

East Tennessee State University

Digital Commons @ East Tennessee State University

ETSU Faculty Works

Faculty Works

7-1-2015

College Students as Facilitators in Reducing Adolescent Obesity Disparity in Southern Appalachia: Team up for Healthy Living

Deborah Slawson

East Tennessee State University, slawson@etsu.edu

William T. Dalton

East Tennessee State University

Taylor McKeehan Dula

East Tennessee State University, mckeehan@etsu.edu

Jodi Southerland

East Tennessee State University, southerlanjl@etsu.edu

Liang Wang

East Tennessee State University, wangl2@etsu.edu

See next page for additional authors

Follow this and additional works at: <https://dc.etsu.edu/etsu-works>



Part of the [Pediatrics Commons](#)

Citation Information

Slawson, Deborah; Dalton, William T.; Dula, Taylor McKeehan; Southerland, Jodi; Wang, Liang; Littleton, Mary Ann; Mozen, Diana; Relyea, George; Schetzina, Karen; Lowe, Elizabeth F.; Stoots, James M.; and Wu, Tiejian. 2015. College Students as Facilitators in Reducing Adolescent Obesity Disparity in Southern Appalachia: Team up for Healthy Living. *Contemporary Clinical Trials*. Vol.43 39-52. <https://doi.org/10.1016/j.cct.2015.04.012> ISSN: 1551-7144

This Article is brought to you for free and open access by the Faculty Works at Digital Commons @ East Tennessee State University. It has been accepted for inclusion in ETSU Faculty Works by an authorized administrator of Digital Commons @ East Tennessee State University. For more information, please contact digilib@etsu.edu.

College Students as Facilitators in Reducing Adolescent Obesity Disparity in Southern Appalachia: Team up for Healthy Living

Copyright Statement

This document is an author manuscript from [PMC](#). The publisher's final edited version of this article is available at [Contemporary Clinical Trials](#).

Creator(s)

Deborah Slawson, William T. Dalton, Taylor McKeegan Dula, Jodi Southerland, Liang Wang, Mary Ann Littleton, Diana Mozen, George Relyea, Karen Schetzina, Elizabeth F. Lowe, James M. Stoots, and Tiejian Wu



HHS Public Access

Author manuscript

Contemp Clin Trials. Author manuscript; available in PMC 2016 July 01.

Published in final edited form as:

Contemp Clin Trials. 2015 July ; 43: 39–52. doi:10.1016/j.cct.2015.04.012.

College students as facilitators in reducing adolescent obesity disparity in Southern Appalachia: Team Up for Healthy Living

Deborah Leachman Slawson, William T. Dalton, Taylor McKeehan Dula, Jodi Southerland, Liang Wang, Mary Ann Littleton, Diana Mozen, George Relyea, Karen Schetzina, Elizabeth F. Lowe, James M. Stoots, and Tiejian Wu¹

East Tennessee State University College of Public Health, United States

Abstract

The proportion of obese adolescents in Southern Appalachia is among the highest in the nation. Through funding from the National Institute on Minority Health and Health Disparities – National Institutes of Health, the Team Up for Healthy Living project was a cluster-randomized trial targeting obesity prevention in adolescents through a cross-peer intervention. The specific aims of the project were to: 1) develop a peer-based health education program focusing on establishing positive peer norms towards healthy eating and physical activity (PA) among high school students, 2) test program efficacy, and 3) explore mechanisms underlying the program. The study was guided by the Theory of Planned Behavior, which presupposes that human behavior is primarily driven by attitude, subjective norms, perceived behavioral control, and social support. To deliver the intervention, undergraduate students from the disciplines of public health, nutrition, and kinesiology were hired as peer facilitators. Ten area high schools were invited to participate, were matched on demographics and then randomized to intervention or control. The primary outcomes of the study included body mass status, dietary behaviors, PA, and sedentary behaviors which were assessed at baseline and at three and twelve months post baseline. Intervention schools received Team Up for Healthy Living curriculum, which consists of eight 40-minute sessions. The curriculum focused on improving nutrition awareness, PA, leadership and communication. Control schools received their regularly scheduled Lifetime Wellness curriculum. The long-term goal of the study was to establish an effective academia–community partnership program to address adolescent obesity disparity in Southern Appalachia.

Keywords

Adolescent; Obesity; Theory of Planned Behavior; Nutrition; Physical activity; School-based intervention

1. Introduction

Obesity continues to present significant challenges to public health in the United States, and addressing this issue has been a priority since the 1977 National Institutes of Health (NIH)

Correspondence to: Deborah Leachman Slawson.

¹Deceased.

publication of *Obesity in America* [1]. Obesity in childhood and adolescence is at epidemic proportions, with data from the 2011–2012 National Health and Nutrition Survey (NHANES) indicating that 17.7% of children aged 6–11 and 20.5% of youth aged 12–19 are obese. Where a recent report [2] shows that rates of obesity among children ages two to five have declined slightly, obesity rates among adolescents remain unchanged since 2003–2004. Childhood obesity is an important public health concern, as pediatric overweight and obesity increase the risk of premature mortality in adulthood [3]. Health risk habits including unhealthy eating and physical inactivity are often established during adolescence [4] and excess weight can persist into adulthood, increasing the lifetime risk of chronic diseases such as heart disease and diabetes [5].

The Southern Appalachian region ranks among the highest in the nation for percentage of obese high school students [6]. The Appalachian region has a population of 23 million residing in 420 counties and 13 states. Forty-two percent of the region's population is rural [7,8]. Compared to other areas of the country, people living in Appalachia face a heavier burden from chronic diseases such as obesity, diabetes, and heart disease, as well as higher rates of premature mortality for those diseases [7,9,10]. There is a pressing need to address these disparities, with adolescent obesity being a primary area of impact. However, effective interventions are limited for this age group [11].

The overall goal of the Team Up for Healthy Living project was to test the efficacy of a cross-age peer-led education program in which college students serve as facilitators to meet the critical community need for adolescent obesity prevention in Southern Appalachia. While respected as role models to high school teens, college students are less constrained by the cognitive immaturity often found among the same-age peer educators. When under the guidance or in collaboration with more capable peers, children are able to access or perform more complex skills [12]. The Theory of Planned Behavior (TPB) served as the theoretical framework for this peer-based approach to address adolescent obesity. TPB has been successfully used to explain health-related behavior including adolescent's eating behavior and physical activities [13–15]. This theory-driven approach to obesity prevention, coupled with a cross-peer application of the intervention, offers a promising, innovative methodology for addressing this complex public health concern. The implementation of this research project was guided by a community–academic partnership through development of a formalized steering committee. The community–academic partnership approach, in which community members are integral to ongoing project management, has been shown to enhance both research and population outcomes and improve the health of communities [16–19]. If proved effective, the proposed program may meet the critical community needs for adolescent obesity prevention by engaging higher education institutes and students in service and fostering within them an ethic of civic responsibility. The program should be readily transferable from research to action without substantial additional resources.

2. Primary research goals

The long-term goal of the Team Up for Healthy Living project was to establish an effective academia–community partnership program to address adolescent obesity disparity in Southern Appalachia. The specific aims were: 1) to develop a peer-based health education

program focusing on establishing positive peer norms and supportive peer relationships towards healthy eating and PA among high school students, 2) to test program efficacy, and 3) to explore mechanisms underlying the program.

Primary and secondary outcomes were measured to investigate study aims 1 and 2. The primary outcomes were body mass status, dietary behaviors, PA, and sedentary behaviors. Secondary outcomes included attitudes and beliefs on weight control, perceived behavior control/self-efficacy, perceived behavioral control (PBC) for healthy eating and physical activity, attitude towards healthy eating and physical activity, perceived group norms of eating and physical activity, social support, weight teasing and weight perception, self-reported body weight and weight concern, unhealthy dieting, health-related quality of life (HRQoL), and dental health. Primary and secondary outcomes were assessed at baseline and at three and twelve months post-baseline.

The primary hypothesis being examined in the proposed study was that a cross-peer health education program (addressing body mass status, healthy eating, and physical activity [PA] and sedentary behaviors) administered through high school *Lifetime Wellness* classes would reduce overall BMI percentile and lead to an overall health-enhancing lifestyle.

The Team Up for Healthy Living program uses a multidisciplinary approach to study management that includes experts in epidemiology, dietetics, exercise physiology, behavioral science, pediatrics, public health, and biostatistics in partnership with community peers to develop program content and to ensure optimal program implementation. To carry out the present study, we took the following steps to strengthen the partnership between ETSU and the participating school districts: 1) Meetings were held with ETSU administrators, program staff, and faculty members, as well as school board members, school principals, and *Lifetime Wellness* teachers to discuss the program and the partnership, and to confirm agreements. 2) A Team Up Steering Committee was created to supervise and coordinate research and partnership activities. This committee was comprised of multidisciplinary representatives from the university and the high schools (ETSU: study personnel; high schools: directors of school districts and coordinated school health coordinators). This committee advised the implementation of project activities and ensured effective collaboration among partners. 3) A formal document of partnership was created. 4) The Team Up Steering Committee members met quarterly to review and monitor program progress [20].

