

The Chronic Disease Prevention Program

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December 9, 2016

Background

The Problem

Obesity is a global epidemic, and the United States is no exception, with over one-third of the population being classified as obese.¹ What used to be a problem among adults has now become a problem for children and adolescents. Over the last thirty years, the percentage of adolescents who are considered obese has more than tripled.² There are disparities among race, income level, and region as well.^{2,3} For example, a larger percentage of non-Hispanic black girls and Mexican-American boys are obese, and youth below 130% of the poverty income ratio have higher rates of obesity than youth from higher income families.³ Further, there are geographic inequities, such as an increased prevalence of obesity in rural areas as well as the southeast.³

There are many physical health, psychosocial, and functional effects of obesity.⁴ Obesity can reduce physical fitness, productivity, and academic performance.⁴ Adolescents have an increased risk for teasing, bullying, low self-esteem, negative body image, and depression, all of which has been found to be related to obesity.⁴ Obesity also increases the risk of cardiovascular disease, cancer, type 2 diabetes, hypertension, sleep apnea, liver disease and other comorbidities.⁴ The current generation of youth is showing signs of hypertension, type 2 diabetes, and high blood pressure higher than any previous generation.⁴ If the rate of diabetes continues to increase at its current rate, one-half of all Hispanic and black children born today are estimated to be diagnosed with type two diabetes during their life.⁵

Poor physical activity and dietary quality are among modifiable risk factors related to obesity, and the current average adolescent's diet fails to meet dietary recommendations

consistently.⁶ The typical adolescent diet is low in vegetables (dark green vegetables, red and orange vegetables, legumes, starchy vegetables), fruit, dairy, whole grains, seafood, nuts, seeds, and oils.^{7,8} The average adolescent male is meeting protein recommendations while the average adolescent female is falling short.^{7,8} Typical adolescent diets are within the recommended daily guidelines for grains.^{7,8} However, most adolescents, particularly American adolescents, are exceeding the recommendations for refined grains, added sugars, saturated fats, and sodium.^{7,8} These dietary patterns are indicative of overconsumption of foods that have lower nutritional benefits and can be contributing to the increasing rates of obesity in this population.⁶

The Effects of Obesity

Obesity and its related comorbidities fall into the category of chronic diseases, and these disease processes are the largest health care expenses and largest causes of death among Americans.⁹ Making healthy lifestyle choices, such as following the dietary guidelines for Americans, maintaining regular physical activity, avoiding smoking and excessive alcohol intake, and scheduling regular preventive visits, can significantly decrease the risk of developing many co-morbidities.⁹ The Affordable Care Act (ACA) has worked to increase the coverage of preventive care services that are reduced or no cost in attempt to reduce the economic consequences of later chronic illness.¹⁰ Practicing these healthy lifestyle choices and regular well visits to the doctor can provide early recognition of disease, maintenance of already developed illness, reduce health care expenses, and improve quality of life.⁹

Preventive Care for Adolescents

National Recommendations for Adolescents

Following key preventive care recommendations for adolescents is one factor that may be related to an increase in this population's health and wellness. The American Academy of Pediatrics (AAP) recommends that all adolescents have an annual physical examination to measure height, weight, Body Mass Index (BMI), and blood pressure.¹¹ These yearly visits also screen adolescents for depression and behavioral problems.¹¹ Vision should be checked every two years or yearly upon the development of poor vision, and oral health should be checked at least twice yearly.¹¹ Additional guidelines from the Office of Disease Prevention and Health Promotion recommend at least sixty minutes daily of physical activity.¹² The Dietary Guidelines for Americans recommends diets high in fruits, vegetables, and whole grains and low in saturated fats, sodium, and added sugars.¹³ Adhering to these guidelines is key for adolescents to develop healthy habits for the future.

