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Increasing Diabetes Awareness Through Educational Programs in Adolescents

A thesis
presented to
the faculty of the Department of Applied Human Science
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Master of Science in Clinical Nutrition

By
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Keywords: diabetes, prevention, adolescents, lifestyle modification

ABSTRACT

Increasing Diabetes Awareness Through Educational Programs in Adolescents

By

Sandra J. Reese

The purpose of this study was to increase knowledge of diabetes and promote healthy lifestyle behaviors to reduce diabetes onset in a community with a relatively high incidence of type 2 diabetes. Three hundred eighty-seven students grades 7 – 12 participated in the program and taste test. Changes in knowledge before and after an educational program focusing on diabetes prevention were measured by comparison of identical pre-, post-, and retention tests. Students were also asked to name specific behaviors they could use to decrease the risk of diabetes. Responses were analyzed using Chi square analysis and content analysis. Overall, respondents demonstrated a statistically significant increase in knowledge. The taste test was very well accepted, with 50% of respondents preferring low fat milk instead of a higher fat option. Goals set by participants to decrease the risk of diabetes strongly emphasized physical activity and healthy eating, further indicating increased knowledge and awareness.

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CHAPTER 1 INTRODUCTION

Background

Diabetes is a disorder of metabolism where the hormone insulin is deficient, ineffective, or absent, resulting in abnormally high blood glucose levels and significant damage to the body's vascular system. Over 17 million people in the United States have diabetes. Type 2 diabetes accounts for over 95% of diagnosed diabetes.¹ As the U.S. population has experienced significant increase in overweight and obesity, the incidence of type 2 diabetes in younger individuals has increased. Diabetes diagnosed in childhood a decade ago was nearly always type 1; recent reports indicate that 8% - 45% of newly diagnosed diabetes in children is type 2 diabetes.²

The monetary cost of diabetes is as significant as the physiological and psychological stress and overall negative effects of poor health on the individual affected by a chronic disease. Estimated dollars spent on direct and indirect costs from diabetes in 1997 exceeded 98 billion dollars.¹ Annual health care expenses for people with diabetes averages \$10,071 compared to annual health care expenses averaging \$2,699 for people without diabetes.³ People with diabetes are at significantly increased risk for heart disease, stroke, high blood pressure, nephropathy, retinopathy, neuropathy, and periodontal disease. Diabetes is the leading cause of blindness, renal failure, and non-traumatic lower extremity amputation in the United States.^{1,3}

The rural Appalachian community targeted in this study has a high prevalence of obesity and consequent heart disease and type 2 diabetes. Data regarding physical risk factors for diabetes within the target population are also evident. In the year 2000, the county had a higher rate of death due to diabetes (28.6 per 100,000) than the region (25.7) or the state (27.9).⁴ Recent studies evaluating the incidence of overweight and obesity in the community's children indicated that the childhood obesity rate is twice the national average in this community.⁵

Several significant studies in the area of diabetes prevention have been conducted, with strong data to support the prevention of diabetes through lifestyle modification and the commitment to healthy habits.⁶ All have indicated that weight loss and physical activity are effective in delaying or preventing the development of diabetes, even in individuals diagnosed

with impaired glucose tolerance.⁷ This study targeted a high-risk population to encourage healthy habits with the goal of preventing type 2 diabetes.

Statement of the Problem

Diabetes has reached an epidemic prevalence in this country, directly affecting an estimated 17 million people in the United States. The county targeted for intervention experiences a higher rate of death due to diabetes than the surrounding region or the state of Tennessee.⁴ According to one recent study, the targeted county also experiences a high rate of childhood obesity, with 42% of children attending kindergarten through sixth grade in public schools being overweight or obese.⁵ Research from around the globe has indicated that diabetes can be effectively prevented or delayed in onset through lifestyle modification.^{7, 8, 9, 10, 11} Increasing awareness of diabetes, its risk factors, and lifestyle changes that can decrease the risk of diabetes has the potential to decrease the rate of diabetes in an at-risk population.

Significance of the Problem

While chronic diseases such as type 2 diabetes have previously been diagnosed in or after middle age, children and adolescents are now developing conditions such as heart disease and type 2 diabetes.¹² Recent reports indicate that 8% to 45% of newly diagnosed diabetes in children is now type 2 diabetes, where in past decades the diagnosis of type 2 diabetes in childhood was rare.² More than 98 billion dollars were spent treating diabetes and its complications or compensating for the disability and premature death resulting from diabetes.³ Diabetes is the leading cause of blindness, renal failure, and non-traumatic lower-extremity amputation in the United States. Diabetes is also the cause of significantly higher rates of heart disease, stroke, and high blood pressure when compared to the non-diabetic population.¹ However, research has shown a 58% reduction in risk of the development of diabetes in high-risk individuals through lifestyle changes focused on weight loss through diet and exercise.^{7, 8, 10} Some researchers have even hypothesized that as many as 91% of new type 2 diagnoses could be prevented through lifestyle intervention.⁹ Clearly the problem is significant, but realistic solutions are available.