3. Study design

3.1. Recruitment and randomization of schools

Five county school districts in Appalachia were contacted based on rurality and socioeconomic status. These school districts were invited to a program-planning workshop conducted in Fall 2011 to identify high schools interested in participating in the project. Ten high schools of thirteen available were interested in participating. One school could not participate due to class scheduling concerns and two did not take part due to minimal interest. The principal investigator (PI) and the project coordinator met with principals and *Lifetime Wellness* teachers at each school to describe the planned intervention and program

requirements. Not all wellness teachers were required to participate in order for the school to be included, although no teachers refused to take part. Classroom materials were offered as incentives to each teacher that participated and office supplies were delivered to each school recruited.

3.2. Recruitment of students

Current students enrolled in the participating high school Lifetime Wellness classes were eligible to participate in the study. Students were primarily 9th graders with some upper classes minimally represented. Exclusion criteria included: 1) current enrollment in another weight management program, 2) presence of a diagnosed eating disorder such as anorexia nervosa and bulimia nervosa, 3) presence of an underlying condition affecting weight status such as hypothyroidism, Cushing's syndrome, or chronic steroid use, 4) current dietary and PA restrictions, such as in children with hypertension, diabetes, or severe orthopedic problems, and 5) pregnancy. Study protocols and parental consent/student assent forms were approved by the Institutional Review Board (IRB) prior to the start of recruitment.

Recruitment of study participants occurred over two waves, with the first taking place in January 2012 and the second occurring in September 2012. See the flow of participants depicted in Fig. 1. Analysis of intra-class correlations for schools and classes at the 3-month assessment for wave one was found to be significant for classes (ICC = 0.108, $p = 0.025$), and not for school (ICC = 0.022, $p = 0.310$). Preliminary power analysis was done on wave one BMI at three months. Using an independent t-test (i.e., statistical model that does not adjust for clustering and covariates), intervention schools demonstrated a significant decrease from baseline to 3-month compared to control schools ($t = 2.05$, $p = 0.041$). Power (using Proc Power in SAS) was found to be 0.50. To achieve a power of 0.80, an N of 400 per treatment arm, $N = 800$, would be needed (assuming $SD = 0.815$). Using a General Linear Mixed Model with age and gender as covariates and classes nested in schools, the effect of treatment was abated by the clusters, as the nesting of classes within schools was significant (covariance parameter estimate = 0.081, $SE = 0.032$, $Z = 2.52$, $p = 0.006$). While the mean effect of treatment favored intervention, it was not significant in chief due to the clusters. Power was found to be 0.25. To achieve a power of 0.80 with an estimated effect size of 0.13, a total of 120 classes ($N = 1800$) would be required. This conservative power estimate biases sample requirements towards having more classes, as opposed to the number of students in each class.

In order to increase the power, all *Lifetime Wellness* classes at each of the participating schools were invited to participate in the study for wave two. As depicted in Fig. 2, the number of classes selected for participation increased from 27 in wave one to 39 in wave two, bringing the total number of classes to 66.

In regard to the process by which participants were recruited, trained research staff came to the classrooms to explain the study to students and distribute a study flyer that described the study and asked the parent's permission for his/her child's participation (via passive parental consent form). A discussion of potential risks and benefits was provided. Inclusion/exclusion criteria were listed in the consent form. The students were asked to take the flyer and consent form to their parents. Parents who did not give consent were not asked whether

exclusion criteria were met. This procedure ensured that non-participating students' privacy was protected.

Approximately one week after the parent consents were sent home, the study staff came to the classroom to review the student assent process with students who were eligible to participate based on the parent consent form response. Each eligible student was provided time to read over the assent form and decide on participation in the study. Inclusion/exclusion criteria were provided in the assent form. In order to protect their privacy, students who declined to participate were not asked if any exclusion criteria were met. If a student had questions regarding participation, he/she could choose to schedule an individual meeting with the study staff at the school prior to giving informed assent, although no such meetings were requested by potential study participants.

3.3. Recruitment of college peer facilitators

A call for applications was distributed to all eligible students through emails and flyers. Students who were interested in serving as peer facilitators submitted a statement of interest and qualification and a brief resume. The applications were reviewed and selected candidate students were then interviewed by project team members. College students serving as peer facilitators served as temporary, paid, employees and had the option of earning credit towards required internship or fellowship hours if their degree program provided this option. Facilitator payment rates were appropriate in comparison to market rates.

The criteria to select college students included: relevant coursework completed, communication and leadership skills, sensitivity towards others, and willingness to sign a program agreement. Exclusion criteria centered on inability to pass a background check.

For each of two semesters, nine undergraduates majoring in public health, nutrition, and kinesiology were selected and trained as facilitators to lead the peer-based intervention.

3.4. Data collection procedures

Data were collected at baseline, 3- and 12-months post-baseline. Graduate students were trained to serve as research assistants and conducted the assessments. These research assistants visited each school at a time convenient to school personnel and students. At baseline and at the 3-month data collection, students were in *Lifetime Wellness* classes, and all participating students in those classes were allowed to complete the assessments during a class period. At the 12-month assessment, school personnel invited participating students to a central location on school grounds in order to complete assessments. Each participant was given five dollars for completion of the 12-month assessment, and study promotional materials in the form of T-shirts, water bottles, pencils and/or Frisbees were provided to randomly selected participants who completed 12-month assessment materials.

3.5. Procedures for retention of the school sample

Consistent communication with the school personnel including coordinated school health (CSH) coordinators at the district level as well as teachers and principals was crucial in maintaining the participant sample. The project coordinator served as the liaison between the

research staff and the school personnel throughout the project. CSH coordinators, principals and teachers all worked together with the project coordinator in order to set up the intervention classrooms, data collection sites and dates for each collection of data on the students. Furthermore, the project coordinator was present for the majority of the data collection visits as well as met with each teacher at the end of the wave 1 intervention to discuss their satisfaction with the peer facilitators. This ongoing dialog and face to face engagement at the school sites were critical in maintaining participation in the research project.

In addition to ongoing updates regarding program implementation, the steering committee, consisting of the CSH coordinators and directors of schools, was given de-identified summaries of demographic and baseline data for each wave to assist in future projects and in grant writing. These demographic and baseline data included: gender, grade level, race/ethnicity, age, basic nutrition, screen time, physical activity, BMI scores and status, sugar drink consumption, weight teasing, and social support for healthy behaviors. Steering committee members from each school district were provided with a summary specific to their own school district in order to provide a snapshot of data specific to students in their school system. We also provided comparison data to the ten participating schools that included state level and national level data where appropriate. Students and parents of the intervention group were given program intervention elements related to healthy behaviors at home. These elements included recipes to try at home, homework assignments to include family and peers in healthy behavior discussions and actions, and intervention hand-outs to share with family and friends.

4. Measures

4.1. Baseline and follow-up assessments

Assessments were performed pre-intervention and at 3 and 12 months post baseline. Adolescents' weights and heights were measured, and all other information was collected through questionnaires.

4.2. Primary outcome measures

4.2.1. Body mass status—Weight and height were collected twice during each assessment using calibrated scales and portable stadiometers. Weight was measured to the nearest 0.1 kg and height to the nearest 0.1 cm. Students were asked to remove heavy outer garments and shoes. BMI (kg/m^2) was calculated and matched to the corresponding Centers for Disease Control and Prevention's (CDC) standardized age- and gender-specific growth charts [21,22].

4.2.2. Dietary behaviors—The Eating Habits Questionnaire (EHQ) [23] is a food frequency questionnaire (FFQ) and was used to assess dietary intake and eating habits in youth. The EHQ is based on recall of foods eaten over the past week and provides information on food intake that can be compared with the food pyramid. The section assessing foods eaten on any one day was eliminated per Speck and colleagues' recommendations. The reliability and validity of the EHQ have been established [23].

Dietary behaviors were further assessed using nine questions from the National Youth Risk Behavior Survey (YRBS). Participants were asked to recall fruit and vegetable intake, soda consumption, and milk consumption over the past 7 days (options ranged from 0 times in past seven days to 4 or more times per day). Participants were also asked how often they eat breakfast (0 days to 7 days) [24].

4.2.3. Physical activity and sedentary behaviors—The Adolescent Physical Activity Recall Questionnaire (APAR-Q) was used to measure self-reported participation in organized and informal PA during a typical week separately for the fall and spring semester. The APAR-Q has demonstrated good reliability and validity in Australian adolescents [25]. The APAR-Q was adapted in the present study for an American audience using an approach similar to Li et al. [26] and Trang et al. [27]. In the present study, context-specific activities such as hiking and baseball were added and activities such as korf ball and cricket were deleted.

The Adolescent Sedentary Activity Questionnaire (ASAQ) was used to assess self-reported sedentary behaviors in youth for each day during a typical school week and a typical weekend. The ASAQ is a valid and reliable measure of sedentary behaviors in youth [28].

We further assessed PA and sedentary behaviors using six YRBS questions. These questions asked students to recall the number of times that they participated in at least 60 min of moderate PA including strengthening and toning muscles (options ranged from 0 days to 7 days). Time spent watching television or playing video games, participation on sports teams, and frequency of physical education classes at school was also assessed [24].