Preventive Care Critical in Adolescents

Adolescence is a critical time in the development of preventive care practices. As youth enter adolescence, they are experiencing rapid physical change changes.¹⁴ If healthy patterns are established during adolescence, they are more likely to continue into adulthood.¹⁵ On the contrary, poor health behaviors and obesity developed during adolescence have also been proven to be carried into adulthood for many adolescents.^{16,17} The time period of adolescence is a key transitional period when youth are able to make more of their own decisions.¹⁸ During this stage, many adolescents are making their own food choices, deciding how to spend their time outside of school, and selecting their peer group.¹⁵ Because of this independence, this

time period is also when obesity, teen pregnancy, tooth decay, substance abuse, and sexually transmitted disease begins to become more prevalent.¹⁹ Targeting the adolescent population for positive health promotion at school, home, and in well-child visits can help to prevent adverse health outcomes as they enter adulthood.²⁰

Following the recommended preventive visits can increase overall health and help with early detection of illness.²¹ With the increased presence of obesity and obesity-related comorbidities among adolescence, the importance of preventive care visits increases.²¹ Physicians can detect early signs of type 2 diabetes, hypertension, and obesity to intervene much earlier.²¹ Early detection and intervention for diseases are associated with improved disease outcomes. With or without these early signs, adolescents and their parents can be educated on healthy lifestyle habits that will decrease their risk of disease development.²¹

Meeting Current Recommendations

Upon analysis of the Medical Expenditure Panel Survey, National Health Interview (NIH) Survey, and National Survey of Children's Health adolescent data from 2011, Adams and colleagues reported that 43.0%, 74.4%, and 81.2% of adolescents had received at least one well preventive visit during the last year.²² The variation of these results indicates poor documentation of preventive care among adolescents. Despite the implementation of the ACA, it is evident that there is still room for improvement in preventive care among adolescents. Adolescents are the least likely age group to access preventive care in the United States, and it is typically avoided due to low-income status, lack of insurance, fear of breached confidentiality, and perception that preventive care is unnecessary.²³

Adolescent Obesity Prevention Programs with Preventive Care Components

The Get Fruved Program is a community-based participatory research study designed to promote healthy living for adolescents. The program was developed by a United States Department of Agriculture (USDA) multistate research team with years of expertise in nutrition education and obesity prevention for the target population. The program has been tested and revised at the college level, and it is currently being pilot tested at one high school in the southeastern region of the US. The project aims to decrease obesity prevalence in adolescents through advocacy, youth empowerment, environmental change, and social marketing to facilitate healthier lifestyles.

As a component of this larger research study, the Chronic Disease Prevention (CDP) program specifically aims to increase adolescents' knowledge of preventive health care. The purpose of the project is to increase the awareness and use of preventive health care as a mechanism for chronic disease reduction. The CDP program's short-term goal is to explore the prevalence of adolescence meeting preventive care recommendations through physical activity (PA), fruits and vegetable (F/V) intake, and well-child visits. The long-term goal of the program is to decrease the prevalence of obesity and chronic disease by increasing the preventive health habits among adolescents.

Methods

Study Design

The Get Fruved research study is a control-treatment, pre-test, post-test trial using nested cohort design with four conditions. Participants in the program may be selected to

participate in one of the four conditions: intense intervention, moderate intensity intervention, diffuse intervention, and control. At the college level, the Fruved intervention was developed by the target population, pilot tested and re-tested in a multi-year project. Upon the conclusion of the college trial, the Fruved program will restart at the high school level with readjustments made by the new target population. The Fruved program will use the college students as mentors as the program enters into the high school. As Year 01 in the high school trial, the current program is being tested at L&N STEM Academy with feedback provided by the participants.

As Get Fruved attempts to focus on obesity prevention through the facilitation of healthy lifestyle choices, the CDP program is one component of the intervention. The design to test the effectiveness of the CDP subproject is a treatment and control group, pre-test, post-test study using a convenience sample of high school students currently enrolled at L&N STEM Academy. The treatment group are the wellness students who received the lecture on chronic disease prevention. The control group are any other student at L&N STEM Academy. Gender distribution of the sample was not taken into consideration during the subproject study.

