

A School-Based Intervention of Adolescent Obesity Prevention in At-Risk Youth

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Abstract

Obesity has become an epidemic in the United States, affecting individuals of all ages. Adolescents are particularly susceptible to obesity due to their decrease in physical activity, as well as to the greater availability of foods void of nutritional value. Adolescents' impressionable natures and changing bodies also contribute to their increased weights. To combat the problem of obesity, many schools have implemented obesity prevention programs. Most of these programs are based on physical education and nutrition education. However, some schools have started mentorship programs, or worked with organizations that employ mentorship programs, to prevent obesity. The Lynchburg Healthy Living program was created to teach at-risk adolescents about exercise and nutrition, as well as to provide them with a role model and coach in how to live a healthy life. The study examined effects of the program on participants' body mass index (BMI), self-reported nutrition and physical activity habits, and perceived health knowledge.

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The Adolescent

Although the exact age span of adolescence varies with each individual, it is often referred to as the period of development that begins at puberty, around 10-12 years of age, and ends with physiological maturity, around 19 years of age (Adolescence, 2009). During this time period, children develop self-identity and independence as they mature into adults. They rely less on their parents, and more on their peers and relationships with friends. Their bodies mature physically, and numerous changes take place as the teenager enters into puberty. Sexual maturity is reached, fine motor skills fully develop, and height and weight increase. On average, females gain 15-55 pounds and grow 2-8 inches, while males gain 15-65 pounds and grow 4.5-12 inches during adolescence. The teenager also learns how to think abstractly about different concepts and outcomes of situations. Many times this is also the period in which young people begin to form their own moral standards and ethical bases for decisions (Ball & Bindler, 2008a).

Nutritional and Physical Activity Requirements

Because adolescence is a period of significant growth and development, most teenagers require more than 2,000 calories a day. It is important that the child has a diet rich in vitamins and minerals. Adolescents need education about proper nutrition, including limiting fast food intake, adding fruits and salads to the diet, and bringing healthy lunches to school. Many teens make their own food and beverage choices, and often eat with friends who influence their decisions. Therefore, early education is vital to helping teenagers form healthy nutritional habits (Ball & Bindler, 2008a).

As many children grow older, physical activity declines. In 2009, only 18.4% of adolescents met the current physical activity guidelines for aerobic physical activity (U.S. Department of Health, 2010d). According to the Centers for Disease Control and Prevention (CDC), adolescents are encouraged to exercise 60 minutes or more every day, with the majority of the recommended exercise being moderate to vigorous aerobic activity. Muscle and bone-strengthening activities are also encouraged at least three days a week as part of the 60 minutes of exercise (Centers for Disease Control, 2011c). It is important that adolescents establish some sort of regular physical activity program, whether that means participating in a sport, riding a bike to school, or walking a dog in their neighborhood. Each teen should be encouraged to find at least one activity that can be performed on a daily basis to incorporate exercise into his or her life. Doing so may prevent diseases later on in life, promote positive self-esteem, and maintain a healthy weight (Ball & Bindler, 2008b).

Issues Related to Body Image

Because of the many changes that occur during adolescence, it is common for teenagers to develop body image issues. A significant number of adolescents care deeply about their weight, which may lead to them having a negative body image. A study of almost 5,000 teenagers who completed the Project EAT (Eating Among Teens) survey examined the prevalence of weight concerns and weight-related behaviors in adolescents. Although the research showed that females were found to be more likely to express concerns and engage in weight-related practices, many males also reported doing the same. The study found that out of 4,746 adolescents, 56.9% of females and 32.7% of males reported unhealthy weight-related practices in the past year, whereas 12.4% of

females and 4.6% of males reported extreme weight-related practices in the past year.

These unhealthy behaviors used to control weight may have serious consequences on the adolescents' health. Therefore, it is vital to educate teenagers about healthy weight-control practices and encourage them to develop healthy behaviors. Interventions to prevent obesity should address different weight-related disorders and support children as they deal with the social stigmas related to obesity (Neumark-Sztainer, Story, Hannan, Perry, & Irving, 2002).

Adolescent Obesity

Definition and Diagnosis

“Obesity is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass” (Levi, Segal, St. Laurent, & Kohn, 2011, p. 17). The 2007 National Survey for Children's Health (NSCH) provides the most current rates of overweight and obesity among children aged 10-17. According to its data, 15.3% of children ages 10-17 nationwide are overweight, and 16.4% are obese (Child and Adolescent Health, 2007). The NSCH defines obesity according to the CDC's criteria: a body mass index (BMI) equal to or greater than the 95th percentile is considered obese, while a BMI between the 85th and 94th percentile is considered overweight (Centers for Disease Control, 2011a). BMI is measured using the child's height and weight measurements, and is calculated as kilograms of weight/m² of height. The formula determines if the child's height and weight are proportional, and shows in what percentile he or she falls compared to other children with the same measurements (Ball & Bindler, 2008b).