4.3. Secondary outcome measures

4.3.1. Attitudes and beliefs on weight control—The Dieting Beliefs Scale (DBS) is a 16-item validated self-report measure that was used to assess perceptions about personal control and the role of genetics, environment, and social support in determining one's weight (1 = very descriptive of my beliefs, 6 = not at all descriptive of my beliefs) [29,30].

4.3.2. Perceived behavior control/self-efficacy—Personal competence and general self-efficacy were assessed using a modified version of the General Self-Efficacy Scale (GSE) and Proactive Attitude Scale (no/maybe/yes) [31,32]. The reliability and validity of the original measure have been well-established [33–35].

4.3.3. Perceived behavioral control for healthy eating—Perceived behavioral control for healthy eating was measured using a 4-item Likert-type scale (1 = definitely yes, 5 = definitely no) that has been validated previously in a study among Appalachian adolescents [36].

4.3.4. Attitude towards healthy eating—Attitude towards healthy eating was assessed using 6 semantic differential anchors (e.g., useful–useless, and harmful–beneficial) along a 6-item scale. The measure has demonstrated good internal validity and reliability in prior research [36].

4.3.5. Perceived group norms of eating—Adolescents' beliefs about the eating habits of referents were assessed using the 4-item Index of Eating Habits of Significant Others (1 = definitely yes, 5 = definitely no). This scale was moderately reliable in prior research [36].

4.3.6. Perceived behavioral control for physical activity—Perceived behavioral control for physical activity was measured using a 4-item Likert-type scale (1 = definitely yes, 5 = definitely no) that has been validated previously in a study among Appalachian adolescents [37].

4.3.7. Attitude towards physical activity—Attitude towards physical activity was measured using 6 semantic differential anchors (e.g., useful–useless, harmful–beneficial) along a 6-item scale [37].

4.3.8. Perceived group norms of physical activity—The Index of Physical Activity of Significant Others is a 4-item Likert-type scale that was used to assess adolescents' beliefs about the PA of referents (1 = definitely yes, 5 = definitely no). The measure demonstrated good validity and reliability in prior research among Appalachian adolescents [37].

4.3.9. Social support—Social support was assessed using two measures. The 8-item Index of Social Support for Healthy Eating (ISSHE) assesses perceptions of social support [38–40]. All items use a 4-point scale (1 = strongly disagree, 4 = strongly agree). The ISSHE has demonstrated acceptable psychometric properties among Appalachian adolescents (Cronbach's $\alpha = 0.695$) [36,37]. The Social Support for Physical Activity measure has 7 items, comprised of two subscales (family support and peer support). All items use a 5-point scale (1 = never, 5 = every day). The measure has been validated previously among adolescent females [41].

4.3.10. Teasing about weight and weight perception—Perceptions of teasing were assessed by 2 items: “Were you teased or made fun of by your peers during the past two weeks because of your weight?” and “Did you witness someone being teased or made fun of by your peers over the past two weeks because of his/her weight?” The response categories range from ‘never’ to ‘almost everyday.’ Weight perception was assessed by one question from the YRBS: How do you describe your body weight? (1 = very underweight, 5 = very overweight) [24].

4.3.11. Self-reported height and weight concern—Self-reported height and weight were assessed by asking students how much they weigh and how tall they are. Weight concern was assessed by one question from the YRBS: “Which of the following are you trying to do about your weight?” (1 = lose weight, 4 = I am not trying to do anything about my weight) [24].

4.3.12. Unhealthy dieting—Problem dieting behaviors were assessed with three YRBS questions using a yes/no format – During the past 30 days, did you: 1) go without eating for 24 h or more (also called fasting) to lose weight or to keep from gaining weight; 2) take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from

gaining weight; and 3) vomit or take laxatives to lose weight or to keep from gaining weight. These questions have demonstrated moderate to strong test–retest reliability [24].

4.3.13. Health-related quality of life—The 23-item Pediatric Quality of Life Inventory 4.0 (PedsQL) is a self-report measure used to assess HRQoL. The Teen Report for Ages 13–18 was used in the current study. The assessment yields three summary scores (total, physical, psychosocial) and three subscale scores (emotional, social, and school functioning). Study participants were asked to respond to each item using a 5-point Likert-type scale ranging from ‘never’ to ‘almost always’. Higher scores indicate greater HRQoL. The reliability and validity of the PedsQL generic core scales have been established in prior studies [42].

The 18-item Pediatric Quality of Life Multidimensional Fatigue Scale is a self-report measure designed to measure fatigue in pediatric patients and comprises the General Fatigue Scale (6 items), Sleep/Rest Fatigue Scale (6 items), and Cognitive Fatigue Scale (6 items), as well as a total score. The Teen Report for Ages 13–18 was used in the current study. Study participants responded to each item using a 5-point Likert-type scale ranging from ‘never’ to ‘almost always’. Higher scores indicate greater HRQoL. Measurement properties have been demonstrated for use with obese pediatric patient populations [43].

4.3.14. Dental health and hygiene—Students were asked 5 questions regarding their dental health and hygiene. Four questions were adapted from the National Health and Nutrition Examination Survey (NHANES), including: “How would you describe the condition of your teeth?”, options ranging from ‘excellent’ to ‘poor’; and “How often during the past year have you had difficulty doing your usual job(s) or attending school because of problems with your teeth or mouth?”, options ranging from ‘very often’ to ‘never’ [44]. The 2 additional NHANES questions are related to perceived need for dental treatment [45]. The question, “Do you feel that you are in current need of dental treatment?” was followed by the item, “If yes, what kind of dental treatment do you feel you need?” Multiple options were provided for response to this item, including an open-ended option to allow depiction of treatment not listed. One question, “Has a dentist ever told you that you have a cavity or tooth decay?” was taken from the National Oral Health Surveillance Survey [46].

4.4. Covariates

4.4.1. Covariates—Student-level demographics (e.g., sex, age, race, family household income and level of education, grade in school, and self-reported grades) and general school characteristics were collected.

4.5. Program effectiveness measures

4.5.1. Level of program involvement—Adolescents' level of program involvement was determined by calculating the number of homework activities completed by each student as well as by calculating their absentee rates for the 8 peer-led *Lifetime Wellness* classes.

4.5.2. Peer facilitators' performance—We employed a number of methods to assess peer facilitators' performance. Facilitator' competency was evaluated during the time of the

health educator training, post-training, and post-intervention. Facilitators completed questionnaires assessing their skills, knowledge and competencies in a broad range of categories as well as program satisfaction. In addition, at the end of the 8-week intervention, adolescents and *Lifetime Wellness* teachers evaluated the facilitators' performance using the Peer Instructor/Facilitator Effectiveness Inventory.

5. Intervention

5.1. Program development

The Team Up for Healthy Living intervention was developed by a multidisciplinary team based on review of the literature and individual areas of expertise as well as efforts to develop a novel approach to obesity prevention with adolescents. ETSU faculty drafted the curriculum, which was then reviewed and critiqued by school principals and wellness teachers in local high schools. The main components of the intervention were piloted in a high school setting in order to ensure feasibility and acceptability [47]. ETSU faculty further developed the curriculum and activities based on the National Health Education Standards to adhere to course requirements. In addition, the first three weeks of the revised curriculum were pilot tested with high school students (N = 10) and *Lifetime Wellness* teachers (N = 2) as a component of focus groups at a local high school not participating in the Team Up project. Feedback was provided by students and teachers on activities, use of peer facilitators, and overall program effectiveness. An additional focus group involving six *Lifetime Wellness* teachers offered additional insights into program acceptability. The combination of these efforts resulted in a modified and refined 8-week curriculum. A summary of the curriculum may be found in Table 1.

5.2. Program content

The cross-age peer-led health facilitator concept and the TPB theoretical framework [48] were integral to this intervention. TPB postulates that human behavior is primarily driven by three major constructs: attitude, subjective norms, and perceived behavior control (PBC) [48,49]. More recently, additional variables including social support have been included to extend TPB as predictors of intention and behavior [50–52]. We hypothesized that influencing the components of the TPB will lead to healthier body weight among adolescents. See the theoretical framework in Fig. 3. This framework describes the interrelationship of the constructs in TPB and their proposed relationship with outcomes, denoting possible mediators in the model. The assumptions underlying this approach are that college students are respected as role models among high school teens and can therefore provide teens with knowledge, resources, and skills to adopt a healthier lifestyle. There has been demonstrated support for the effectiveness of cross-age peer interactions and their impact on mentees' school connectedness and self-esteem [47]. Team Up for Healthy Living focused on youth's intentions and behavior through impacting the three main constructs of TPB: attitude, subjective norms, and PBC [48,49], as well as by influencing social support [50–52].