Target Population

L&N STEM Academy is a public magnet high school located in Knox County.²⁴ The focus of the school is to provide students with engaging opportunities in science, technology, engineering, and mathematics. L&N STEM Academy opened in Fall of 2011 and currently has approximately 612 students.²⁴ Of the student population, 45% are females and 55% are males.²⁴ The 2014-2015 demographics of the school population, as well as Knox County, can be seen in Table 1. Admission is based on a lottery system; therefore, the student population of

L&N STEM Academy is comprised of students from all sectors of the county.²⁴ This distribution of students allows L&N STEM Academy to be more representative of the county as a whole than other community-based schools. As noted in Table 1, the percentage of Hispanic students is slightly lower at the high school compared to the county (3.9% and 7.2%, respectively) and the percentage of students categorized as economically disadvantaged by the school system is lower at the L&N (21.5% and 40%, respectively).²⁴

	2014-2015 Profile²⁴			
	L&N STEM Academy		Knox County Schools	
	Number of Students	Percentage of Students	Number of Students	Percentage of Students
Race:				
<i>White</i>	445	78.8%	43,694	73.1%
<i>African American</i>	80	14.2%	9,906	16.6%
<i>Hispanic</i>	22	3.9%	4,295	7.2%
<i>Asian/Pacific Islander</i>	14	2.5%	1,478	2.5%
<i>Native American/Alaskan</i>	0	0%	228	0.4%
Economically Disadvantaged	121	21.5%	23,900	40.0%

Table 1. 2014-15 Demographic Profile of L&N STEM Academy compared to Knox County schools.

School Recruitment

Key stakeholders were determined and contacted by the research team in the Spring of 2016. These stakeholders included members of the Knox County school board, L&N STEM Academy administrative staff, L&N STEM Academy wellness educators, and university officials and faculty. During the Summer of 2016, meetings between the research team and the key stakeholders allowed for the formation of the relationship between project coordinators and school officials. The project has been approved by the Knox County and University of Tennessee Institutional Review Board (IRB).

The key stakeholders identified that the Get Fruved program may be a good fit with current wellness and health education offered in high schools. As a result, project coordinators determined how the program could fit into current state curriculum standards for health science. The Tennessee State Board of Education has developed a set of Lifetime Wellness Curriculum Standard that establishes a basic set of guidelines for all Tennessee wellness educators to follow. The guidelines encompass many aspects of overall health and wellness that are also focused on in the Get Fruved program. Because of the similarities in interests, the project will work closely with wellness educators to cover gaps in the education. However, one major gap in the curriculum is the education of preventive care for adolescents.

Participant Recruitment

Participant recruitment began in September 2016 and concluded in November 2016. Undergraduate and graduate researchers were present at the school in common areas at least once weekly over a two-month period to recruit study participants. Recruitment tactics included flyers in the school distributed via student and parent email, announcements in the daily student newsletter, announcements via the Parent Teacher Student Association (PTSA) weekly newsletter, class announcements by undergraduate student researchers and educators, and in-person tabling events. At tabling events, educational activities were provided that mimic some of the activities offered through the college-level Fruved program to increase student enthusiasm for the pilot study.

During recruitment, students were given parental consent forms to take home and return. The consent form detailed the project purpose, how the data will be stored, and that the data will not be identifiable. Upon return of the parental consent form, students were

provided with a Get Fruved T-shirt or other promotional item to serve as an incentive for participation. In addition to parental consent, participants were given the option to provide assent for their data to be used in the research study prior to completing the online survey. The wellness classes and physical education classes were both used for participant recruitment. The students within these classes received a wellness report card as an additional incentive to complete the survey. The wellness report cards give students a snapshot of their health in comparison to their peers.

Overall Program Development

The CDP program fits into the larger Get Fruved high school pilot as another means for health promotion to address one gap identified in the current wellness curriculum. The program will work to show students how living a healthy lifestyle can include receiving preventive health care. The development of a logic model (Figure 1) identified all aspects of the project to consider during the implementation of the CDP program. The logic model also

provides a clear mission for the program.