Question to be Addressed

The primary question to be addressed through this research project is, will adolescents become more aware of diabetes and lifestyle factors that can either put them at risk or decrease their risk for diabetes through participation in an interactive educational program. Increased knowledge and awareness of diabetes will be measured through paper and pencil pre- and posttests.

Hypothesis

Participants will have increased knowledge and awareness of diabetes upon completion of the educational program as indicated by the comparison of pretest and posttest scores.

Null Hypothesis

Participants will demonstrate no increase in knowledge or awareness of diabetes upon completion of the educational program as indicated by the pretest and posttest.

Limitations

Limitations of this study include limited access to classes within the schools, having the nutrition programs presented by different people, and participation in the nutrition program multiple times for some students as a result of their academic schedules. Due to unexpected changes in classes attending the nutrition programs from within the schools, some students did not complete the pretest prior to the program but did complete the posttest. The testing tool was not adequately adjusted to meet the needs of the younger grades included in this study because changes in class schedules after IRB approval did not allow adequate time for revisions.

The lesson plan and visual aids were developed by the principal investigator but were presented by dietetic interns, as this project was implemented through the dietetic internship at East Tennessee State University. While the principal investigator was present for the presentation of all programs, each of the presenters had slightly different knowledge levels of the subject, which may have impacted the interpretation of the lesson plan and reception by the audience.

Definition of Terms

Diabetes: Abnormality of glucose utilization resulting from either insufficient insulin production or insulin resistance causing blood sugar to be elevated. Insulin, a hormone made in the pancreas, allows glucose in the blood from food to be taken into body cells and used for energy. In diabetes, insulin is deficient, less effective, or absent. Diabetes is generally classified as type 1 or type 2 diabetes.¹³

Type 1 diabetes: An autoimmune disease caused by lack of secretion of insulin from the pancreas. Daily insulin injections, in addition to regular exercise and dietary management, are required to control type 1 diabetes.³

Type 2 diabetes: Abnormally elevated blood glucose levels resulting from cellular resistance to the insulin the body makes or inadequate insulin secretion. Careful diet and exercise regimens, with or without oral medication or sometimes insulin injections, are required to control the type 2 diabetes.³

Impaired glucose tolerance (IGT): Elevated fasting blood glucose levels between normal and diabetes levels (110-126 mg/dl) indicate insulin resistance and a significant risk of diabetes.³

Blood sugar: Glucose in the blood, normally between 70-100 mg/dl fasting. Fasting blood glucose (sugar) above 126 mg/dl indicates diabetes.³

Body Mass Index (BMI): Weight in proportion to height, calculated by dividing weight in kilogram by height in meters, squared. BMI is used as an indicator of appropriate weight for height for most normal people and risk for weight related health problems.¹³

Overweight: In adults, a BMI in the range of 25-30 or up to 20% over ideal body weight; for children, a BMI that is between the 85th and 95th percentiles for age and sex.¹⁵

Obesity: In adults, a BMI greater than 30 for adults or more than 20% over ideal body weight; for children a BMI above the 95th percentile for age and sex.¹³

Hypertension: Blood pressure greater than 140-90 mm Hg.³

Dyslipidemia: Lipid profile with specific values of HDL cholesterol less than or equal to 35 mg/dl and triglycerides greater than 250 mg/dl.³

Lifestyle intervention: Changes made to previous habits, such as eating less fat or fewer calories, exercising regularly, or losing weight.¹¹

Complication: Negative effect of a disease.¹³

Risk factor: An element in the environment or a chemical, psychological, or genetic element thought to predispose an individual to a disease.¹³

CHAPTER 2

LITERATURE REVIEW

Prevalence of Diabetes

Diabetes is the sixth leading cause of death in the United States. According to the American Diabetes Association, only 35% - 40% of deceased people who had diabetes have diabetes identified on their death certificate, so that death resulting from the complications of diabetes is very likely underreported.¹ Seventeen million people in this country – approximately 6.2 % of the U.S. population - have diabetes. Type 2 diabetes accounts for approximately 95% of all cases. It is estimated that as many as 5.9 million affected individuals are undiagnosed, increasing the risk for long-term complications. One million Americans over the age of 20 are diagnosed annually; 8.6 % of the U.S. population over the age of 20 has diabetes.¹ The prevalence of diabetes worldwide is increasing and by the year 2025 is expected to reach at least 300 million people.¹¹