5.2.1. The Team Up for Healthy Living curriculum—The eight 40-minute sessions each included a lesson overview, lesson objectives, lesson activities, materials needed,

facilitators preparation, and lesson activities: guidance for facilitators sections (Table 1). The elements of the curriculum were designed to address key aspects of TPB as interpreted through the theoretical framework in Fig. 3. The primary outcome of body mass status and secondary outcomes of dietary, PA, and sedentary behaviors would be impacted via curricular components that directly address healthy eating and PA. These outcomes would also be impacted through curricular elements addressing attitudes, social norms, social support, and elements of PBC. The curriculum included weekly challenges to foster teamwork and critical thinking. Each *Lifetime Wellness* class was divided into small teams of four to six students. In-class team activities were conducted to promote collaboration. Specific activities, shown in Table 2, were conducted in class or assigned to be completed at home. Incentives (e.g., water bottles, and Frisbees) were given to the team based on a variety of performance variables. The peer facilitators assumed a mentoring role during team activities with students on each individual team. They provided feedback regarding performance of the activity, served as role models, and provided feedback and guidance to enhance students' self-esteem and self-efficacy.

Two peer facilitators were assigned to each *Lifetime Wellness* class at each partnering intervention school to deliver the 8-week curriculum. The *Lifetime Wellness* teachers at the five schools assigned to intervention were present during the intervention sessions, helping with classroom management, and providing assessments of perceived peer facilitator effectiveness at the conclusion of the 8 week program. The project coordinator assisted with coordinating schedules and facilitating communication between peer facilitators and *Lifetime Wellness* teachers. Non-participating students were allowed to observe and take part in all curriculum activities, with no penalty for non-participation.

5.3. Peer facilitator training

The multidisciplinary research team participated in training the peer facilitators in the topics of their expertise. Training of peer facilitators took place over a fourteen-week span for wave one, and was condensed to seven weeks for peer facilitators in wave 2. This training included a series of didactics on topics including rationale of the study, protection of human subject procedures, topics as related to the curriculum, peer role modeling, and empowering youth, among other topics. The book by R. D. Myrick and T. Erney, titled *Youth Helping Youth: a Handbook for Training Peer Facilitators*, was used to guide training [53]. Quizzes were also used to assess each peer's level of knowledge on major topics. In addition to the lectures, training included practical role playing. Each peer facilitator practiced through rehearsal and role play of different aspects/activities of each group session. The practice sessions occurred before a panel of investigator-trainers who provided constructive feedback. Additionally, peer facilitators reviewed the video recordings and self-critiqued their performance in an effort to determine strengths and areas for improvement. Peer facilitators were judged to have completed training when their quiz scores and role playing satisfied the panel. Peer trainees read *Caring and Sharing: Becoming a Peer Facilitator* [54], an accompanying text to *Youth Helping Youth*. Furthermore, students were asked to complete readings related to a topic for the week. A description of a typical week of peer facilitator training is outlined in Table 3.

5.4. Intervention fidelity

In an effort to promote treatment fidelity, peer facilitators completed a Peer Facilitator Self Evaluation Form following completion of each group session delivered throughout the course of the intervention. These forms assessed whether all content and activities were completed, perceptions of performance including strengths and weaknesses, and other factors related to the delivery of the information and skills of the peer facilitator. These forms were reviewed and discussed at weekly debriefing sessions with the peer facilitators and research team. In addition, it was at these weekly debriefing sessions where peer facilitators were encouraged to discuss any potential barriers to implementation of the curriculum. Multiple members of the investigative team were at these debriefing sessions, and they encouraged discussion around identifying barriers and arriving at solutions to any concerns identified. Furthermore, a research team member observed each peer facilitator in the school setting and provided constructive feedback to further support adherence to the curriculum and treatment integrity.

In an effort to assess treatment fidelity, every group session was audio recorded by the peer facilitators, with the understanding that a random sample of one out of every five (20%) of each week's recordings would be assessed for completeness of intervention delivery. A coding sheet was developed and doctoral level research assistants supervised by members of the investigative team randomly selected and coded 20% of the group sessions for each week. A Co-I assisted in making final decisions when there were discrepancies in coding. Specifically, this effort resulted in a representation of the number of activities completed, time taken to complete the activities, comments related to presentation and student engagement, and overall ratings of presentation, engagement, and time allotted for each activity. This information was used to indicate whether all the components were successfully delivered during each session. Additionally, regular monthly meetings were held with the project staff and regular quarterly meetings were carried out with the Team Up Steering Committee to provide ongoing support, to discuss intervention implementation and delivery, and to monitor program activities.

5.5. Control condition

Schools/students assigned to the control condition completed assessments at baseline, 3-, and 12-months post-baseline. However, no intervention was delivered to these students who received *Lifetime Wellness* class as routinely provided. These students were enrolled in the *Lifetime Wellness* course and received the standard curriculum provided by *Lifetime Wellness* teachers.

6. Data analysis

6.1. Statistical analysis plan

Major descriptive analyses will be conducted on all demographic and baseline data: BMI Z score, dietary intake and PA and sedentary behaviors, as well as for secondary outcome measures. Intervention and control groups will be compared at baseline to determine the success of the randomization process. Should between-group differences denoted at baseline for any variables, those variables will be adjusted for in subsequent multivariate analyses.

Mean changes from baseline to post intervention in BMI Z score, dietary intake and PA and sedentary levels will be compared between the intervention and control groups. Since the outcome variables will be assessed at three points in time (baseline, and at 3 and 12 months post-baseline), repeated measures of outcomes within individuals in this study are correlated whereas those measurements between individuals are independent. To account for within subject correlation across multiple measurements on each individual, we will fit the generalized repeated measure models for analysis of the binary outcome (status of overweight and obesity) and the mixed effect models for analysis of the continuous outcome (BMI Z score). The Generalized Estimating Equation (GEE) method will be utilized to estimate the parameters, by which the hypothesis will be tested with group (intervention, control) as a between subjects factor (fixed effect) and time (baseline, 3 months, and 12 months) as a within subjects factor. In addition, we will include covariates such as adolescent's sex, age, race, grade in school, self-reported grades, family household income and level of education as well as general school characteristics in the analysis. If an imbalance between intervention and control groups in a baseline variable is found, the variable will also be included in the model. Statistical significance is defined as p-value < 0.05.

In order to provide a better understanding of the possible pathways for intervention effects, changes in potential mediating variables will be compared between the intervention and control groups. These mediating variables include: 1) attitudes and beliefs on weight control, 2) attitude towards healthy eating and physical activity, 3) perceived behavior control (PBC)/self-efficacy, 3) PBC for healthy eating and physical activity, 4) perceived group norms of eating and physical activity, 5) social support, 6) weight teasing and weight perception, 7) self-reported body weight, weight concern, and unhealthy dieting, and 8) HRQoL We will fit the generalized repeated measure models for analysis of binary outcomes and mixed effect models for analysis of continuous outcomes.

In addition to the analysis of the variables as potentially direct outcomes of the intervention, a causal structure/path diagram will be used (Fig. 3) to link the intervention, the potential mediating variables, eating behaviors and PA, and eventually body mass measures. We have used a causal structure to analyze the eating behavior/intention for healthy eating among adolescents [47]. With the application of Structural Equation Modeling (SEM) (Fig. 3), we will fully assess program effectiveness by examining possible mechanisms, which will significantly enhance our understanding of impacts of the peer-based intervention. In addition, we will also do analyses nested/stratified by intervention or baseline status (sex, obesity status, experience of weight teasing, etc.).

To increase power via reducing residual variance in the outcome, we will include a number of covariates in the model, including student's characteristics (e.g., sex, age, race, and grade in school) and family characteristics (e.g., income level/poverty status, level of education, and health status).

6.2. Data quality

A data management team consisting of biostatisticians, epidemiologists, and project staff is used to monitor data quality and accuracy. Data were collected using standardized paper

forms and were entered into an SPSS database. Trained research assistants and the project coordinator reviewed forms for completeness. Data were entered independently by two research assistants, and discrepancies were corrected by the project coordinator based on source documents. The quality of the data was monitored continuously and any problems detected were discussed with the PI.

6.3. Participant safety

As a study that has been classified as research that involves minimal risk, the following plan is being used to monitor the safety of study participants.

1. A baseline record of weight and general health status was created at the beginning of the study.
2. During the intervention period, as a part of each group session, peer facilitators encouraged each participant to anonymously indicate if there were any concerns about information covered in the intervention. Participants were also encouraged to indicate their plans on how they would use information provided during the intervention.
3. Peer facilitators were instructed to familiarize themselves with classroom policies and procedures related to classroom management and safety in order to become aware of medical or psychosocial conditions that may present among participating high school students that may require study exclusion or further action to prevent harm.
4. The PI or Co-I met with the coordinator and reviewed information collected in order to identify any possible physical or psychological issues that may be of concern.
5. If concerns were identified, the appropriate member of the study team (clinical and educational psychologists, pediatrician, or dietitian) contacted the project participant and initiated appropriate measures to address the concern.
6. At the 3 and 12 month post baseline follow-ups where weight and height were being recorded, research staff also reviewed these data for possible problems such as excessive weight loss during the study.
7. All project staff (coordinator, research associates/assistants) met on a weekly basis for ongoing training, monitoring of protocol, and problem solving. Questions regarding data collection and safety issues are promptly referred to the PI.
8. Research staff and peer facilitators are trained to identify events that would fall under mandatory reporting guidelines. These include physical injury to any child caused by other than accidental means or information from a study participant that leads staff to believe a person is in imminent danger of physical harm. Peer facilitators were to report any concerns at weekly debriefing sessions – or sooner, depending on the urgency of the situation. In the case of imminent danger they were to also notify the teacher and principal immediately.