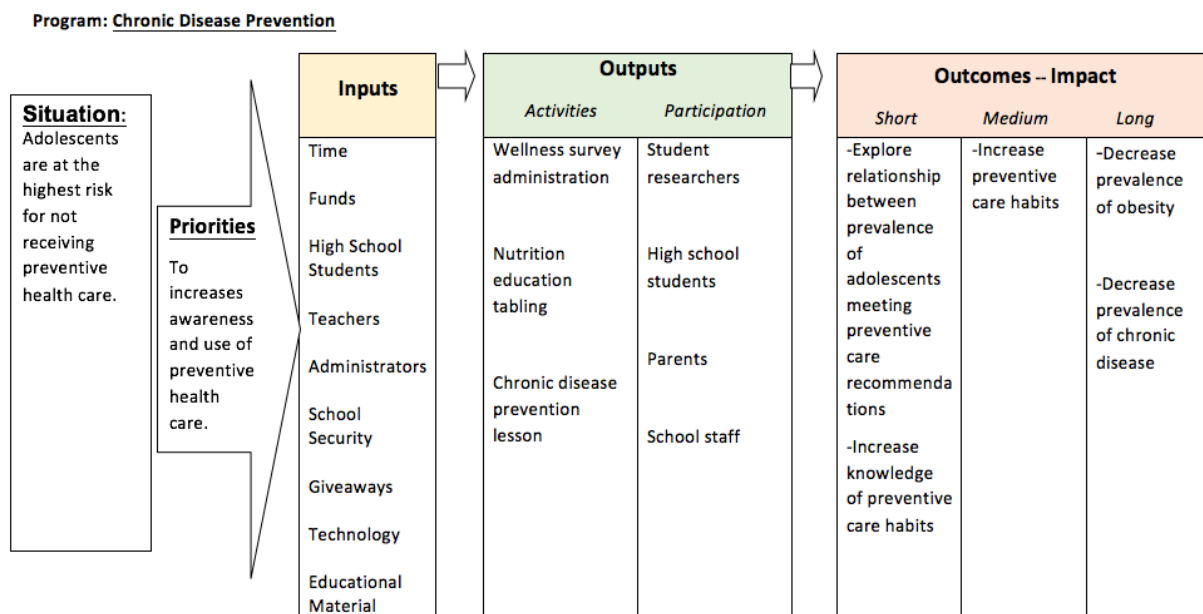


Figure 1. Logic Model for development of Chronic Disease Prevention (CDP) Program.

Program Description

The CDP Program will take place primarily in the high school setting. The program is established based on the Health Belief Model (HBM). The program relies on the core principals of the HBM: desire to avoid illness and belief lifestyle choices can influence the likelihood of avoiding illness. The six key concepts of HBM were used to develop questions for consideration when developing the CDP program (Table 2).

THEORY CONCEPT	QUESTIONS OF CONSIDERATION
PERCEIVED SUSCEPTIBILITY	How concerned are adolescent students about developing chronic diseases?
PERCEIVED SEVERITY	How do adolescent students see chronic diseases affecting their lives?
PERCEIVED BENEFITS	How do adolescent students think their lifestyle choices impact their risk of developing chronic diseases?
PERCEIVED BARRIERS	What is stopping adolescents from preventive health care practices?

CUES TO ACTION	Do adolescents have a family history of chronic disease? Have they already developed a chronic disease or chronic disease risk factor?
SELF-EFFICACY	Do adolescents believe they have the power to control how preventive their lifestyle is?

Table 2. Use of the Health Belief Model for CDP Program Development.

Program Components

The CDP program consists of two components: (1) preventive care assessment and (2) chronic disease lecture. All components are designed to take place within the high school setting with the target population.

Preventive Care Assessment

The preventive care assessment takes place as part of the Get Fruved online survey. This portion of the program will be used to identify gaps in the students' current preventive care practices. The assessment can be repeated throughout the program to gauge progress made. For the pilot study, this will include an assessment of practices done at baseline and after intervention implementation.

Chronic Disease Lecture

This component of the CDP program was piloted in one wellness class during September 2016. The lesson focused on relating healthy lifestyle choices to disease prevention. This concept was lacking from the Tennessee Lifetime Wellness Standard as identified by the key stakeholders. The lesson plan was developed based off of the Dietary Guidelines for Americans and Office of Disease Prevention and Health Promotion physical activity recommendations.

Data Collection

Quantitative data will be collected pre-test, post-test on the sample. The inclusion criteria included any high school student currently enrolled at L&N STEM Academy, students who turned in a parental consent form, provided assent, and completed the online wellness survey. Survey administration occurred on multiple days during wellness class periods, physical education class periods, and during select lunch and homeroom periods. An undergraduate student researcher was present for each survey administration session to help students access the survey as well as answer any questions. Survey administration was completed during November of 2016.

Assessment Methods

The survey data will be used to explore the prevalence of adolescence meeting preventive care recommendations through well-child visits, PA, and F/V intake. Assessment of this data will highlight areas for the CDP program to target and test program effectiveness.