Although chronic diseases had been thought to occur only in or after middle age, research has indicated that nutrition-related chronic diseases, such as diabetes and heart disease, are seen with increasing frequency in children and adolescents as well.¹² As the U.S. population has experienced significant increase in overweight and obesity, the incidence of type 2 diabetes in younger individuals has increased. Diabetes diagnosed in childhood a decade ago was nearly always type 1; recent reports indicate that 8% - 45% of newly diagnosed diabetes in children is type 2 diabetes.²

Risk Factors for Diabetes

Factors known to increase the risk of the development of type 2 diabetes include ethnic and racial background, age, family history, overweight or obesity, sedentary lifestyle, hypertension, dyslipidemia, history of gestational diabetes, or a history of giving birth to an infant over nine pounds.^{1,3} Ethnicity/racial background is known to be one of the most significant risk factors for diabetes: the prevalence of type 2 diabetes is increased in African-Americans, Latino and Hispanic Americans, American Indians, Alaskan natives, and those of Asian or Pacific islander descent when compared to non-Hispanic Caucasians.¹ In children and adolescents diagnosed with type 2 diabetes, most are overweight, have a family history, are

members of a racial or ethnic background known to be at high risk, and are at least 10 years of age and in mid- to late puberty, although diagnoses of type 2 have been made in children as young as 4 years old.²

There is strong evidence that modifiable risk factors, namely obesity and physical inactivity, are the main determinants of diabetes development outside of genetics,¹⁰ which are thought to control only 40% of body composition variation.¹⁴ Lifestyle changes, specifically the increase of sedentary lifestyles and energy-dense diets seen in prosperous developed nations, are largely to blame for the increasing prevalence of diabetes around the globe.¹¹ A sedentary lifestyle, independent of obesity, significantly contributes to the development of type 2 diabetes.⁹ Americans have ever-increasing access to high fat, energy-dense foods that are abundant, inexpensive, and highly advertised. Sixty-one percent of American adults are overweight (BMI > 25); 14% of children in the U.S. are overweight (> 95th percentile weight-for-height). Increased BMI during adolescence is strongly predictive of obesity in adulthood.¹⁴ Other factors that increase the risk of type 2 diabetes include increased waist circumference and intra-abdominal fat. These factors, combined with obesity and physical inactivity, are strong predictors of glucose intolerance.⁶

Socioeconomic status also plays a role in the risk for diabetes because low income and minority groups are more likely to be exposed to environmental factors that promote unhealthy lifestyles. Neighborhood safety is a key influence on physical activity, especially with regard to children. Lack of sidewalks, adequate lighting, and playgrounds limit physical activity. Limited selection of healthy foods at grocery stores and/or reliance on convenience stores have a negative impact on food choices.¹⁴

Complications and Costs Related to Diabetes

The expense resulting from the treatment and complications of diabetes is significant. Estimated dollars spent on direct and indirect costs from diabetes in 1997 exceeded 98 billion dollars.¹ The majority of this expense was due to the disability and premature death secondary to the complications of diabetes. Annual health care expenses for people with diabetes averages \$10,071 compared to annual health care expenses average \$2,699 for people without diabetes.³ People with diabetes are at significantly increased risk for heart disease, stroke, high blood pressure, nephropathy, retinopathy, neuropathy, and periodontal disease. Diabetes is the leading

cause of blindness, renal failure, and non-traumatic lower extremity amputation in the United States. Other significant complications include an increased risk of birth defects and pregnancy complications, increased susceptibility to illness, and, if the disease is not controlled, biochemical disturbances resulting in hospitalization and possible death.^{1,3} By controlling blood glucose, blood lipids, and blood pressure, as well as preventive care for the feet, eyes, and kidneys, the incidence of these complications can largely be delayed and prevented.¹

Benefits of Lifestyle Modification

Several significant studies in the area of diabetes prevention have been conducted, with strong data to support the prevention of diabetes through lifestyle modification and the commitment to healthy habits.⁶ All have indicated that weight loss and physical activity are effective in delaying or preventing the development of diabetes, even in individuals diagnosed with impaired glucose tolerance.⁷ The latest guidelines established as a joint effort by the Center for Disease Control and Prevention, the National Institute for Health, the American Heart Association, and the American College of Sports Medicine, recommend that adults get at least 30 minutes of physical activity most, preferably all, days of the week, and that children should get at least 60 minutes of physical activity every day.¹⁴ Regular physical activity cannot only decrease the risk of diabetes but can decrease the risk of chronic diseases such as cardiovascular disease, osteoporosis, and some cancers as well.

