses have the knowledge and expertise to promote the prevention of overweight and obesity and address the needs of overweight and obese youth in schools" and it is their role to "assist students who are overweight and obese to obtain a healthy lifestyle. School nurses are in the prime position to influence the behavior of children and adolescents in developing good-decision-making skills related to nutrition and physical activity to develop and achieve healthy lifestyles."[29]

The leveraging of existing infrastructure by capitalizing on the placement of skilled health care providers in the highly accessible school setting has tremendous public health significance compared to specialty clinics, which have limited reach due to access and the expense of intensive resources required, including the cost to the family in terms of transportation, copayments and time. The present study demonstrated that a weight management counseling intervention was feasible for school nurses to deliver with high fidelity in the school health setting and was acceptable to overweight and obese adolescents. This finding, along with promising results in weight-related behavior change and a trend toward modest favorable anthropometric outcomes, suggests the potential for a more intensive school nurse intervention to have an impact on BMI. If ultimately found to be effective, a case can be made for increasing the availability of school nurses to deliver these services and potentially be recognized by the healthcare delivery system as being effective and reimbursable. In addition, additional resources could be brought to bear in schools (for example, temporary nurses to cover the clinic) to free up the school nurses to deliver this intervention to have a public health impact. Also, a broader recruitment process could be instituted in the schools to reach a greater proportion of overweight and obese students for maximal public health impact. Should an expanded and more comprehensive version of the intervention tested in this study be found to be effective in helping adolescents reduce their

BMI, there would be tremendous implications for the ability of school health to contribute to the reduction of adolescent obesity in a cost effective manner.

Human Subject Approval Statement

The University of Massachusetts Medical School (UMMS) Human Subjects Institutional Review Board approved the study protocol (Docket #H12681).

Acknowledgments

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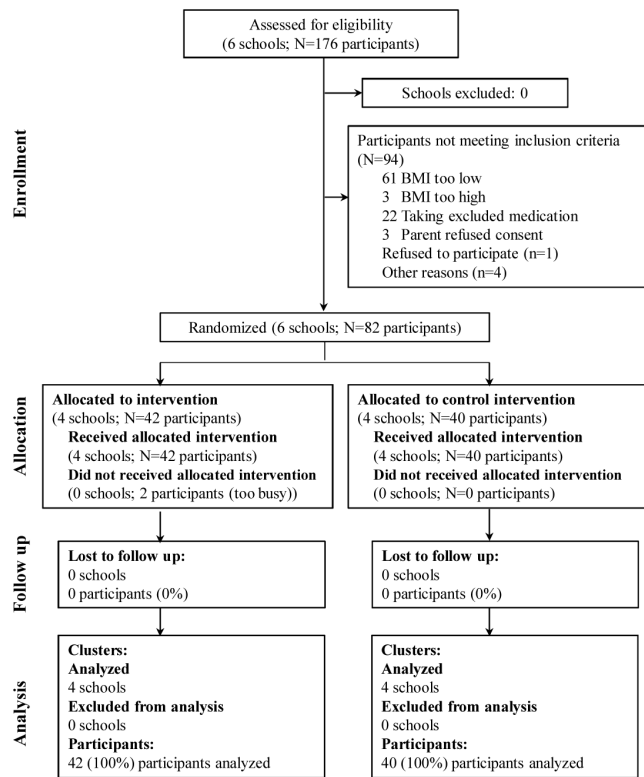
Figure 1.
Consort Diagram

Visit	Topic Covered and Goals Set

At Each Visit	• Weigh
	• Review diet and physical activity log
	• Assess progress toward behavior change goals set at prior visit
	• Review successes and strategies used
	• Problem-solve challenges experienced
	• Establish new plan for goals not achieved
	• Weigh-in with feedback
	• Discuss session's topics using student booklet, and set new goals
	   • Assess current behavior and provide recommendation for that behavior
	   • Identify barriers to maintaining positive behavior or changing problematic behavior
	   • Discuss ideas/strategies for handling these challenges
	   • Set structured goal for the week