Preventive Health Care Assessment

The preventive health care assessment was added to the Get Fruved online wellness survey to assess the effectiveness of the CDP program. The two preventive health care questions address the number of well-child physician visits and dental visits that occurred within the last twelve months. The two questions were adapted from the National Survey of American's Families to meet the needs of the target population.^{25,26} The adaptations are visible in Table 3.

**NATIONAL SURVEY OF
AMERICAN FAMILIES²⁵**

**GET FRUVED WELLNESS
SURVEY**

WELL-CHILD PHYSICIAN VISITS QUESTIONS	About how many of [the child's] visits to a doctor or other medical professional that you told me about were for well-child care, such as check-ups?	About how many of your visits to a doctor or other medical professional in the last year were well-child visits, such as check-ups?
DENTAL VISITS QUESTIONS	During the last 12 months, how many times did [the child] see a dentist or dental hygienist?	During the last 12 months, how many times did you see a dentist or dental hygienist?

Table 3. Comparison of Original and Adapted Questions

International Physical Activity Questionnaire

The survey includes questions from the International Physical Activity Questionnaires (IPAQ) which is designed to assess the physical activity levels of individuals 15-69 years of age.²⁷ This validated, eleven-question component of the survey will be used to analyze the physical activity levels of each student, including intensity of activity, sedentary activity, and amount of time spent being physically active.²⁷

National Cancer Institute Fruit and Vegetable Screener

The National Cancer Institute Fruit and Vegetable Screener (NCI F/V) was included in the online survey to assess how frequently the sample meets F/V recommendations.²⁸ The validated, twenty-question questionnaire will be used to analyze the daily F/V intake of the students by asking about average intake of various products that include F/V items over the last 30 days.²⁸

Adolescent Perspectives of Food Security

A two-question food security questionnaire was developed by Hager and colleagues to assess adolescents' perspectives on food security in their household.^{29,30} As the USDA Food Screener (FFS) typically assesses food security at a household level, this particular survey allows

us to evaluate food security on an individual level. Both questions are included in all versions of the USDA FFS. The two items are as follows: (1) “Within the past 12 months, we worried that our food would run out before we got money to buy more”; (2) “Within the past 12 months, the food we bought just did not last and we did not have enough money to get more.”²⁹ This questionnaire will be used to compare the prevalence of students considered economically disadvantaged to the overall county and school population.

Chronic Disease Prevention Knowledge

Developed by a member of the USDA multi-state team, the chronic disease prevention knowledge questionnaire assess the level of knowledge related lifestyle choices that affect prevalence of chronic disease. These questions are currently being validated and include items about nutrition. For assessment of the CDP program, one question in the questionnaire will be analyzed. This item is as follows: “What people eat or drink affects whether or not they will develop major disease” with a five-item Likert-scale on how strongly the participant agrees or disagrees.

Demographics

Basic demographic information including age, race and year in school will be collected to compare the sample to the overall school and county population to assess representativeness and further describe the sample.

Statistical Plan

The variables analyzed will include: demographics, preventive health care, F/V intake, PA level, food security status, and belief in lifestyle choices preventing chronic disease. In order to analyze all the variables together, a Multivariate Analysis of Variance (MANOVA) will be

conducted. Table 3 depicts the mechanism in which each variable will be analyzed. Additional coding may be done in order to categorize adolescents to groups whether or not preventive care guidelines for dental and medical visits were met or not.

Data Collection Tool	Time Point	Description	Analysis
Demographics	Baseline	Age, race/ethnicity, year in school, and participation in free and reduced-price school lunch programs.	• Frequencies and distribution
Preventive Health Care	Pre-test, post-test	Preventive health care measures will be assessed using a modified version of questions from the National Survey of America's Families. ^{25,26}	• Participants who respond with one or more well-visits to a doctor within the last year will be classified as meeting recommendations for medical care. • Participants who respond with two or more well-visits to a dentist within the last year will be classified as meeting recommendations for dental care. • These categorical variables will be analyzed with MANOVA as the independent variables.
Physical Activity	Pre-test, post-test	The International Physical Activity Questionnaire ²⁷	• Participants are classified by screener in three levels: sedentary (1), physically active (2), or highly physically active (3) • Participants coded as 2 or 3 may be re-coded as meeting recommendations. • MANOVA as a dependent variable.
Fruit and Vegetable	Pre-test, post-test	The National Cancer Institute Fruit and Vegetable Screener will be used to	• Participants who achieve ≥ 5 cups of fruits and vegetables per day will be classified as meeting recommendations.