Contributing Factors

There are many factors that contribute to the development of obesity. Obesity is most often caused by a combination of both genetic and environmental factors. Over 600 genetic factors, including genes, markers, and chromosomal regions have been associated with the phenotype for obesity. This may predispose many adolescents to obesity from birth (Sinha & Kling, 2009). Genes are thought to play a role in the regulation of how the body captures, stores, and releases energy gained from food (Centers for Disease Control and Prevention, 2011e). However, genetics is only one aspect of adolescent obesity; numerous environmental factors interact with the teenager's genetic makeup to produce obesity, the most prominent of which are lifestyle and diet. Decreased physical activity, increased time spent watching television, irregular sleeping patterns, frequent snacking, skipping meals, the consumption of high calorie soft drinks, and increased fast food intake are just some of the lifestyle and diet choices that can lead an adolescent to become obese (Sharma & Branscum, 2010).

Other possible environmental factors include the socioeconomic status and home environment of the child. Obesity is more common in low-income families, which may be partially due to the high cost and decreased availability of nutritional foods and fewer physical fitness opportunities (Sinha & Kling, 2009). The home environment of the teen also affects nutrition and exercise habits. Adolescents are easily influenced and are therefore impacted by the food choices of their parents, as well as their friends that spend time at their home. If these dietary choices are unhealthy, teenagers are likely to develop the same unhealthy eating habits. The availability and accessibility of nutritious food in

the child's home also play a part in his or her weight and health (Sharma & Branscum, 2010).

At-risk youth are particularly predisposed to become overweight or obese. In a study consisting of around 6,000 predominantly minority middle school students, around half were found to be overweight (The HEALTHY Study Group, 2009). Another study focusing on teens in California found that in 2007, the prevalence of obesity was almost three times greater in the lowest income group than in the highest income group. (Babey, Hastert, Wolstein, & Diamant, 2010). Although the term *at-risk* has no consistent definition, it is widely used to describe youth who are at a higher risk for poor life outcomes in general. Some examples of these outcomes include incarceration, economic instability, academic failure, and poor health. Often, the adolescents themselves, as well as their families and communities are at-risk. The adolescents may be considered at-risk on a personal level if they are disabled, have low self-esteem, or have a history of abuse. An at-risk family is often one that faces issues such as poverty, lack of parental education, or single parenthood. Communities may be described as at-risk if they have a high-crime rate, a low high-school graduation rate, or are low-income. All three factors—the adolescent, family, and community—play a significant role in making a teenager at-risk (Moore, 2006).

Physical and Developmental Effects

Because obesity affects almost every part of the body, it can lead to numerous physical and developmental issues in adolescents. It is the leading cause of pediatric hypertension, and may contribute toward the development of cardiovascular disease as well. Adolescent obesity has also been shown to increase the risk for type 2 diabetes

mellitus (T2DM). As of 2008, the prevalence of T2DM in teenagers was two times that of type 1 diabetes, and its occurrence has continued to increase. A fifth of new diagnoses of diabetes in children are currently T2DM (Sinha & Kling, 2009). Approximately 215,000 people under the age of 20 have diabetes, and two million between the ages of 12-19 have prediabetes (Levi et al., 2011).

Obese adolescents are at a higher risk for cancer, liver disease, neurological issues, cardiovascular disease, asthma, sleep apnea, and orthopedic problems. Because the number of fat cells in a person is determined by late adolescence, many obese children face the consequences of adult obesity as well (Levi et al., 2011). In fact, it is estimated that 70-80% of overweight or obese children will stay overweight for the rest of their lives (Schaub & Marian, 2011). One study examined the height and weight records of 854 subjects, and found that those subjects who were obese after age six were at least 50% more likely to be obese as adults (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Overweight adolescents have also been found to engage more often in unhealthy and extreme weight-related behaviors, such as taking laxatives or diet pills, vomiting, or skipping meals. These can have a negative impact on the growth of teenagers and cause lasting health consequences (Neumark-Sztainer et al., 2002).

Psychological and Psychosocial Effects

In addition to the physical and developmental effects, adolescent obesity may lead to a range of psychological and psychosocial problems. Overweight and obese teenagers may have eating disorders, such as binge eating disorder or bulimia. Low self-esteem, depression, and anxiety have also been shown to be more common in obese adolescents (Brennan, 2011). Obese adolescents have also been noted to be more socially isolated,

have fewer friends than normal weight peers, have lower social support, and experience more victimization (Pearce, Boergers, & Prinstein, 2002; Sharma & Branscum, 2010).