1	• Assess personal reasons for wanting to achieve a healthy weight
	• Identify problem areas associated with weight gain
	• Review program goals: 5-3-2-1-0
	   • 5 or more servings of fruits and vegetables a day
	   • 3 structured meals a day, including daily breakfast
	   • 2 hours or less of TV, computer and video games a day
	   • 1 hour or more of moderate physical activity a day
	   • 0 limit soda and sugar-sweetened drinks
	   • Limit portions
	• Discuss session's topics:
	   • Soda and sugar-sweetened drinks (0)
	   • Portion sizes
	• Provide and instruct in use of the pedometer (for self and support person)
	• Instruct in and problem solve challenges to use of the Food and Activity Tracking Log

2	• Discuss session's topics:
	   • Physical activity ($\geq$ 1 hour/day)
	   • Sleep (at least 9 hours/night)
	   • TV and video game time ($\leq$ 2 hours/day)
	   • Getting support for healthy behavior change

3	• Discuss session's topic: Eating out (limit # of times; eat out smart; reduce portion sizes)

4	• Discuss session's topics:
	   • Fruits and vegetables (at least 5 servings/day)
	   • Eating a healthy breakfast (3 structured meals/day)

5	• Discuss session's topics:
	   • Limit unhealthy snacks (replace with healthy alternatives; 3 structured meals/day)
	   • Limit deserts (replace with healthy alternatives; 3 structured meals/day)

6	• Discuss session's topic: Eating when not hungry: bored, stressed or sad • Wrapping it up (review program goals, goals achieved, challenges/problems encountered and anticipated, strategies to address)

Figure 2.
Counseling Intervention Protocol: Lookin' Good Feelin' Good

Table 1

Characteristics of Student Participants at Baseline

	Intervention (N=42)	Control (N=40)	p-value
Mean Age (SD)	15.9(1.03)	15.7(1.01)	p < .516
% Female	64.3	75.0	p < .343
Race			p < .435
%White	73.8	80.0	
% Black	14.3	5.0	
% Hispanic Ethnicity	14.3	15.0	p < 1.000
% participate in reduced or free school lunch	47.6	17.5	p < .005
% Obese (BMI percentile 95)	78.6	60.0	p < .093
Hours watch TV on average school day in past 7 days			p < .981
% None	2.4	2.5	
% < 1 hour per day	28.6	25.0	
% 1 hours/day	7.1	10.0	
% 2 hours/day	23.8	22.5	
% 3 or more hours/day	38.1	40.0	
Hours play video or computer games on average school day in past 7 days			p < .308
% None	21.4	12.5	
% < 1 hour per day	14.3	22.5	
% 1 hours/day	23.8	10.0	
% 2 hours/day	14.3	20.0	
% 3 or more hours/day	26.2	35.0	
Servings of vegetables in a typical day in past 7 days			p < 1.000
% None	9.5	7.5	
% 1–2 servings per day	50.0	50.0	
% 3 or more servings per day	40.5	42.5	
Servings of fruit in a typical day in past 7 days			p < .439
% None	4.8	7.5	
% 1–2 servings per day	42.9	55.0	
% 3 or more servings per day	52.4	37.5	
Times drink soda (not diet) in a typical day in past 7 days			p < .020
% None	19.1	37.5	
% 1–2 times per day	66.7	35.0	
% 3 or more times per day	14.3	27.50	
Times drink sugar sweetened beverages in a typical day in past 7 days			p < .064
% None	16.7	27.5	
% 1–2 times per day	40.5	17.5	
% 3 or more times per day	42.9	55.0	
Times eat food from fast food restaurant in past 7 days			p < .257