The Da Qing Impaired Glucose Tolerance and Diabetes Study conducted in China was one of the first studies to investigate the possibility of decreasing the risk of diabetes in high-risk individuals.¹⁰ Five hundred seventy seven individuals with impaired glucose tolerance (IGT) participated in the study that used experimental groups with altered diet, exercise, or a combination of diet and exercise. The conclusion drawn from this study was that diet and exercise are equally effective in decreasing the risk of diabetes in individuals with IGT.

The Diabetes Prevention Study in Finland investigated the effect of intensive lifestyle change, including weight loss and physical activity, in delaying or preventing the progression of IGT to diabetes in 522 individuals diagnosed with IGT.¹⁰ Participants lost an average of 3-4 kg over a four-year period, with a goal for at least 4 hours of physical activity weekly. Weight loss combined with exercise in this study resulted in a 58% reduced incidence of diabetes. Even without weight loss, increasing physical activity was again noted to significantly decrease the

risk of diabetes. Researchers concluded that the results of the study indicate the relevance of even relatively small decreases in weight [5%] in preventing diabetes.

The Diabetes Prevention Program was a 27-center randomized clinical trial conducted in the United States and involving 3,234 participants.¹⁶ More than 45% of the study cohort was from high-risk minority groups. The purpose of the study was to evaluate the safety and efficacy of interventions to delay or prevent diabetes. Participants were divided into three groups: intensive lifestyle modification, standard care with metformin (850 mg twice daily), and standard care with a placebo. A fourth study group using troglitazone was discontinued in 1998 due to safety concerns. Goals for the intensive lifestyle intervention group were a minimum of 150 minutes of exercise per week together with a healthy diet to achieve and maintain at least 7% weight loss. While the metformin group did see a 31% decrease in the risk of diabetes, the lifestyle intervention resulted in a 58% decrease in risk. Researchers concluded that diabetes can be delayed or prevented through lifestyle modification,¹¹ but the study did not provide conclusive evidence to support the use of medication as a substitute for lifestyle modification to prevent diabetes.¹⁶

In association with the Nurses' Health Study, Hu et al. monitored risk factors for diabetes and the development of diabetes in study participants.⁹ The Nurses' Health Study began in 1976 and included 121,700 female nurses between the ages of 30 and 55 at baseline. Hu et al.'s study initially (1980) assessed food frequency and non-dietary factors including smoking, body weight, and physical activity for 84,941 female nurses free of diabetes, heart disease, and cancer at baseline. The last dietary assessment took place in 1996. Overweight or obesity was the single greatest predictor of diabetes. After adjustment for BMI, other factors associated with an increased risk for diabetes included lack of exercise, poor diet, and smoking. Researchers estimated that 91% of the cases of diabetes that occurred within this cohort were attributable to the behaviors identified previously. Researchers concluded their findings "support the hypothesis that the majority of cases of type 2 diabetes could be prevented by the adoption of a healthier lifestyle." (Hu et al., 2001)

Prevalent Risk Factors in a Rural Appalachian Community

Positive changes in health status of a population require sustained cultural change.⁶ The initiation of cultural change represents a significant challenge to the rural southern Appalachian

community targeted in this study. The area is economically depressed with over 28% of its residents falling below the established poverty guideline. Combined with geographic isolation resulting from mountainous terrain, a relatively limited diet consisting of excessive intake of high carbohydrate and high fat foods, and a high prevalence of obesity, the targeted community faces multiple risk factors for diabetes as well as challenges for implementing and sustaining healthy lifestyle behaviors.¹⁵ Environmental issues including a lack of parks, sidewalks, and safe places to play and exercise, as well as reliance on motorized transportation, have a negative health impact on the community as well.¹⁴

Recent data regarding physical risk factors for diabetes within the target population are also evident. In the year 2000, the county had a higher rate of death due to diabetes (28.6 per 100,000) than the region (25.7) or the state (27.9).⁴ One recent study indicated the prevalence of childhood obesity to be well above the national average of 14%. A sample of 928 children ages 6 to 11, grades kindergarten through sixth grade, was assessed for height and weight. Using BMI tables, 42% of the children were found to be overweight or obese. Eighteen percent had a BMI between the 85th and 95th percentiles, which indicated overweight, and 24% had a BMI over the 95th percentile, which indicated obesity. Based on these results, the targeted community has a childhood obesity rate almost twice the national average.⁵ This astounding rate of childhood obesity indicates great need for lifestyle intervention to decrease the risk of chronic diseases like diabetes in children and residents of all ages to promote good health within the community.