9. The PI, Co-investigator, and other members of the investigation team meet monthly for on-going monitoring and problem-solving.

The likelihood of misrepresentation of the study's goals or strategies by study participants leading to poor eating in order to lose weight was an unlikely possibility, but was addressed in facilitator training, project materials, and the data safety monitoring plan. The potential for psychological risks to the adolescents as a result of a study-initiated focus on management of weight, e.g., the development of an eating disorder or a negative alteration of self-image, was recognized by the key study personnel. Therefore, protections were prioritized in the study design to safeguard against these risks.

The possibility of physical harm due to poor eating in an attempt to lose weight was minimized through the collaboration of the PI and registered dietitian (Dr. Slawson), pediatrician (Dr. Schetzina), and clinical psychologist (Dr. Dalton) in developing a plan that included instructions for adolescents on what constitutes healthy nutrition. In addition, follow-up visits by research staff to the schools provided ongoing communication with *Lifetime Wellness* teachers and the adolescents. Following each group session, the peer facilitator answered any questions posed by the students in the intervention. The PI and project coordinator were available by phone to parents who had questions. Should any concerns about psychological or physical well-being of children occur, Dr. Schetzina or Dr. Slawson would notify the school administration of the potential concern. Any adverse event, such as inappropriate weight loss or gain, would be reported to the PI and to the Coordinated School Health Coordinator at the relevant school district.

Pregnancy/suspected pregnancy was clearly identified as a reason for study exclusion to students and parents. A discussion about how nutrition requirements and how PA may change with pregnancy was included in the curriculum materials. Information about food insecurity and suggestions and resources for eating healthy on a limited budget were included in the curriculum. A "Food Allergies and Dietary Restrictions Form" was completed by all participants at the beginning of the study. Facilitators received training in procedures for reporting cases of suspected child abuse or neglect, including emergency procedures, consistent with state law and school policies. A list of local and online resources for nutrition, PA, and healthy living was provided to facilitators and distributed to intervention participants.

7. Discussion

Team Up for Healthy Living is a cluster-randomized trial evaluating the effectiveness of a cross-peer intervention for obesity prevention among adolescents through the high school setting. Undergraduate students from a regional university were trained as peer mentors and program facilitators and lead an eight-week intervention for students in *Lifetime Wellness* classes in high schools randomly assigned to intervention. The project will test the efficacy of the cross-age peer-led intervention and will seek to address disparate rates of obesity among youth in the Southern Appalachian region [6]. The intervention is based on the tenets of the TPB [48] and focuses on improving weight status, and dietary, PA, and sedentary behaviors by impacting peer norms towards healthy eating and PA and sedentary habits. The intervention also targets youth's behavioral intentions to engage in healthy eating and PA

through addressing attitudes towards healthy eating, physical activity, and weight control, subjective norms for these behaviors, and PBC to influence dietary and PA behaviors. Self-efficacy, social support, weight teasing and weight perceptions including self-reported body weight and weight concerns, and HRQoL are also key elements of the intervention. Sessions provided opportunities for participants to practice skills in effective communication, goal setting, leadership and team building. By incorporating small group work and team challenges, participants are able to actively engage in positive behaviors related to nutrition and PA awareness and to build supportive peer relationships around these behaviors.

Programs to promote healthy body weight during adolescence are particularly critical, since the transition period from childhood to adolescence is a high-risk period for declining PA [55], and excess body weight at this time of life is predictive of obesity [56] and premature mortality in adulthood [3]. Adolescence is a period characterized by peer pressure and conformity to peer group norms [57], and a peer-based approach is a promising strategy for modifying adolescents' behaviors. Peer education and cross-age mentoring have become increasingly popular methods of health promotion among adolescents [58–69]. Although used extensively in other areas [58,59,61,63–65,68], peer-based approaches have rarely been applied in studies to change dietary behaviors and PA behaviors among adolescents. A number of studies suggest that, after controlling for various family and individual factors, weight-related attitudes and behaviors among friends may predict body image, dieting onset, chronic dieting, unhealthy weight control behaviors (UWCBs), and eating disorder symptoms [69–75]. Social norms could be one mechanism through which peer influence may operate on adolescent dieting [76] and binge eating [77]. As adolescents tend to seek approval from peers, it is presumed that food acceptability and selection are determined by peer influence and group conformity [78–80]. For example, a study in the Netherlands found that best friends were associated with 19% of food choices, most being snack foods [78]. Results from qualitative focus group research have been inconsistent in determining the effects of peer influence on eating behaviors in adolescents [80–82]. Inconsistent results in empirical studies may be due to adolescents' desire for independence, and they may not recognize the outside influence from peers [78]. Peer influences have also been shown to play a major role in impacting adolescents' participation in PA [13–15,48,49,83,84]. Peer-led initiatives can directly affect the social environment, provide positive role models, and help change social norms. A metaanalysis of adolescent drug prevention programs revealed peer-led programs were more effective than other models [69]. However, few studies have used a peer-led education model to change dietary behaviors and PA behaviors among adolescents [85,86]. Team Up for Healthy Living seeks to test the efficacy of this model for healthy body weight promotion, and through structural modeling will ascertain the mechanisms inherent in the interrelationships of program participation to primary and secondary outcomes.

Community engagement is central to the management and oversight of Team Up for Healthy Living. Principles of CBPR [87] undergirded the development of the intervention, and were essential to the implementation plans for the project. Based on the history of partnership building that has defined the role of ETSU in the region [16,17], this form of project management better ensures that community members share ownership of the program and are actively engaged in ensuring optimal implementation of the intervention and data

collection processes. The Team Up Steering Committee involves school district personnel and faculty from participating schools in planning and implementation of the project.

While there are several strengths related to the design of this study and its implementation fidelity elements, there are some limitations that should be considered. As the focus of this project is on rural Appalachian youth, its utility in urban settings has not been tested. Further, as this program has been designed for use in the high school setting, its applicability for younger audiences would need to be assessed. Ongoing research efforts may benefit from a longer-term follow-up as well as engagement of school-based and parent-focused elements. Such additions would further illuminate critical elements in solving the complex problem that is pediatric obesity.

In summary, Team Up for Healthy Living offers an innovative approach to adolescent obesity prevention, grounded in theory and built on CPBR principles. Maximizing community and academic partnership efforts to address this major public health problem offers a promising and potentially sustainable approach. The cross-age peer-led curriculum that forms the central element of the Team Up for Healthy Living project is designed to establish an atmosphere of acceptance of others, group trust and cohesion, supportive peer relationships, peer leadership, and the promotion of healthy behavioral choices regarding eating and PA. A cluster-randomized trial design is being used to assess the effectiveness of the program for adolescent obesity prevention, and through structural modeling, we will explore the mechanisms underlying program outcomes. Findings may have applicability for other settings outside Appalachia with populations exhibiting disparate rates of adolescent overweight, and will inform intervention development in school-based settings.

Acknowledgments

The project described was supported by Grant Number R01MD006200 from the National Institute on Minority Health and Health Disparities. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Minority Health and Health Disparities or the National Institutes of Health.

References

1. Bray GA. Obesity in America. 1979 NIH, Publication No.79-359.
2. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA*. 2014; 311:806–14. [PubMed: 24570244]
3. Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int J Obes*. 2011; 35:891–8.
4. Hunter SM, Bao W, Berenson GS. Understanding the development of behavior risk factors for cardiovascular disease in youth: the Bogalusa Heart Study. *Am J Med Sci*. 1995; 310:S114–8. [PubMed: 7503113]
5. Guo SS, Wu W, Cameron W, Roche AF. Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *Am J Clin Nutr*. 2002; 76:653–8. [PubMed: 12198014]
6. U.S. Department of Health and Human Services, Health Resources and Service Administration. The national survey of children's health. Overweight and physical activity among children: a portrait of states and the nation. *Matern Child Health*. 2005
7. Halverson JA. An analysis of disparities in health status and access to health care in the Appalachian region. 2004