School-based Methods of Adolescent Obesity Prevention

School Health

Due to the drastic increase in obesity rates over the years, as well as the fact that adolescents often spend the majority of their days in school, schools are placing a stronger emphasis on obesity prevention and health promotion. Each state has standards related to student health. The Healthy, Hunger-Free Kids Act of 2010 sets new health-related standards for schools. This Act governs the nutritional content of meals and snacks, ensuring that students receive proper nutrition from the foods they eat during school. The United States Department of Agriculture (USDA), guided by the policies in this new Act, must work to help schools move towards serving healthier meals and snacks, as well as institute nutritional standards for all foods and beverages offered at schools (Levi et al., 2011).

The Center for Disease Control and Prevention (CDC) has also placed a strong emphasis on school health. The CDC recognizes that health and academic performance correlate with one another. Hunger and illness may lead to poor success in school, and physical inactivity has been linked to lower grades and test scores (Centers for Disease Control, 2011b). Because of the effects of poor health, there is a need for school-based programs that focus on improving the health status of students. Schools are vital in the development of healthy dietary and physical activity behaviors in adolescents. For this reason, the CDC has developed a set of guidelines to aid in the establishment of school-based nutrition and physical activity policies and programs. These guidelines are helpful

as more schools aim to implement successful methods of obesity prevention (Centers for Disease Control, 2011d).

The major areas of focus in the CDC's guidelines include the development of a coordinated school health program, healthy school environments, quality meal programs, comprehensive physical activity programs, effective health education, comprehensive health services, the participation of family and community members, and employment of qualified professionals to conduct health-related programs. Although not all guidelines are practical for every school, they are useful recommendations that all schools should consider before starting a health program (CDC, 2011d).

It is important for schools to focus on existing methods of obesity prevention in order to understand their usefulness and take advantage of the successes of such strategies. Although schools have employed a variety of techniques to combat the problem of obesity, two primary methods will be discussed: physical activity and nutrition programs, and mentorship programs.

Physical activity in schools. Inactivity among teens has become a widespread problem that greatly contributes to the development of obesity. This is largely due to the increased number of adolescents who spend free time on the computer and watching television. A lack of physical activity can pose a risk to both a teen's physical and psychological health. As well as helping to prevent obesity, physical activity has been shown to increase test scores, improve concentration in class, and promote positive behavior in school. Despite the benefits of physical activity, many schools are decreasing or eliminating physical education (PE) time all together, further exacerbating the problem of obesity (Levi et al., 2011).

However, as obesity rates rise, the need for physical activity in schools only increases. *Healthy People 2020*, a report issued by the Department of Health and Human Services, established objectives aimed to improve the health of all Americans. Included in the report are objectives related to the health of students in schools (U.S. Department of Health, 2010a). Two of the goals of *Healthy People 2020* are to increase the proportion of schools in the United States that require daily physical education (PE) for all students, as well as to increase the proportion of high school students who participate in daily school PE. In 2006, a mere 2.1% of public and private high schools required daily PE for all students. In 2009, only 33.3% of adolescents participated daily in school PE (U.S. Department of Health, 2010d). Schools have a unique role in that they often have both the resources and time to incorporate physical activity programs, making PE requirements a feasible addition to the normal school day. Most schools are also equipped with some type of fitness facility and instructors that can be utilized to start an established and required PE time (Spear et al., 2007).

Nutrition in schools. Many students eat the majority of their meals at school. Nine out of ten public school students in either elementary or secondary school eat lunch while at school, and approximately 20% of students also eat breakfast at school. Many schools are rethinking which food and drinks they serve and taking steps to improve nutrition choices because of the number of students to which they provide meals (Levi et al., 2011). *Healthy People 2020* presents objectives that, if reached, will give teenagers the opportunity to make better food and drink choices in the location where the majority of their time is spent during the day. One of these objectives is to increase the proportion of schools with a school breakfast program to 75.5% (U.S. Department of Health, 2010c).

School breakfast programs give students the opportunity to eat a healthy meal that meets the recommendations of the Dietary Guidelines for Americans. Meals that are served through this program are required to provide important vitamins and minerals in a child's diet (United States Department of Agriculture, 2011).

Another objective from *Healthy People* is to increase the proportion of schools that offer nutritious foods and beverages outside of school meals to 18.1%. Part of this objective also includes increasing the proportion of schools that do not offer sweetened beverages, which are often high-calorie and offer few nutrients. Another aspect of the objective is to increase the number of school districts that require schools to make fruits and vegetables available whenever other foods are offered or served (U.S. Department of Health, 2010b). All of these goals presented by *Healthy People* aim to improve the health of students and create school environments conducive to obesity prevention. If achieved, these goals are a positive step towards fighting the problem of adolescent obesity.