	Intervention (N=42)	Control (N=40)	p-value
% None	31.0	47.5	
% 1–2 times	54.8	37.5	
% 3 or more times	14.3	15.0	
Mean # days eat breakfast in past 7 days (SD) (range from 0 to 7)	3.1(2.4)	3.7(2.9)	p < .327[*]
Barriers to healthy behaviors (% Strongly Agree to Agree)			
% days too busy to exercise	16.7	42.5	p < .015
% do not like way body feels when exercise	23.8	37.5	p < .232
% feel embarrassed or awkward exercising in front of others/public	26.2	47.5	p < .066
% do not feel safe walking or jogging in neighborhood	9.5	15.0	p < .514
% eating healthy costs too much	23.8	10.0	p < .142
% healthy food does not taste good	21.4	5.0	p < .049
% healthy food is not available to me	11.9	7.5	p < .713
Barriers to Nutrition Score (range 3 to 12)	5.57(1.8)	4.95(1.5)	p < .091
Barriers to Exercise Score (range 4 to 15)	7.52(1.9)	8.55(2.4)	p < .036
Confident can do the following (% Very Confident)			
Lose Weight	59.5	57.5	p <1.000
Eat smaller portions of junk food you like	40.5	40.0	p <1.000
Not eat junk food when bored or depressed	52.4	32.5	p < .079
Eat healthy when friends are not	47.6	27.5	p < .072
Drink fewer sodas or sweetened beverages	66.7	45.0	p < .074
Eat healthier meals and snacks	71.4	45.0	p < .024
Eat more fruits and vegetables	61.9	57.5	p < .822
Get mom, dad or adult living with you to buy healthier food	73.8	67.5	p < .629
Order healthier choices when you are at a fast food or sit down restaurant	59.5	30.0	p < .009
Exercise on most days of the week	52.4	45.0	p < .517
Turn off the television and do something active	50.0	40.0	p < .384
Mean Confidence Score (SD) (range 15 to 33)	27.5(3.8)	25.6(4.1)	p < .023[*]
Mean Minutes Spent in MVPA (from accelerometers) (SD) (range 5.3 to 109.7)	38.53(22.1)	27.33(15.5)	p < .012[*]
Mean Total Caloric Intake (SD) (range 585.0 to 3888.3)	1724.5 (678.3)	1881.2(695.2)	p < .314
Mean % Calories from Total Fat (SD) (range 14.8 to 52.4)	30.8(7.1)	31.0(7.9)	p < .938
Mean % Calories from Saturated fat (SD) (range 3.5 to 23.8)	11.9(4.3)	11.3(3.9)	p < .475
Mean Sugar Intake (grams) (SD) (range 1.0 to 131.1)	109.6(72.7)	116.4(56.2)	p < .644
Mean % Calories from Carbohydrates (SD) (range 33.3 to 70.1)	52.8(8.5)	53.0(9.5)	p < .946
Mean Glycemic Load Glucose (SD) (range 37.7 to 342.9)	142.4(70.1)	147.9(57.0)	p < .260[*]
Mean BMI (SD) (range 24.3 to 49.1)	32.8(5.9)	31.2(5.3)	p < .161[*]
Mean % Body Fat (SD) (range 13.1 to 57.5)	37.9(9.3)	38.0(7.9)	p < .991
Mean BMI percentile (SD) (range 84.1 to 99.7)	96.4(3.4)	95.3(3.8)	p < .188[*]
Mean Waist Circumference (SD) (range 72.3 to 132.1)	99.7(13.8)	98.2(11.6)	p < .606

	Intervention (N=42)	Control (N=40)	p-value
Mean Systolic Blood Pressure (SD) (range 95 to 145)	117.7(10.0)	116.3(9.9)	p < .508
Mean Diastolic Blood Pressure (SD) (range 51 to 88)	69.0(8.2)	70.3(7.2)	p < .425

*
p value derived from Rank-Sum Test.