Marketing Lifestyle Change to Adolescents

Adolescence is an ideal period in an individual's life to encourage healthy behaviors because eating behaviors established during adolescence become lifelong habits. In comparison with younger children, adolescents have more control over what they eat, where they eat, and how often they eat. They have more access to food outside the home and are more likely to snack.¹⁶ Research has demonstrated that the dietary intakes of adolescents generally do not meet recommended nutrition guidelines, frequently lacking in fruits, vegetables, whole grains, calcium, and iron, and high in fat, sugar, and salt.¹² Total energy intake increases as the number of eating occasions increase.¹⁶ In addition to the tendency to develop poor dietary habits, most adolescents couple poor eating habits with inadequate physical activity.¹² Physical education requirements in schools continue to decrease as academic requirements change: between the

years of 1991 and 1995, required daily physical education for high school students on average dropped from 42% to 25%.¹⁴

Social marketing programs need to target a specific audience to effectively meet program objectives of increasing awareness of health and behaviors that impact health.¹⁴ Review of health promotion program structure has indicated that effective programs generally contain the following elements: behavioral focus, the inclusion of instructional strategies based on learning theories appropriate for the targeted population, adequate exposure to the program, peer involvement, self-assessment and feedback, and community involvement. The most successful programs, as indicated by sustained behavior change, focused on behavior, with the overall goal of enhancing health by reducing risk factors.¹² Because parents do provide access to food and act as highly influential role models for their children, programs that include the family are also more effective.

Intervening with youth is cost-effective and early enough in the life cycle to significantly reduce the risk of chronic disease. In particular, public health interventions carry great potential when disseminated through channels that can reach the majority of children and adolescents in a population, such as schools or after-school programs.¹² Encouraging healthy eating behaviors and regular physical activity has the potential to reduce the risk of chronic disease. Participation in regular physical activity throughout one's lifetime is one of the most important influences on health and needs to be emphasized as children and adolescents spend significant time in front of the television and computer.¹⁴

Justification of Prevention Programs

There are five key considerations in the development of disease prevention programs. As identified by the American Diabetes Association and National Institute of Diabetes, Digestive, and Kidney Disorders, they are: (1) the disease should be an important health problem that imposes a significant burden on an affected population; (2) the early development and natural history of the disease should be understood to facilitate identification of parameters to measure disease progression; (3) there should be a test to detect the pre-disease state that is safe, acceptable, and predictive; (4) there should be safe, reliable, and effective methods to prevent or at least delay the disease from occurring; and (5) an effort to identify high risk individuals and the cost of intervention should be cost effective and not burdensome to the individual(s) or

groups involved.⁷ There is strong evidence that type 2 diabetes meets all of these criteria, especially through the recent research demonstrating the efficacy of lifestyle modification identified previously.⁹ The significantly greater benefit of lifestyle intervention in the form of weight loss and increased physical activity when compared to pharmaceutical intervention suggests that lifestyle intervention should be the preferred choice of intervention to prevent or delay diabetes.⁷ The goals of diabetes prevention programs need to focus on efficacious methods to advertise, implement and monitor interventions to ensure success, as current strategies to prevent obesity struggle with ever-increasing rates of overweight and obesity.⁹

CHAPTER 3

DESIGN AND METHODOLOGY

Demographics

This study was conducted at the middle school, high school, and vocational school in a rural southern Appalachian community. The county's population of approximately 16,600⁴ is primarily Caucasian, with less than three percent of the population being of another race. Over 28% of the county's residents fall below poverty guidelines.¹⁵ The county is mountainous with some elevations reaching over 5,000 feet above sea level, resulting in the geographic isolation of many residents. The county has one emergency room, a nurse-managed 24-hour clinic, and several physician-managed clinics. Significant industry in the area includes farming, manufacturing, and a correctional facility.^{5, 15}

The Sample

The sample consisted of 387 students in twenty classes, grades 7 through 12, attending the county's middle, or high schools. Programs were coordinated through the county's Nutrition and Diabetes Coalitions.

Testing Tool

The testing tool used in this research was developed by the principal investigator and reviewed by graduate faculty. The test was administered three times: once as a pretest and twice as a posttest: once immediately following the program and a second time at least one week following the program to indicate retention of information. The goals and objectives for the nutrition program upon which the tests were based are listed in Table 1. A copy of each tool administered is included in Appendix A.

Data Collection Procedure

Permission to conduct this study was received from the East Tennessee State University Institute Review Board. Students were given a pretest by the classroom teachers prior to the program. An educational program discussing diabetes, its complications, treatment, and risk factors was presented to each class by graduate level dietetic interns and the principal

investigator. Presenters and students discussed modifiable risk factors, namely physical activity, food choices, and body weight, to emphasize prevention of type 2 diabetes. Lesson plans were modified to be age appropriate for the middle and high school students. The middle school lesson plan can be found in Appendix B. The high school/ vocational school plan can be found in Appendix C.