Physical Activity and Nutrition Programs

As schools have worked to achieve health-related goals, many have already incorporated some type of obesity prevention program that focuses on both physical activity and nutrition. Several of these programs have displayed positive results that provide beneficial information for future initiatives. One such program called New Moves took place in Minnesota and was aimed specifically at overweight or at-risk for becoming overweight teenage girls. It sought to prevent weight-related problems by providing all-girls physical education and nutrition education classes for sixteen weeks during the school semester. The program focused on both obesity prevention and eating disorders, and sought to give the girls an environment where they felt comfortable and

supported when they were exercising or needed to discuss weight-related topics. New Moves encouraged the girls to engage in moderate to vigorous activity at least one hour per day, and to develop a positive self-identity. Although no significant changes were found in the participants' BMIs or body fat percentages at the end of the program, improvements were found in sedentary activity, unhealthy weight control behaviors, and body image, all of which may contribute to adolescent obesity (Neumark-Sztainer et al., 2010).

Another example of a school-based obesity prevention program was the LEAP (Lifestyle Education for Activity Program) program. The purpose of LEAP was to evaluate the effects of the program on physical activity levels of high-school girls. The LEAP program included 24 high schools that implemented a new instructional program and changed the school environment to increase the support and encouragement of physical activity. The Coordinated School Health Program model guided the strategies used throughout the program. The LEAP physical education component aimed to increase physical activity enjoyment, to teach how to live an active lifestyle, and to involve the girls in physical activity for at least half of the physical education class time. The other component of the program was the environmental aspect, which involved role modeling by school faculty, increased communication about physical activity, community activities, and increased promotion of physical activity. The researchers who implemented the LEAP program found that at the program's conclusion, the percentage of participants who received the intervention reported higher amounts of vigorous physical activity than those in the control group. This program demonstrated the ability of

a school-based approach to obesity prevention to increase physical activity, which may deter the development or progression of adolescent obesity (Pate et al., 2005).

A third school-based approach towards preventing obesity in students took place in Massachusetts. A group of middle school students participated in the interdisciplinary study over a period of two years in which teachers incorporated Planet Health educational materials into their normal class time. The Planet Health sessions focused on topics such as increasing fruit and vegetable intake, increasing moderate and vigorous exercise, decreasing television viewing, and reducing intake of high-fat foods. At the end of the program, the prevalence of obesity was decreased in females who participated when compared to the control group. The Planet Health program also reduced the amount of television viewing time in boys and girls, and increased vegetable and fruit consumption in girls (Gortmaker et al., 1999).

Mentorship Programs

In addition to physical activity and nutrition school-based obesity prevention programs, some schools have incorporated mentorship programs to curb the rise in obesity among students. Mentoring is a method of focusing on the needs of adolescents and providing them with adequate support and guidance as they develop. It is essential for individuals to have supportive relationships as they develop, and mentors are able to fulfill this need. These types of relationships are of significant value for young people, and have been found to benefit multiple areas of their development (DuBois, Portillo, Rhodes, Silverthorn, & Valentine, 2011).

Because of the many advantages of mentoring relationships, mentorship programs have been launched with a focus on improving health in adolescents. A World Fit For

Kids! (*WFIT*) is an organization located in Los Angeles that provides after-school training to young people in how to form healthy habits in various aspects of their lives. The organization's teen leadership program, called Mentors in Motion, provides youth with mentorship and training in areas such as personal fitness, nutrition, confidence building, leadership, and first aid/CPR. The individuals being mentored are then given the opportunity to use what they have learned, and act as mentors for other individuals after completion of the Mentors in Motion program (Mentors in Motion, 2010). Data collected in 2010-2011 showed the mentorship program to be effective in improving the health of its participants. About half of the participants in the Mentors in Motion program increased their frequency of engaging in aerobic and muscle strengthening exercises. Results from the previous year showed that participants who took part in the program increased their level of physical activity as well when compared to the year before (A World Fit, n.d.).

Another program, called HealthCorps, was a high school peer-mentoring program that took place in New York. The goal of HealthCorps was to encourage adolescents to live healthier lives by educating them about physical fitness and nutrition. The participants in the program were matched with a peer mentor who delivered the HealthCorps educational material during various established times during or after the school day. Around twenty HealthCorps classes were offered throughout the semester for the students involved. The program resulted in a 13% decrease in consumption of soda among participants, with a 25.7% decrease specifically among female participants. At the end of HealthCorps, 45% of those adolescents who completed the entire program

reported being more physically active at that time than the year before (Cawley et al., 2011).

A final example of an obesity prevention mentorship program is the Challenge! program, which took place in Baltimore. Challenge! was a home-and community-based program for adolescents aged 11-16 that was held at a university medical center. The purpose of the program was to help participants experience healthy eating and physical activity, as well as to give them the confidence to adopt new behaviors. Each participant was paired with a race-and gender-matched young adult mentor with whom he or she met once a week for a total of twelve weeks. Each intervention session included the making of healthy snacks, physical activity, a challenge given by the mentor, and the formation of a personal goal for the adolescent. At the end of the Challenge! program, the percentage of overweight/obese adolescents that participated was reduced by 5%. The percentage of overweight/obese adolescents that did not participate was increased by 11%. Those who took part in the program also showed a greater reduction in their total intake of snacks and desserts when compared to those who were in the control group (Black et al., 2010).