Table 2

Intervention Effect on Physiologic Outcomes

	Baseline Mean (SD)	2 months				6 months			
		Unadjusted Mean Change (SD)	Adjusted Mean Change* (95% CI)	Adjusted Mean Difference in Change* (95% CI)	p-value*	Unadjusted Mean Change (SD)	Adjusted Mean Change* (95% CI)	Adjusted Mean Difference in Change* (95% CI)	p-value*
BMI					p < .819				p < .676
Control	31.24 (5.33)	0.14 (1.14)	0.12 (−0.37, 0.61)			0.26 (1.59)	0.23 (−0.46, 0.91)		
Intervention	32.78 (5.91)	0.01 (1.64)	0.03 (−0.45, 0.51)	−0.09 (−0.82, 0.65)		−0.01 (1.98)	0.01 (−0.66, 0.68)	−0.22 (−1.23, 0.80)	
BMIZ					p < .781				p < .736
Control	1.81 (0.41)	0.01 (0.11)	0.01 (−0.04, 0.07)			0.01 (0.17)	0.01 (−0.06, 0.08)		
Intervention	1.95 (0.44)	0.00 (0.17)	0.00 (−0.05, 0.05)	−0.01 (−0.09, 0.07)		0.00 (0.21)	0.00 (−0.07, 0.07)	−0.02 (−0.12, 0.09)	
Waist Circumference(cm)					p < .503		N=81		p < .504
Control	98.27 (11.56)	1.33 (4.14)	1.58 (−0.13, 3.29)			0.70 (5.22)	0.88 (−1.30, 3.06)		
Intervention	99.73 (13.79)	0.98 (4.45)	0.72 (−0.96, 2.40)	−0.86 (−3.38, 1.66)		−0.05 (6.59)	−0.22 (−2.35, 1.91)	−1.10 (−4.34, 2.13)	
% Body Fat					p < .733				p < .391
Control	37.95 (7.86)	−0.44 (2.64)	−0.48 (−1.67, 0.71)			−1.02 (3.54)	−1.17 (−2.74, 0.40)		
Intervention	37.93 (9.32)	−0.82 (4.68)	−0.79 (−1.96, 0.37)	−0.31 (−2.09, 1.47)		−0.26 (5.91)	−0.14 (−1.67, 1.39)	1.03 (−1.32, 3.37)	
Systolic BP					p < .314				p < .272
Control	116.28 (9.90)	−2.33 (10.49)	−2.43 (−5.74, 0.87)			4.16 (12.30)	4.80 (1.31, 8.29)		
Intervention	117.74 (10.00)	−0.01 (13.09)	0.11 (−3.11, 3.32)	2.54 (−2.41, 7.48)		2.49 (12.61)	1.88 (−1.53, 5.28)	−2.93 (−8.14, 2.29)	
Diastolic BP					p < .958				p < .622
Control	70.34 (7.24)	0.66 (8.03)	1.12 (−2.16, 4.40)			−1.49 (10.09)	−0.64 (−3.26, 1.98)		
Intervention	68.96 (8.20)	1.25 (8.57)	0.99 (−2.24, 4.22)	−0.13 (−4.93, 4.67)		1.12 (9.88)	0.35 (−2.21, 2.90)	0.98 (−2.93, 4.90)	

*
Adjusted for school, age, gender, baseline measurement and the following baseline variables: participation in free lunch program, confidence score, soda consumption, barriers to exercise score.