Following the nutrition program, students completed the posttest before participating in a taste test. The posttests were collected before the answers were reviewed with each class. The taste testing included a healthy snack mix made with whole grain cereal, dried fruit, and nuts in addition to comparing 2% and 1% milk and diet and regular soda. The posttest was given an additional time as an indicator of retention, 7 to 10 days following the program by the classroom teachers and returned in postage paid envelopes provided by the principal investigator.

Data Analysis

Data for questions on the test with only two possible answers were analyzed using the Chi Square test for statistical significance. Questions with more than two possible answers were broken down by percentage of respondents for each possible answer.

Table 1. Goals and objectives used in lesson plan and testing tool development	
Goal	Objective
<ul style="list-style-type: none"> • Increase awareness of type 2 diabetes. • Promote understanding of and desire to institute lifestyle changes to decrease the risk of developing type 2 diabetes. 	<ul style="list-style-type: none"> • State two risk factors for diabetes. • State two long-term complications of diabetes. • Identify risk factors that can be altered to decrease the risk of diabetes. • List lifestyle factors that can decrease the risk of diabetes and chronic disease. • Participate in a taste test to try low fat milk.

CHAPTER 4

RESULTS

The Sample

Participants in the nutrition programs ranged in grade level from 7th through 12th grades attending middle or high school in the targeted county. No data were collected on sex, age, or ethnicity. Three hundred eighty seven students participated in the nutrition education programs. Three hundred-sixty (93%) completed pretests, 332 (86%) completed the posttest, and 340 (88%) completed the retention test. Variability in numbers of students completing the pretest resulted from confusion for one class about which class was going to attend the program, so that one class did not receive pretests. The percentage of posttests returned completed was affected by student willingness to respond and one large program in the middle school where students were not prepared with enough pencils for everyone to complete the posttest in the time allowed. The retention tests were to be distributed by the classroom teachers and mailed to the principal investigator. Some teachers failed to return the tests, resulting in an 88% response rate.

Data Analysis

The testing tool included 10 objective questions (Appendix A). The posttest and retention tests also included a question asking students to name one thing they could do to decrease the risk of developing diabetes, based on class discussion. Six questions had answers limited to correct or incorrect: these questions were analyzed using the Chi square analysis. Four questions had more than two possible answers. These questions were addressed for content only. The results of these questions are listed in Tables 3 and 4, with both the number of respondents and the percentage of respondents for each answer per test administration listed.

Chi square analysis was used to determine statistical significance for questions numbered 1, 2, 3, 4, 8, and 10. Table 2 describes the responses for these questions on all three tests; non – respondents were not included in the statistical analysis. All tests were performed at the α 0.05 level of significance. The statistical analysis for these items is included in Appendix D.

Existing Knowledge

The first question addressed previous exposure and experience with diabetes. There was no significant difference in responses for students with previous knowledge before and immediately following the program, as would be expected. However, the number of respondents answering that they knew about diabetes immediately following the program and later on the retention test did show significant variance ($0.050 > p > 0.025$; $\alpha 0.05$). There was no significant difference in correct answers between the pretest and retention test.

Prevalence of Diabetes

The second question was a true or false question addressing the prevalence of diabetes in the United States. There was a significant difference in respondents answering correctly when the pretest was compared to either the posttest ($p < 0.001$; $\alpha 0.05$) or the retention test ($p < 0.001$; $\alpha 0.05$). The percentage of respondents answering correctly increased 6% from the pretest on both of the other tests, which, when combined with the results of Chi square test, indicate a significant increase in knowledge.

Question number 3 addressed the increase in type 2 diabetes in younger populations as a true false question. Responses to the pretest varied significantly from the posttest ($p < 0.001$; α

Table 2. Responses to questions 1 – 4, 8, and 10 used for Chi square analysis

Question	Pretest n = 360 No., (%)			Posttest n = 332 No., (%)			Retention Test n = 340 No. (%)		
	Correct	Incorrect	No Response	Correct	Incorrect	No Response	Correct	Incorrect	No Response
1. Previous awareness	346 (96%)	14 (4%)	0 (0%)	323 (97%)	6 (2%)	3 (1%)	324 (95%)	16 (5%)	0 (0%)
2. U.S. incidence	332 (92%)	25 (7%)	3 (1%)	324 (98%)	4 (1%)	4 (1%)	332 (98%)	6 (1.5%)	2 (0.5%)
3. Increase of type 2 in young people	256 (71%)	100 (28%)	4 (1%)	315 (95%)	13 (4%)	4 (1%)	303 (89%)	33 (10%)	4 (1%)
4. Increase in DM due to overweight	227 (63%)	129 (36%)	4 (1%)	316 (95%)	12 (4%)	4 (1%)	305 (90%)	31 (9%)	4 (1%)
8. No cure for diabetes	311 (86%)	45 (13%)	4 (1%)	311 (94%)	11 (3%)	10 (3%)	318 (94%)	12 (3%)	10 (3%)
10. High incidence in county	140 (39%)	212 (59%)	8 (2%)	287 (86%)	35 (11%)	10 (3%)	297 (87%)	38 (11%)	5 (2%)