Research has found that mentoring is an effective mode of intervention in the lives of young people (DuBois et al., 2011). Due to the success of mentorship programs, as well as their encompassing and flexible nature, there is a need for more programs such as these in the field of adolescent obesity prevention. The Lynchburg Healthy Living program was created in order to teach at-risk adolescents about exercise and nutrition, as well as to provide them with a role model and coach in how to live a healthy life. The purpose of the study was to evaluate the effects of the program on BMI, self-reported

nutrition and physical activity habits, and perceived health knowledge of the adolescents. The seven-week Lynchburg Healthy Living program was modeled after the Baltimore Challenge! program.

Method

Participants

Participants in this study were eleven at-risk adolescents who attended an after-school center in central Virginia. The employees at the afterschool center recommended the adolescents to be involved in the study, but participation was voluntary. Eligibility criteria included individuals 12-18 years of age and consistency in attendance at the center; one exception was made for a female student in the fifth grade due to her desire to participate in the program. The center's employees and volunteers recorded attendance on a daily basis. Because the after-school center targets children from a lower socioeconomic population, most participants were of this status. Two of the adolescents were males. All but one was African American; the other adolescent was Hispanic. One participant was in seventh grade, six in eighth, two in tenth, and one in eleventh.

The mentors that participated in the study were five female undergraduate students at a local university. All mentors were in their senior year and were ages 21-22. Three were nursing majors, one psychology major, and one elementary and special education major.

Materials

The nursing students serving as mentors took baseline measurements of the participants including blood pressure, heart rate, height, and weight. The materials used were a blood pressure cuff and a weight scale. The American Academy of Family

Physician's *Aim-Hi Fitness Inventory* assessment (see Appendix) was given to the participants prior to and at the conclusion of the program. The participants received a handmade notebook created by the mentors to record their weekly goals and progress. Each hour-long, weekly session included a physical fitness activity, nutrition education, and application period. The gymnasium, sports equipment, cardio room, and multipurpose room at the after-school center were used for the physical fitness time, and the mentors provided a workout video. The mentors also created nutrition education worksheets for three of the sessions.

Nutrition and exercise education was focused on the curriculum of a national obesity prevention program, *Let's Go!*. *Let's Go!* uses the 5-2-1-0 message to emphasize the important aspects of a healthy lifestyle. The 5-2-1-0 message consists of four key points: 5 or more fruits and vegetables, 2 hours or less of recreational screen time, 1 hour or more of physical activity, and 0 sugary drinks every day (About us, 2011). The seven-week program reviewed 5-2-1-0 weekly, and discussed one aspect of the message in-depth each week.

During the application time, money was provided for the participants to purchase a snack and beverage. During two out of the seven weeks, the mentors purchased ingredients for the participants to prepare a healthy recipe during the session. The adolescents received certificates at the completion of the study to recognize their success and commitment.

Procedure

The Lynchburg Healthy Living program was a nonrandomized study approved by the Institutional Review Board of the local university where the mentors attended school.

Parents of the participants signed an informed consent form created by the principal researcher, and the adolescents involved gave written assent. The study took place in the fall of 2011 over a period of seven weeks at an afterschool center in central Virginia. The duration of the program was seven weeks.

Prior to the start of the seven week program, the mentors took baseline assessments and collected demographical information on the eleven participants, including height, weight, blood pressure, heart rate, and age. This information was collected privately and kept confidential. The participants also completed the Academy of Family Physician's *Aim-HI Fitness Inventory*, which was a self-reported assessment of fitness and nutrition habits. The principal researcher randomly assigned each participant to a mentor based on mentor availability. Two mentors were paired with one student, two with two students, and one with five students.

Mentors met with their assigned students individually for one hour every week for the duration of the seven-week Lynchburg Healthy Living program. For the first half hour of each session, the mentors and adolescents performed moderate to vigorous physical activity. These physical activities included basketball, soccer, football, volleyball, time on the elliptical trainer and stationary bike, or completing a workout video. Each mentor had an assigned activity to complete with her students for the specific week. After the physical fitness time, the mentors educated the adolescents on an aspect of nutrition for approximately ten minutes. The mentors planned the nutrition education lessons prior to each session, and created educational worksheets for three of the weeks.

Following the nutrition education period, each mentor spent around ten minutes at the local convenience store with her student. After walking to the store, the adolescent

selected a snack and beverage, which were purchased by the mentor using funding from a local hospital. The mentors bought a similar snack, and encouraged the adolescents to apply what they had learned during the nutrition education time when choosing their snack and beverage. Upon returning to the afterschool center, the mentors and students ate their snacks together and discussed any questions that were pertinent to that week's session. The trip to the convenience store took place four out of the seven weeks.