8. Appalachian Regional Commission.
9. Centers for Disease Control and Prevention. Coronary heart disease mortality trends among whites and blacks: Appalachia and United States. *Morb Mortal Wkly Rep*. Nov 27.1998 47:1005-8–1015.
10. Centers for Disease Control and Prevention. Cancer death rates – Appalachia, 1994–1998. *Morb Mortal Wkly Rep*. 2002; 51:527–9.
11. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2011; 12:CD001871. doi:CD001871. [PubMed: 22161367]
12. Hamilton SF, Hamilton MA. Building mentoring relationships. *New Dir Youth Dev*. 2010; 2010:141–4. [PubMed: 20665836]
13. Courneya KS, McAuley E. Reliability and discriminate validity of subjective norm, social support, and cohesion in an exercise setting. *J Sport Exerc Psychol*. 1995; 17:325–37.
14. Hagger MS, Chatzisarantis N, Biddle S. The influence of self-efficacy and past behavior on the physical activity intentions of young people. *J Sports Sci*. 2001; 19:722–5.
15. Hausenblas H, Carron A, Mack D. Application of the theories of reasoned action and planned behavior to exercise behavior: a meta-analysis. *J Sport Exerc Psychol*. 1997; 19:36–51.
16. Brown DE, Behringer B, Smith PL, et al. Graduate health professions education: an interdisciplinary university–community partnership model. *Educ Health*. 2003; 16:176–88.
17. Goodrow B, Olive KE, Behringer B, et al. The community partnerships experience: a report of institutional transition at East Tennessee State University. *Acad Med*. 2001; 76:134–41. [PubMed: 11158831]
18. Israel B, Schulz A, Parker E, Becker A. Review fo community-based research: assessing partnership approaches to improve public health. *Annu Rev Public Health*. 1998; 19:173–202. [PubMed: 9611617]
19. Seifer, SD.; Shore, N.; Holmes, SL. Developing and sustaining community–university partnerships for health research: infrastructure requirements. Seattle WA: Community–Campus Partnerships for Health; 2003.
20. Southerland J, Behringer B, Slawson DL. Using the give–get grid to understand potential expectations of engagement in a community–academic partnership. *Health Promot Pract*. 2013
21. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: methods and development. *Vital Health Stat*. 2002; 11:1–190.
22. National Center for Health & Statistics. CDC growth charts. US Department of Health and Human Services; 2000.
23. Speck BJ, Bradley CB, Harrell JS, Belyea MJ. A food frequency questionnaire for youth: psychometric analysis and summary of eating habits in adolescents. *J Adolesc Health*. 2002; 28:16–25. [PubMed: 11137901]
24. Brener ND, Kann L, McManus T, Kinchen SA, Sundberg EC, Ross JG. Reliability of the 1999 youth risk behavior survey questionnaire. *J Adolesc Health*. 2002; 31:336–42. [PubMed: 12359379]
25. Booth ML, Okley AD, Chey T, Bauman A. The reliability and validity of the adolescent physical activity recall questionnaire. *Med Sci Sports Exerc*. 2002; 23:1986–95. [PubMed: 12471306]
26. Li M, Dibley MJ, Sibbritt D, Yan H. Factors associated with adolescents' physical inactivity in Xi'an City, China. *Med Sci Sports Exerc*. 2006:2075–85. [PubMed: 17146313]
27. Trang NHHD, Hong TK, Dibley MJ, Sibbritt DW. Factors associated with physical inactivity in adolescents in Ho Chi Minh City, Vietnam. *Med Sci Sports Exerc*. 2009:1374–83. [PubMed: 19516164]
28. Hardy L, Booth M, Okley A. The reliability of the Adolescent Sedentary Activity Questionnaire (ASAQ). *Prev Med*. 2007; 45:71–4. [PubMed: 17532371]
29. O'Brien KS, Puhl RM, Latner JD, Mir AS, Hunter JA. Reducing anti-fat prejudice in preservice health students: a randomized trial. *Obesity*. 2010; 18:2138–44. [PubMed: 20395952]
30. Stotland S, Zuroff DC. A new measure of weight locus of control: the Dieting Beliefs Scale. *J Pers Assess*. 1998; 54:191–203. [PubMed: 2313541]
31. Schwarzer R, Jerusalem M. Measures in healthy psychology: a user's portfolio. Casual and control beliefs; Generalized Self-Efficacy Scale. 1995

32. Tang CS, Au W, Schwarzer R, Schmitz G. Mental health outcomes of job stress among Chinese teachers: role of stress resource factors and burnout. *J Organ Behav.* 2001; 22:887–901.
33. Scholz U, Gutierrez Dona B, Sud S, Schwarzer R. Is general self-efficacy a universal construct? *Eur J Psychol Assess.* 2002; 18:242–51.
34. Schwarzer R, Born A. Optimistic self-beliefs: assessment of general perceived self-efficacy in thirteen cultures. *World Psychol.* 1997; 3:177–90.
35. Schwarzer R, Babler J, Kwiatek P, Schroder J, Zhang JX. The assessment of optimistic self-beliefs: comparison of the German, Spanish, and Chinese versions of the General Self-Efficacy Scale. *Appl Psychol.* 1997; 46:69–88.
36. Wu T, Snider JB, Floyd MR, Florence JE, Stoots JM, McKamey MI. Intention of healthy eating among Southern Appalachian teens. *Am J Health Behav.* 2009; 35:115–24. [PubMed: 18844506]
37. Stoots M, Wu T, Florence J, Floyd M, Snider B, Ward R. Physical activity and psychological perceptions among adolescents in rural Southern Appalachia. Sep 12.2009
38. Cutrona CE, Russell DW. The provisions of social relationships and adaptation to stress. *Adv Pers Relat.* 1987; 1:37–67.
39. Cutrona, CE.; Russell, D. Type of social support and specific stress: toward a theory of optimal matching. In: Sarason, IG.; Pierce, GR., editors. *Social support: an interactional view.* New York, NY: Wiley; 1990.
40. Motl RW, Dishman RK, Saunders RP, Dowda M, Pate RR. Measuring social provisions for physical activity among adolescent black and white girls. *Educ Psychol Meas.* 2004; 64:682–706.
41. Dishman RK, Hales DP, Sallis JF, et al. Validity of social–cognitive measures for physical activity in middle-school girls. *J Pediatr Psychol.* 2010; 35:72. [PubMed: 19433571]
42. Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the pediatrics quality of life inventory version 4.0 generic core scales in healthy and patient populations. *Med Care.* 2001; 39:800–12. [PubMed: 11468499]
43. Varni JW, Limbers CA, Bryant WP, Wilson DP. The PedsQL Multidimensional Fatigue Scale in pediatric obesity: feasibility, reliability, and validity. *Int J Pediatr Obes.* 2010; 5:34–42. [PubMed: 19593727]
44. Dye BA, Barker LK, Li X, Lewis BL, Beltrán-Aguilar ED. Overview and quality assurance for the oral health component of the National Health and Nutrition Examination Survey (NHANES), 2005–08. *J Public Health Dent.* 2011; 71:54–61. [PubMed: 21667544]
45. Drury T, Winn D, Snowden C, Kingman A, Kleinman D, Lewis B. An overview of the oral health component of the 1988–1991 National Health and Nutrition Examination Survey (NHANES III – Phase 1). *J Dent Res.* 1996; 75:620–30. [PubMed: 8594086]
46. Malvitz DM, Barker LK, Phipps KR. Development and status of the National Oral Health Surveillance System. *Prev Chronic Dis.* 2009; 6
47. Wu T, Stoots M, Florence J, Abernathy C, Floyd M, Snider B. A health education program for healthy eating and physical activity among Appalachia teens: a pilot study. 2009
48. Ajzen I. The theory of planned behavior. *Organ Behave Hum Decis Process.* 1991; 50:178–211.
49. Ajzen I, Driver BL. Application of the theory of planned behavior to leisure choice. *J Leis Res.* 1992; 24:207–24.
50. Conner M, Armitage CJ. Extending the theory of planned behavior: a review and avenue for further research. *J Appl Soc Psychol.* 1998; 28:1430–64.
51. Courneya KS, Plotnikoff RC, Hotz SB, Birkett NJ. Social support and the theory of planned behavior in the exercise domain. *Am J Health Behav.* 2000; 24:300–8.
52. Rhodes RE, Jones LW, Courneya KS. Extending the theory of planned behavior in the exercise domain: a comparison of social support and subjective norm. *Res Q Exerc Sport.* 2002; 73:193–9. [PubMed: 12092894]
53. Myrick, RD.; Erney, T. *Youth helping youth: a handbook for training peer facilitators.* Minneapolis, MN: Educational Media Corporation; 1979.
54. Myrick, R.; Erney, T.; Sorenson, D. *Caring and sharing: becoming a peer facilitator.* 2nd. Minneapolis, MN: Educational Media Corporation; 2000.