0.05); there was also significant variance between the posttest and the retention test ($0.010 > p > 0.001$; $\alpha 0.05$). While there was a 24% increase in respondents ability to answer the question on the posttest immediately following the nutrition program, the increase in correct answers between the pretest and the retention test dropped to 18%. This increase in knowledge was still a significant ($p < 0.001$; $\alpha 0.05$) despite the significant drop in correct responses ($0.010 > p > 0.001$; $\alpha 0.05$) between the posttest and retention test.

Risk Factors for Type 2 Diabetes

The fourth question addressed the relationship between overweight and obesity and the increased incidence of diabetes in the U.S. in the form of a true false question. Again, there was significant variance among the three tests. More respondents were able to correctly answer the question on the posttest than the pretest ($p < 0.001$; $\alpha 0.05$), but fewer respondents were able to correctly answer the question on the retention test than the posttest ($0.010 > p > 0.001$; $\alpha 0.05$). The lower response on the retention test was still significantly greater than the pretest ($p < 0.001$; $\alpha 0.05$), indicated by an increase in correct responses of 27%. The response on the posttest increased 32% from the pretest.

Question 5 asked respondents to identify two risk factors for diabetes, given a list of four items. Table 3 contains the numeric data for this question. The choices most frequently identified on the pretest were overweight (65%) and eating too much sugar (62%), followed by family history (60%), and contact with a diabetic person selected least frequently (7%). Initially, 65% of respondents identified overweight as a risk factor, a correct answer. 95% of respondents correctly identified this risk factor on the posttest, with the number slightly decreasing to 90% on the retention test. Sixty percent of respondents were able to correctly identify family history on the pretest, compared with 80% and 78% on the post and retention tests, respectively. Respondents labeled eating too much sugar as a risk factor for diabetes dropped from 62% on the pretest to 18% and 28% on the post and retention tests, respectively.

The last question on the quiz addressed the relationship between increased prevalence of diabetes in the county and the increased risk for residents of that area. There was a significant difference between the correct and incorrect responses on the pretest and the posttest ($p < 0.001$; $\alpha 0.05$) as well as between the pretest and the retention test ($p < 0.001$; $\alpha 0.05$). Correct

responses improved 47% from the pretest to the posttest, and 48% from the pretest to the retention test. There was no significant difference between the post and retention tests ($p > 0.100$; $\alpha 0.05$).

Complications of Diabetes

The sixth question on the test asked respondents to identify two long term complications of diabetes given a list of four items. Table 3 contains the numeric data for this question. Kidney failure (76%) and liver disease (46%) were selected most frequently on the pretest, followed by blindness (36%) and cancer (26%). The posttest showed significant improvement, with 92% of respondents selecting kidney failure and 89% of respondents selecting blindness on the posttest. The retention test indicated a decrease in correct responses, with only 81% of respondents selecting kidney failure and 74% selecting blindness as long term complications of diabetes.

Table 3. Responses to questions 5 – 7 of the testing tool

Question	Pretest n = 360 No., (%)				Posttest n = 332 No., (%)				Retention Test n = 340 No., (%)			
	a	b	c	d	a	b	c	d	a	b	c	d
5. Identify 2 risk factor for diabetes ^a	235 (65%)	223 (62%)	215 (60%)	26 (7%)	315 (95%)	60 (18%)	263 (80%)	8 (2%)	306 (90%)	94 (28%)	264 (78%)	14 (4%)
6. Two long term complications of diabetes ^b	94 (26%)	272 (76%)	166 (46%)	129 (36%)	10 (3%)	305 (92%)	30 (9%)	294 (89%)	53 (16%)	274 (81%)	70 (21%)	252 (74%)
7. How is diabetes treated ^c	212 (59%)	201 (56%)	31 (9%)	290 (81%)	262 (79%)	236 (71%)	9 (3%)	308 (93%)	248 (73%)	229 (67%)	23 (7%)	312 (92%)

^a For question 5: a) overweight; b) eating too much sugar; c) parent or sibling has diabetes; d) contact with someone who has diabetes. The correct answers were *a* and *c*.