During one of the seven weeks, the participants and mentors tie-dyed t-shirts to be used as their workout shirts and to remind them of the importance of physical activity. The mentors provided the adolescents with healthy snacks and drinks for this time as well. For the remaining two weeks, the mentors purchased ingredients to prepare a healthy snack at the afterschool center following the nutrition education time. The mentors and students discussed the health and nutritional benefits of the recipe they chose, and proceeded to prepare and eat the snack made from the recipe together. The purpose of the recipe was to demonstrate to the students that making a homemade snack can be both enjoyable, affordable, and appetizing. At the end of every session, the mentors and participants discussed a healthy living goal for the upcoming week. Once participants created a goal, they wrote it in their goal books to keep them accountable and help them to remember it throughout the upcoming week. Any goals from previous weeks were also reviewed during this time to keep track of their progress.

Results

Data collected during the study were entered into the computer program SPSS for analysis. A Wilcoxon test was used to determine if there was a significant difference between the data collected from the *Aim-HI Fitness Inventory* prior to the program and at

the completion of the program. BMI values were also compared pre- and post-intervention to see if there were any differences.

BMI

The results from the adolescents’ BMIs before and after the program were significant ($p < 0.05$), in the direction of an increase in BMI ($p = .016$). One participant decreased in BMI, and the other ten participants increased in BMI.

Test Statistics^b

	BMI_Post - BMI_Pre
Z	-2.405 ^a
Asymp. Sig. (2-tailed)	.016

a. Based on negative ranks.

b. Wilcoxon Signed Ranks Test

Self-reported Nutrition and Physical Activity

Questions from the *Aim-HI Fitness Inventory* under the section entitled, “How Happy Or Satisfied Are You?” were omitted from data analyses due to irrelevance to the study. Results for all questions that were analyzed are included in Tables 1 and 2. Some participants chose not to answer some of the survey questions; this is reflected in the total number of responses recorded in the tables.

Table 1 displays the change in responses of the adolescents to the questions under the physical activity portion of the survey, pre- and post-intervention. A change indicates that the adolescent’s response on the survey was different when completed after the seven-week program.

Table 1

Activity Level - "How Active Are You?"				
Survey Question	# of Adolescents with no change	Increase in behavior	Decrease in behavior	P value (if significant)
Hours TV/computer per day	6	1	3	—
Times per week doing yard/house work that causes you to build up a sweat	6	1	4	—
Times per week going on a brisk walk for 10 minutes or more	6	2	3	—
Times per week participating in sports or exercise	6	1	4	—

Table 2 displays the changes in responses of the adolescents to the questions under the nutrition habits portion of the survey, pre- and post-intervention.

Table 2

Nutritional Habits- “How Well Do You Eat?”				
Survey Question	# of Adolescents with no change	Increase in amount	Decrease in amount	P value (if significant)
Servings of fruit or vegetables per day	7	1	3	—
Servings of whole grains per day*	7	4	0	0.046
Times per week eating lean protein	6	2	2	—
Times per week eating high fat foods	3	1	6	—
Times per week eating fast food	3	3	5	—
Amount of margarine, butter, or meat fat used in cooking or on food*	6	0	5	0.034
Amount of sugary drinks per day	5	2	4	—
Times per week eating desserts/sweets	7	0	4	—
How often eating when not hungry or out of emotional reasons	8	0	3	—

*Significant value ($p < 0.05$)

Results showed that there was a significant difference ($p=0.046$) between the amount of whole grains consumed per day prior to and at the conclusion of the program. Four participants increased their intake of whole grains, zero decreased their intake, and seven remained the same.

Test Statistics^b

	Grains_Post - Grains_Pre
Z	-2.000 ^a
Asymp. Sig. (2-tailed)	.046

a. Based on negative ranks.

b. Wilcoxon Signed Ranks Test

Results also showed that there was a significant difference ($p=0.034$) between the amount of margarine, butter, or meat fat used in cooking or on food from before and after the program. Of the eleven participants, five decreased their intake of margarine, butter, or meat fat, and six remained the same in their intake.

Test Statistics^b

	Butter_Post - Butter_Pre
Z	-2.121 ^a
Asymp. Sig. (2-tailed)	.034

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

As well as the two questions that yielded significant results, there were four questions that displayed positive trends. These four questions included times per week the adolescent eats high fat foods, fast food, and sweets/desserts, and how many sugary drinks consumed in a week. For all of these questions at least four of the eleven students recorded that they either decreased their frequency or amount in regards to these foods and drinks, indicating a positive change in regards to nutritional habits.