Table 3

Intervention Effect on Physical Activity, Diet and Lifestyle Factors

	Baseline Mean (SD)	2 months				6 months			
		Unadjusted Mean Change (SD)	Adjusted Mean Change* (95% CI)	Adjusted Mean Difference in Change* (95% CI)	p-value*	Unadjusted Mean Change (SD)	Adjusted Mean Change* (95% CI)	Adjusted Mean Difference in Change* (95% CI)	p-value*
Minutes/Day in MVPA					p < .509				p < .910
Control	27.33 (15.45)	2.29 (16.35)	0.55 (−6.84, 7.95)			3.96 (13.97)	0.22 (−4.26, 4.70)		
Intervention	38.53 (22.08)	1.78 (16.43)	4.33 (−3.53, 12.18)	3.77 (−7.43, 14.98)		−2.28 (13.70)	0.65 (−4.77, 6.08)	0.43 (−7.11, 7.98)	
Days eat breakfast in past 7 days					p < .028				p < .605
Control	3.73 (2.88)	0.28 (2.16)	0.25 (−0.35, 0.85)			−0.13 (2.31)	−0.01 (−0.79, 0.77)		
Intervention	3.10 (2.36)	1.24 (1.87)	1.26 (0.68, 1.85)	1.01 (0.11, 1.92)		0.40 (2.52)	0.30 (−0.46, 1.05)	0.31 (−0.86, 1.47)	
Total Calories/Day					p < .240				p < .112
Control	1881.18 (695.15)	−76.11 (798.31)	23.50 (−256.05, 303.06)			−15.67 (696.48)	31.59 (−156.17, 219.35)	N=76	
Intervention	1724.45 (678.30)	−120.28 (834.89)	−232.43 (−519.41, 54.55)	−255.94 (−682.92, 171.05)		−150.91 (632.55)	−202.89 (−396.34, −9.43)	−234.5 (−524.0, 55.0)	
% Calories Total Fat					p < .635				p < .992
Control	30.97 (7.92)	1.69 (10.26)	1.62 (−1.43, 4.66)			1.69 (14.51)	1.19 (−1.92, 4.30)	N=76	
Intervention	30.84 (7.15)	0.48 (12.47)	0.48 (−2.66, 3.61)	−1.13 (−5.84, 3.56)		0.86 (9.75)	1.21 (−1.99, 4.41)	0.02 (−4.76, 4.81)	
% Calories Saturated Fat					p < .700				p < .293
Control	11.26 (3.86)	0.29 (5.09)	−0.31 (−1.61, 0.99)			−0.51 (6.17)	−1.21 (−2.78, 0.36)	N=76	
Intervention	11.92 (4.28)	−1.36 (6.22)	−0.71 (−2.04, 0.63)	−0.39 (−2.40, 1.61)		−0.57 (5.62)	0.06 (−1.54, 1.66)	1.27 (−1.10, 3.64)	
Total Sugar (g/day)					p < .035				p < .241
Control	116.44 (56.17)	0.65 (103.06)	12.45 (−15.03, 39.92)			−19.94 (66.60)	−11.37 (−30.71, 7.96)	N=74	
Intervention	109.58 (72.66)	−21.75 (80.75)	−33.34 (−61.70, −4.98)	−45.79 (−88.34, −3.24)		−19.81 (79.89)	−29.15 (−49.08, −9.22)	−17.78 (−47.48, 11.92)	
Added Sugar (g/day)					p < .014				p < .469
Control	79.00 (55.75)	13.82 (100.13)	25.20 (−1.39, 51.78)			−14.44 (72.68)	−7.20 (−27.59, 13.19)	N=73	
Intervention	75.67 (62.93)	−16.96 (77.74)	−26.16 (−53.57, 1.26)	−51.35 (−92.45, −10.26)		−9.79 (78.23)	−18.87 (−40.17, 2.43)	−11.67 (−43.23, 19.89)	
Glycemic Load					p < .093				p < .352
Control	147.93 (57.05)	−6.76 (72.15)	1.09 (−21.05, 23.23)			−15.15 (53.10)	−11.08 (−27.36, 5.20)	N=72	
Intervention	142.41 (70.06)	−22.46 (78.88)	−28.98 (−51.18, −5.06)	−29.21 (−63.33, 4.92)		−17.73 (68.30)	−22.93 (−39.68, −6.18)	−11.85 (−36.83, 13.12)	

*
Adjusted for school, baseline participation in free lunch program, confidence score, soda consumption, barriers to exercise score, and baseline levels of each outcome variable.

Table 4

Intervention Effect on the 5-3-2-1-0 Intervention Targets

		Baseline	2 Months		6 Months	
		Percent	Percent	OR (95% CI) p-value	Percent	OR (95% CI) p-value
5 Fruits and Vegetables per Day	Control	50.00	75.00	0.25(0.04, 1.29)	62.50	0.76(0.23, 2.47)
	Intervention	54.76	66.67	p < .115	57.14	p < .797
				N=78		N=76
3 Meals per Day (Including Breakfast)	Control	65.00	50.00	1.54(0.51, 4.89)	48.72	1.72(0.54, 5.64)
	Intervention	58.97	58.97	p < .548	62.16	p < .436
Less than 2 Hours of TV or Computer Time per Day	Control	27.50	22.50	2.07(0.35, 15.51)	25.00	2.97(0.66, 11.31)
	Intervention	28.57	38.10	p < .584	50.00	p < .091
Active 1 Hour per Day At Least 5 Days per Week	Control	30.00	37.50	0.92(0.27,3.13)	37.50	1.57(0.55, 4.52)
	Intervention	30.95	40.48	p < 1.000	52.38	p < .480
				N=81		
No Soda or Sugary Drinks.	Control	12.50	10.26	3.34(0.52, 37.85)	2.50	12.33(0.58, 1251.77)
	Intervention	7.14	19.05	p < .283	9.52	p < .153

ORs are from models adjusted for baseline participation in the free lunch program, confidence score, soda consumption, barriers to exercise score, and baseline evels of each outcome variable. Percentages are actual percentages at each time point. N used to compute OR is equal to 82 unless otherwise specified.