		calculate the number of cups of fruits and vegetables consumed per day. ²⁸	• MANOVA compared to preventive care assessment as a dependent variable.
Food Security	Baseline	Food security will be assessed using two validated questions from the USDA FSS. ^{29,30}	• Answering “yes” to either question will classify participants as at risk for food insecurity. • Frequencies and distributions may be analyzed to compare the sample.
Chronic Disease Prevention Knowledge	Pre-test, post-test	The USDA multi-state team developed a question that is currently being validated.	• Answers will be classified based on scaled response. • Frequencies and distributions may be analyzed to compare the sample

Table 4. Description of Data Collection Tools and Analyses.

Discussion

The CDP program was developed to be an adaptive program that could evolve to fit the needs of specific schools while maintaining the goal of decreasing the prevalence of obesity and chronic disease by increasing the preventive health habits in adolescents. Being a part of the larger USDA-funded Get Fruved project strengthens the likelihood of success for the CDP program. The Get Fruved project provides significant resources, such as a collaborative team with extensive nutrition, physical activity, statistic, and adolescent knowledge. The relationship between Get Fruved and the CDP program will be critical to the maintenance of the program as it moves forward.

An additional strength of the pilot testing of overall Fruved program and CDP was the relationship developed with the key stakeholders representing the high school. The proximity of L&N STEM Academy to the University of Tennessee allowed researchers to frequently be present at the high school. This presence strengthened the relationship between the research

team and the students. The research team and L&N STEM Academy staff worked closely together throughout the piloting process. Maintaining this close relationship was essential to reaching the target population.

During the pilot phase of the program, it was discovered that the adolescent population is slow to accept outside organizations. Despite the ability to frequently visit the school, it took weeks of being present at the school and various outreach approaches for the students to accept the Get Fruved Program. When working with other schools in the future, the program will require an adequate size team to ensure that the relationship with school faculty is maintained and that the program can become properly immersed within the school. Making sure that these relationships form will be vital in reaching the adolescent population.

Another barrier for the CDP program is the restrictions that come with working with minors. Requiring students to bring home a consent form for parents to sign and return presented a problem. For future execution of the program, parental consent forms can be presented directly to parents at an open house or meet the teacher. Additionally, the research team may be available to present forms during school registration at the beginning of the school year.

The student population of L&N STEM Academy has a lower percentage of Hispanics and economically disadvantaged students than the Knox County student population. Because of these differences, the CDP program should be piloted in another Knox County school with a higher population of Hispanics and economically disadvantaged students. Running this second pilot study would allow for comparison of the program among various demographics. It would

also allow evaluation of the program's effectiveness within a more low-income population, which may need to be targeted more aggressively to increase preventive care services.

An additional aspect to consider for future implementation of the CDP program is the disease prevention lecture. Most of the adolescent students are in classes for many hours a day listening to lectures. In order for the chronic disease prevention lecture to make an impact, it must be different from all the other lectures that they hear. The lecture portion of the program will have to become school specific in order to meet each school's needs. The program was developed around the HBM in order to address the concern of a lecture-based approach being effective. Because of this design, the lecture component of the program should be effective; however, further testing needs to be performed in order to measure the impact of the chronic disease prevention lecture.

Another aspect to consider when evaluating the impact of the CDP program is the factors that remain outside of adolescents' control. Many adolescents do not have control over their food security and insurance coverage. These aspects may inhibit their ability to practice proper preventive health care measures. While the CDP program may not see an immediate effect in student's practices because of these factors that remain outside of their control, the knowledge they obtain can impact their view. Their view of preventive health care will be what influence their choices as they enter adulthood. Establishing these lifelong practices can then influence these adolescents as well as future generations.

Future implementation of the CDP program will require the material to be properly fit for the audience. Maintaining strong relationships with county school officials as well as school leaders will also be critical for the program's success. Ideally, the CDP program will be widely

accepted by the target population. This acceptance will allow room for the target population to take over the implementation and sustain the program.

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