Perceived Health Knowledge

At the conclusion of the program, participants were asked to write what they had learned, thereby demonstrating which areas they had increased in their health knowledge. Two adolescents made references to the 5-2-1-0 message: “I have learned a lot about 5-2-1-0. 5 or more fruits and veggies everyday, 2 hours of TV, 1 hour of working out, 0 sugary drinks,” and “It’s good to have 2 hours or less of TV.” Some participants wrote specific aspects of the program that they learned: “We should eat whole fruits like apples and pears and others,” “Not healthy to eat potato chips,” and “I learned that I can eat as many fruits and vegetables as we want a day and that soda is bad for us.” One student even discovered a new favorite food, saying, “I learned my favorite veggie is broccoli.” Three other participants recorded that they learned how to eat healthier and be more active.

Discussion

The Lynchburg Healthy Living program was a pilot study designed to test the efficacy of a nutrition and exercise mentorship program on at-risk adolescents. It was modeled after the Baltimore Challenge! program, which demonstrated success in reducing the percentage of overweight/obese status in participating adolescents. In the Lynchburg Healthy Living program, no improvements were made in the participants’ BMIs, with the exception of one adolescent. However, improvements did occur in self-reported diet and physical activity habits, which were determined using the *AIM-HI Fitness Inventory*. Statistically significant changes were noted in two of the nutritional habits included on the survey. Positive trends were found in four additional nutritional habits.

BMI

Increases in BMI, rather than decreases, were most likely due to a variety of factors. The program's short duration of seven weeks was most likely the largest factor that inhibited the participants from improving their BMI scores. The adolescents' attendance at the program was also inconsistent. Another component that played a role was the adolescents' lack of support from school, family, and friends for the lifestyle changes that we encouraged. Many of the students reported that their parents would not purchase fresh fruits and vegetables from the store. Some teens had no choice but to eat breakfast and lunch at school, where unfortunately a nutritional meal was often not available. The influence of the participants' friends was most likely an even bigger factor. Because adolescents are greatly impacted by the people around them, it was probably difficult for the participants to make healthy decisions if their friends were not doing the same. Their friends and peers may have even discouraged the participants' attempts at times.

Self-reported Nutrition and Physical Activity

The same factors that contributed to BMI most likely played a role in why there were not many significant changes in the participants' self-reported nutrition and physical activity habits. There are also some additional factors related to the tool itself, the *AIM-HI Fitness Inventory*. The survey that was given to the adolescents only presented three possible answers for all but one question. Most participants did not make a drastic positive or negative change in their behaviors, but rather stayed the same or made a slightly positive change. Although there were many positive trends in the adolescents' answers, changes were not big enough to yield statistically significant results, in part due

to the limited answer-choices. In the future, it would be helpful to use a survey that contained questions with more response options.

Perceived Health Knowledge

Although the program did not result in as many significant changes as was hoped for, it was evident to the researchers that the participants greatly benefited from the Lynchburg Healthy Living program. This was evidenced by their comments throughout and at the conclusion of the program. When asked if they would participate in the program again given the opportunity, all adolescents replied that they would. Each mentor also observed growth in her students throughout the program in regards to health-related knowledge and improvement in physical activity and nutrition habits. The quotes of the participants at the end of the study demonstrated this growth.

At-risk Status

It should be noted that the population included in the study consisted of at-risk adolescents. Although not considered a limitation, working with an at-risk group poses unique challenges. Many of the adolescents came from homes where healthy eating and exercise were not modeled by their parents and families due to decreased education about nutrition and exercise and reduced accessibility of healthy foods. Although parents have less influence in the lives of teenagers than their peers, they are usually the ones who provide the food and beverages for the home. The communities of the adolescents were also not conducive to positive changes in health, providing minimal access to healthy foods and opportunities for physical activity. The at-risk status of the participants illustrates the great need for the Lynchburg Healthy Living program and other similar strategies to prevent obesity in similar populations. The study sought to teach the

adolescents how to maximize the resources available to them and make their own healthy decisions, regardless of the influence of those around them.

Strengths and Limitations

It is important to examine the specific strengths and limitations in order to accurately understand the results of the study. One strength of the study is its ability to provide a basis for a larger-scale study of the same nature. The Lynchburg Healthy Living program was a pilot study modeled after the Baltimore Challenge! program, with the intent of demonstrating the program's feasibility in a specific community in Central Virginia. By conducting the program on a smaller scale, its practicality and success were able to be evaluated before implementing a similar program into various schools in Virginia. This study also allowed researchers to examine the strengths and weaknesses of the program, and recommend changes for future programs. Numerous challenges arose in the Lynchburg Healthy Living program that can now be addressed prior to implementation in a larger population, providing hope of a more effective obesity prevention program. Some of these challenges included lack of interest or motivation among participants, inconsistency in attendance, external circumstances such as holidays and other events that encouraged overeating, logistical conflicts with the after-school center, and generally learning how to communicate with and motivate each adolescent.