55. Kimm SYS, Glynn NW, Kriska AM, et al. Longitudinal changes in physical activity in a biracial cohort during adolescence. *Med Sci Sports Exerc.* 2000
56. Finkelstein EA, Graham WC, Malhotra R. Lifetime direct medical costs of childhood obesity. *Pediatrics.* 2014; 133:854–62. [PubMed: 24709935]
57. Steinburg, L. *Adolescence.* New York, NY: McGraw-Hill, Inc; 1996.
58. Backett-Milburn K, Wilson S. Understanding peer education: insights from a process evaluation. *Health Educ Res.* 2000; 15:85–96. [PubMed: 10788205]
59. Black DR, Tobler NS, Sciacca JP. Peer helping/involvement: an efficacious way to meet the challenge of reducing alcohol, tobacco, and other drug use among youth. *J Sch Health.* 1998; 68:87–93. [PubMed: 9608448]
60. Bloor M, Frankland J, Parry Langdon N, et al. A controlled evaluation of an intensive, peer-led, schools-based, anti-smoking programme. *Health Educ J.* 1999; 58:17–25.
61. Cowie H. Peers helping peers: interventions, initiatives, and insights. *J Adolesc.* 1999; 22:433–6. [PubMed: 10469507]
62. King A, Staffeiri A, Adelgais A. Mutual peer tutoring effects of structuring tutoring interaction to scaffold satisfaction and peer leading. *J Educ Psychol.* 1993; 90:293–152.
63. Komro KA, Perry CL, Veblen-Mortenson S, Williams CL. Peer participation in Project Northland: a community-wide alcohol use prevention project. *J Sch Health.* 1994; 64:319–22.
64. Komro KA, Perry CL, Murray DM, Veblen-Mortenson S, Williams CL, Anstine PS. Peer-planned social activities for preventing alcohol use among young adolescents. *J Sch Health.* 1996; 66:328–34. [PubMed: 8959592]
65. Komro KA, Perry CL, Veblen-Mortenson S, Williams CL, Roel JP. Peer leadership in school and community alcohol use prevention activities. *J Health Educ.* 1999; 64:319–22.
66. Morey RE, Miller CD. High school peer counseling: the relationship between student satisfaction and peer counselors' style of helping. *Prof Couns.* 1993; 40:293–301.
67. Powell MA. Peer tutoring and mentoring services for disadvantaged secondary school students. *Calif Res Bur Note.* 1997; 4:1–10.
68. Tobler NS. Meta-analysis of 143 adolescent drug prevention programs: quantitative outcome result of program participants compared to a control or comparison group. *J Drug Issues.* 1986; 16:537–67.
69. Topping, K.; Ehly, SW. *Peer assisted learning.* New York: Norton; 1998.
70. Gibbs R. Social factors in exaggerated eating behavior among high school students. *Int J Eat Disord.* 1986; 15:1103–7.
71. Huon GF, Walton CJ. Initiation of dieting amount adolescent females. *Int J Eat Disord.* 2000; 18:226–30. [PubMed: 10897086]
72. Huon G, Liam J, Gunewardne A. Social influences and female adolescent dieting. *J Adolesc.* 2000; 23:299–32.
73. Neumark-Sztainer D, Falkner M, Story M, Perry C, Hannan PJ, Mulert S. Weight-teasing among adolescents: correlations with weight-status and disordered eating behaviors. *Int J Obes.* 2001; 26:123–31.
74. Paxton SJ, Schutz HK, Wertheim EH, Muir SL. Friendship clique and peer influences on body image concerns, dietary restraint, extreme weight loss behaviors and binge eating in adolescent girls. *J Abnorm Psychol.* 1999; 108:255–66. [PubMed: 10369035]
75. Pike KM. Bulimic symptomatology in high school girls. *Psychol Women Q.* 1995; 19:373–96.
76. Austin SB. Population-based prevention of eating disorders: an application of the rose prevention model. *Prev Med.* 2001; 32:268–83. [PubMed: 11277685]
77. Crandall CS. Social contagion of binge eating. *J Pers Soc Psychol.* 1988; 55:588–98. [PubMed: 3193348]
78. Feunekes G, de Graaf C, Meyboom S, van Staveren W. Food choice and fat intake of adolescents and adults: associations of intakes within social networks. *Prev Med.* 1998; 28:645–56. [PubMed: 9808794]

79. French S, Story M, Hannan P, et al. Cognitive and demographic correlates of low fat vending snack choices among adolescents and adults. *J Am Diet Assoc.* 1999; 99:471–5. [PubMed: 10207402]
80. Neumark-Sztainer D, Story M, Perry C, Casey M. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *J Am Diet Assoc.* 1999; 99:937.
81. California Project Lean. Food on the Run Campaign. A summary report on adolescent behaviors, perceptions, values and attitudes on health, nutrition, and physical activity. 1998
82. Zollo, P. Wise up to teens: insight into marketing and advertising to teenagers. 2nd. Ithaca, NY: New Strategist Publications, Inc; 1999.
83. Prochaska JJ, Rodgers MW, Sallis JF. Association of parent and peer support with adolescent physical activity. *Res Q Exerc Sport.* 2002; 73:206–10. [PubMed: 12092896]
84. Smith AL. Perceptions of peer relationships and physical activity. *J Sport Exerc Psychol.* 1999; 21:329.
85. Birnbaum AS, Lytle LA, Story M, Perry CL, Murray DM. Are difference in exposure to a multicomponent school-based intervention associated with varying dietary outcomes in adolescents? *Health Educ Behav.* 2002; 29:427–43. [PubMed: 12137237]
86. Perry CL, Klepp KI, Halper A, Dudovitz B, Golden D, Griffin G. Promoting healthy eating and physical activity patterns among adolescents: a pilot study of “slice of life”. *Health Educ Res Theory Pract.* 1987; 2:93–103.
87. Viswanathan M, Ammerman A, Gartlehner G, et al. Community-based participatory research: assessing the evidence. *Evid Rep Technol Assess (Full Rep).* 2004:99.

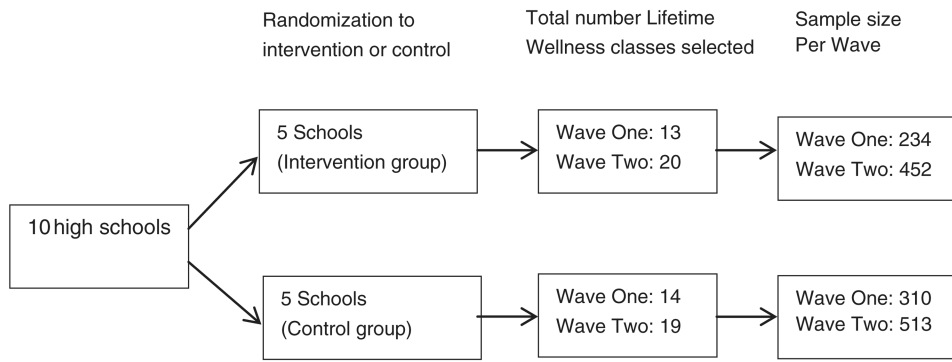


Fig. 1. Enrollment plan for Team Up for Healthy Living.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

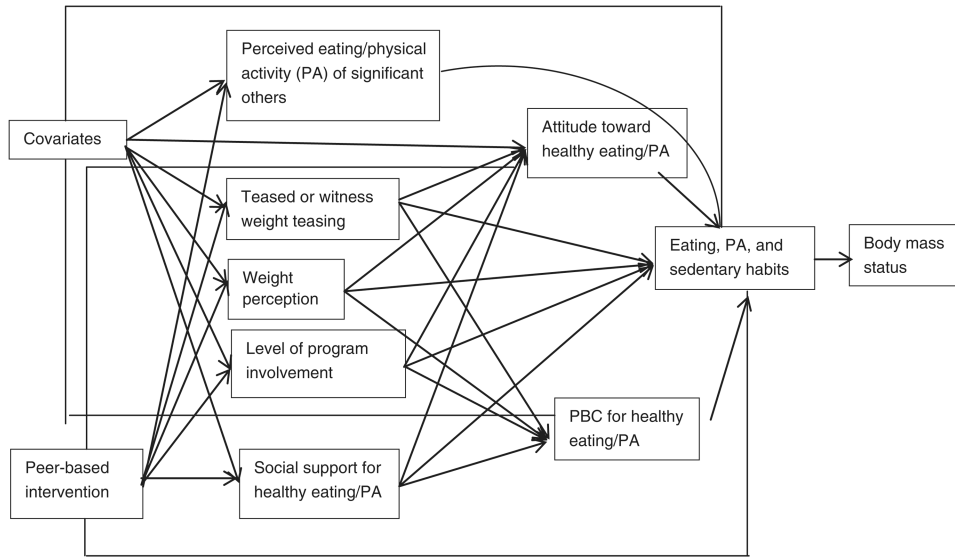


Fig. 2. Theoretical framework for Team Up for Healthy Living.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

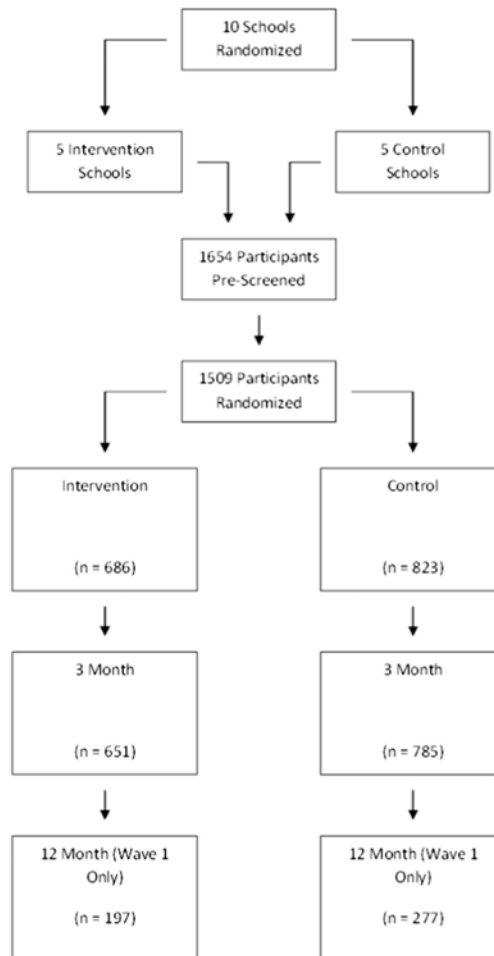


Fig. 3.
Flow of participants through the Team Up for Healthy Living study.