Other strengths of the Lynchburg Healthy Living program include setting and resources. The setting of the study was at an after-school center where many of the participants came every day of the week. The center provided a somewhat controlled setting for a population whose families may not have much consistency. The center was equipped with multiple areas for mentors and participants to exercise, including a full-

sized gymnasium, cardio/weight room, multi-purpose room, and outside recreational space. Televisions and DVD players were also available for use. The fact that the convenience store was located next to the center also was a strength. The time spent going to and from the store was used efficiently because of the close distance, and it was a realistic location for the participants to buy food outside of the weekly mentor-led sessions. Many of the adolescents came to the convenience store multiple times throughout the week to purchase snacks and beverages, and were able to apply what they learned from the program.

The small size of the study sample may have hindered the ability of the program to produce statistically significant data in regards to changes in BMI and pre- and post-assessments of the adolescents. With a larger sample size, the study may have produced more significant results. Another limitation was the program's short duration. Although originally intended to be twelve weeks, the program could only be carried out for seven weeks due to unforeseen protocol that was required to be followed. Seven weeks is not an amount of time in which the effects of a study of this nature can be successfully evaluated. Changes in BMI, nutrition, and physical activity habits often occur after months of intervention. It is recommended that in future studies the program duration is longer than seven weeks, with more frequent evaluations of participants, in order to effectively measure outcomes. A final limitation was the inconsistency in attendance of the participants. The majority of the adolescents missed at least one of the scheduled weekly sessions due to various circumstances. Because of the short duration of the program, it is likely that even one missed session had a significant impact on the outcomes.

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Appendix

AIM-HI Fitness Inventory

Name: _____ Date: _____

We understand that physical activity, healthy eating and emotional well-being are an important part of your health. We want to partner with you to achieve your goals in these areas.

Please answer the following questions to help us better understand your interests and needs in these areas. (Please note: we will work with you on these issues over time and may not attempt to address all of them in this office visit.)

How Active Are You?

Please select the one choice that best describes you:

- I'm physically active already and don't need help to be more active.
 I'm ready to get more active and would like help.
 I'm not sure if I'm ready to be more active, but I'm ready to talk about it.
 I'm not very active and not interested in being more active at this time.

1) How many hours each day do you spend watching TV or videos or on the computer?

- less than 1 1-2 more than 2

2) How many times a week do you do yard or house work or duties on the job that cause you to work up a sweat?

- 4 or more 1-3 Less than 1

3) How many times a week do you get out for a brisk walk of 10 minutes or more?

- 4 or more 1-3 Less than 1

4) How many times a week do you participate in sports or an exercise program?

- 4 or more 1-3 Less than 1

(turn over)

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How Well Do You Eat?

Please select the one choice that best describes you:

- I'm eating healthy at this time.
 I'm ready to make some changes to eat healthier and would like help.
 I'm not sure if I'm ready to change the way I eat, but I'm ready to talk about it.
 I'm not interested in changing the way I eat at this time.

A serving of food is the amount that would fit in the palm of your hand.

- 1) How many servings of fruits or vegetables do you eat each day?
 5 or more 3-4 2 or less
- 2) How many servings of whole grains (like whole grain bread or cereal, oatmeal, brown rice, etc.) do you eat each day?
 3 or more 2 1 or less
- 3) How many times a week do you eat lean protein like chicken, turkey, fish, tofu or beans?
 6 or more 3-5 2 or less
- 4) How many times a week do you eat high fat foods like fried food, pastries or chips?
 1 or less 2-3 4 or more
- 5) How many times a week do you eat fast food meals or snacks?
 1 or less 2-3 4 or more
- 6) How much margarine, butter or meat fat (lard) do you use in your cooking or put on bread, potatoes or other vegetables?
 very little some a lot
- 7) How many sugary drinks (like regular soft drinks, sweet tea or fruit flavored drinks) do you drink each day?
 none 1-2 3 or more
- 8) How many times a week do you eat desserts or other sweets?
 3 or less 4-6 7 or more
- 9) How often do you eat when you are not hungry, for example out of habit or for emotional reasons?
 Rarely Sometimes Often All the time

How Happy or Satisfied Are You?

Please select the one choice that best describes you:

- I'm happy and satisfied with my life at this time.
 I'm ready to make some changes to be happier and would like help.
 I'm not sure if I'm ready to work on being happier, but I'm ready to talk about it.
 I'm not interested in working on my happiness or satisfaction at this time.

In the last week, how often did poor physical or emotional health keep you from doing your usual activities?

- Not at all Some days Most days Everyday

How often does stress or depression affect your ability to pursue healthy lifestyle changes?

- Rarely Sometimes Often All the time

How many days per week do you participate in some form of a spiritual or cultural activity that gives you emotional strength?

- Daily 3-6 days 1-2 days None

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