Table 1

Team Up for Healthy Living curriculum: summary of lesson activities.

Week	Theme	Lesson overview	Lesson objectives	Lesson activities
1	Get to know you	This is the first week of the program where you will form teams, introduce yourself, students will introduce one another, and you will engage students in discussion surrounding leadership and cooperation as well as health behaviors and answer questions about Team Up for Healthy Living.	<ul style="list-style-type: none"> Describe characteristics of leaders and how groups work as teams Describe factors associated with health behaviors 	<ol style="list-style-type: none"> Team formation Introduce yourself Self-introduction to team members Discussion of leaders, teams, and cooperation View video Discussion of video Questions and answers Introduce next topic: nutrition awareness – week 2
2	Nutrition awareness	Students are introduced to nutrition information (i.e., food pyramid, colorful diet, go, slow, whoa, nutrition food labels) and taste and rate a new healthy food. Additionally, students are introduced to Challenge 1 and journaling.	<ul style="list-style-type: none"> Recognize major food groups and benefits of a healthy diet Describe a strategy for making healthy food choices Recognize important components of a food label Discover new foods and healthier ways of eating 	<ol style="list-style-type: none"> Introduce food guide pyramid Introduce a colorful diet Introduce go, slow, whoa Introduce nutrition food labels Food demonstration Discussion of food demonstration Introduce Challenge 1 (at home) Journal entry Introduce next topic: eating styles and portion distortion – week 3
3	Eating styles and portion distortion	Students are introduced to factors that influence eating as well as serving sizes and portions. Additionally, students are encouraged to taste a new healthy food, complete Challenge 2, and become aware of portions consumed at home.	<ul style="list-style-type: none"> Recognize factors that influence eating Describe serving sizes and portions Discover a strategy for portion control Create an illustration to promote healthy eating 	<ol style="list-style-type: none"> Discuss journal entry responses and Challenge 1 Discuss factors that influence eating Discuss serving size and portion distortion Serving size demonstration Introduce MyPlate with visuals Fat and sugar demonstration Food demonstration Students will experience Challenge 2 (in class) Journal entry Homework: portion distortion

Week	Theme	Lesson overview	Lesson objectives	Lesson activities
				11 Introduce next topic: small steps count – week 4
4	Small steps count	Students are introduced to physical activity including health benefits, types, and guidelines. Students will also learn about self-monitoring health behaviors and be challenged to do this at home via Challenge 3.	<ul style="list-style-type: none"> • Explain the health benefits of physical activity • Give examples of types of physical activity • State physical activity recommendations • Employ self-monitoring of health behaviors 	1 Discuss journal entry responses and week 3 homework 2 Guidelines and types of physical activity 3 Health Benefits of Physical Activity 4 Introduce fitness principles (FITT)/apply FITT to Types of physical activity 5 Pedometer activity 6 Introduce self-monitoring of health behaviors 7 Students will experience Challenge 3 (at home) 8 Journal entry 9 Introduce next topic: active living – week 5
5	Active living	Students are introduced to screen time including types, statistics, and guidelines. Students will also learn about goal-setting and apply this knowledge by developing an individual goal. Additionally, students will complete Challenge 4 in class.	<ul style="list-style-type: none"> • Give examples of types of screen time • State screen time statistics and guidelines • Demonstrate understanding of SMART goal-setting criteria • Apply SMART goal-setting criteria to an individual goal • Develop a brief physical activity routine to incorporate physical activity during screen time 	1 Discuss journal entry responses and Challenge 3 2 Screen time through the years 3 Estimate screen time via <i>We Can!</i> screen time log 4 Screen time statistics and current guidelines 5 Introduce SMART goal setting 6 Team activity/homework 7 Students will experience Challenge 4 (in class) 8 Journal entry 9 Introduce next topic: effective communication and leadership – week 6
6	Effective communication and leadership	Students are introduced to active listening and characteristics of leaders. Students will imagine themselves as leaders and assume leadership roles in health promotion activities. Additionally, students will complete Challenge 5 at home.	<ul style="list-style-type: none"> • List components of active listening • Describe characteristics of leaders • Apply active listening and leadership skills to case scenarios 	1 Discuss journal entry responses and week 5 homework 2 Telephone game/discussion 3 Active listening 4 Characteristics of leaders 5 Team activity 6 Students will experience Challenge 5 (at home) 7 Journal entry 8 Introduce next topic: caring and sharing – week 7

Week	Theme	Lesson overview	Lesson objectives	Lesson activities
7	Caring and sharing	Students are introduced to weight prejudice, ridicule, and teasing. Students will recognize experiences in their own lives during which they have been the victim of prejudice, ridicule, and teasing and increase acceptance of others and practice of a supportive role. Additionally, students will complete Challenge 6.	<ul style="list-style-type: none"> Recognize weight prejudice, ridicule, and teasing Recognize experiences in their own lives during which they have been the victim of prejudice, ridicule, or teasing Show increased commitment to support others 	<ol style="list-style-type: none"> Discuss journal entry responses and Challenge 5 View video Discussion of video Statistics on weight teasing The power shuffle The power shuffle decompression activity/ homework Students will experience Challenge 6 (in class) Journal entry Introduce next topic: team up for change – week 8
8	Team up for change	Students explore and establish team agreements, develop group cohesion and trust, and understand teamwork. Additionally, students will review concepts learned during Team Up for Healthy Living via a team competition, jeopardy.	<ul style="list-style-type: none"> Define teamwork and develop rules for working effectively in teams Demonstrate knowledge of material learned throughout the Team Up for Healthy Living program 	<ol style="list-style-type: none"> Discuss journal entry responses and week 7 homework Teamwork Team Up for Healthy Living jeopardy Certificate of completion

Table 2

Team Up for Healthy Living: team challenges.

Challenge	Description
Challenge 1 (completed at home)	Try a variety of fruits and vegetables at home. Rate flavor and texture.
Challenge 2 (completed in class)	Create energy posters or come up with another poster idea for presenting favorite healthy foods to promote healthy eating for students at your school. Consider a creative presentation of your healthy meal ideas. Display in the school and publicize through school newspaper, website, or announcements generated by participants.
Challenge 3 (completed at home)	Students will gain a baseline measure of steps using a pedometer and the Self-Monitoring Form. Additionally, students should track type and minutes of physical activity as well as number of fruits and vegetables eaten each day until the following class.
Challenge 4 (completed in class)	Students will use physical activity materials provided to develop a physical activity routine emphasizing at least one type of physical activity (i.e., aerobic, muscle-strengthening, bone-strengthening). The routine will be able to be completed in as short a time frame as a television commercial (60 s). Teams will work together for 4 min to develop a routine and afterwards each team will demonstrate the routine to the larger class. Teams will vote on the best routine (besides their own) and members of the winning team will receive a reward.
Challenge 5 (completed at home)	Find a friend or family member that would be willing to talk to you about their diet and physical fitness activities. Practice your active listening skills and demonstrate leadership characteristics when you're talking to them. How can you partner with them to support an improved diet or increased physical fitness activities?
Challenge 6 (completed in class)	Create a poster on ways to prevent weight teasing and bullying. Include an "I will" pledge that lists at least 3 specific actions team members will take to address this problem. Sign the pledge and display the poster in the school.

Table 3

Team Up for Healthy Living: typical week for year 1 peer facilitator training.

Day 1 (2 hour meeting)	Day 2 (2 hour meeting)	Day 3 (3 hour meeting)	Homework for week
<ul style="list-style-type: none"> Discuss administrative issues/ answer questions of peer facilitators Discuss <i>Caring and Sharing</i>* chapter reading via discussion questions created by peer facilitators and participate in selected activities Discuss self-critique assignment of previous week video recorded practice Discuss curriculum content/materials for week 	<ul style="list-style-type: none"> Receive feedback from investigators regarding previous weeks' video recorded practice Observe investigator role-play week session as well as additional didactics on week topic Participate in providing feed back and discussing intervention refinement with investigators Question/Answer period for peer facilitators to gain better understanding of content 	<ul style="list-style-type: none"> Participate in practice of week session (in front of other peer facilitators and members of research team) while being video recorded Receive immediate constructive feedback from research team members familiar with the intervention 	<ul style="list-style-type: none"> Read chapter in <i>Caring and Sharing</i> text Complete selected <i>Caring and Sharing</i> activities Create <i>Caring and Sharing</i> discussion questions to facilitate discussion Complete additional readings related to curriculum content and assigned by project investigators View and self-critique previous week video recorded practice Familiarize self with material and practice curriculum activities for upcoming week at home

Note: The following text was utilized in training: Myrick R.D., Erney T., Sorenson D.L. *Caring and Sharing: Becoming a Peer Facilitator* (2nd Ed.) Minneapolis, MN: Educational Media Corporation, 2000 [56].