^b For question 6: a) cancer; b) kidney failure; c) liver disease; d) blindness. The correct answers were *b* and *d*.

^c For question 7: a) diet and exercise; b) pills; c) surgery; d) insulin shots. The correct answers were *a*, *b*, and *d*.

Treatment of Diabetes

Question 7 addressed the treatment of diabetes. Given a list of four items, respondents were asked to identify three methods used to control diabetes. Table 3 contains the numeric data for this question. Initially, 59% of respondents selected diet and exercise, 56% identified pills, and 81% selected insulin shots. Nine percent of respondents incorrectly identified surgery as a method to treat diabetes. The posttest indicated increased knowledge of the subject, as more respondents were able to identify diet and exercise (79%), pills (71%), and insulin shots (93%) as methods used to treat diabetes. The retention test demonstrated retention of the knowledge, with 73% selecting diet and exercise, 67% selecting pills, and 92% selecting insulin shots as possible treatment methods.

The eighth question on the test was a yes or no question that asked if there is a cure for diabetes. There was a significant increase in respondents answering correctly when the pretest was compared to the posttest ($p < 0.001$; $\alpha 0.05$) or the retention test ($p < 0.001$; $\alpha 0.05$). Furthermore, there was no significant difference between the posttest and the retention test ($p > 0.100$; $\alpha 0.05$). There was an 8% increase in correct responses when the pretest was compared to either additional test.

Table 4. Responses to question 9 of the test tool*

Option	Pretest n = 360 No., (%)	Posttest n = 332 No., (%)	Retention Test n = 340 No., (%)
a) Eat less sugar	244 (68%)	92 (28%)	99 (29%)
b) Exercise regularly	238 (66%)	318 (96%)	323 (95%)
c) Lose weight if you are overweight	211 (59%)	256 (77%)	303 (89%)
d) Don't eat carbohydrates	50 (14%)	20 (6%)	29 (9%)
e) Eat a balanced diet with food from all the food groups	273 (76%)	255 (77%)	291 (86%)
f) Stay away from people that have diabetes	13 (4%)	2 (0.6%)	5 (1%)

*The correct answers were *b*, *c*, and *e*.

Lifestyle Intervention to Prevent or Delay Diabetes

Question 9 dealt very specifically with diabetes prevention and risk factors that can be altered. Respondents were asked to identify three items from a list of six that may help reduce the risk of developing type 2 diabetes. Table 3 contains the numeric data for this question. Consistent with the pretest responses to question number 5, 68% of respondents indicated eating less sugar on the pretest. This number declined to 28% on the posttest and 29% on the pretest. Exercise regularly was a correct answer that most respondents were able to identify following the nutrition program, with the percent response jumping from 66% on the pretest to 96% on the posttest, with a negligible decline to 95% on the retention test. Weight loss, if needed, was the second correct answer that was selected more frequently on the posttest (77%) than the pretest (59%), and response to this option increased significantly to 89% on the retention test. The third correct answer was to eat a balanced diet. Most respondents were able to identify this option on the pretest (76%) and on the posttest (77%). Response to the balanced diet option increased to 86% on the retention test. The number of respondents selecting “don’t eat carbohydrates” or “stay away from people with diabetes” dropped between the pretest (14% and 4%, respectively) and the posttest (6% and 0.6%). There was a slight increase in the selection of “don’t eat carbohydrates” (up to 9% from 6%) on the retention test.

Taste Test

The taste test consisted of sampling 1% and 2% milk, diet and regular soft drinks, and a snack mix made from cereal, dried fruit, and nuts. Table 5 contains the results of the taste test. Three hundred twenty-nine middle and high school students participated in the taste test. The snack mix was essentially provided as a snack and was not assessed in any way outside of

	Preferred	No Preference	No Response
Milk		13 (4%)	35 (11%)
1%	166 (50%)		
2%	118 (36%)		
Soft Drink		27 (8%)	13 (4%)
Diet	87 (26%)		
Regular	205 (62%)		

*The taste test was completed immediately following the posttest.

classroom discussion; it was very well accepted. Fifty percent of respondents preferred the 1% milk, 36% preferred 2%, and 4% indicated no preference. Eleven percent of the students participating in the program did not select any of the items on the taste test form. Regular soda was preferred overall when compared to diet soda (62% to 26%, respectively). Eight percent could not tell the difference between diet and regular soda, and 4% did not respond on the taste test form. Overall, the taste test was well accepted and enjoyed by students participating in the nutrition program.

Student-Set Goals

The post- and retention tests had a question added which asked them to set a specific, realistic goal that they could add to their daily routine to lower the risk of developing diabetes. Responses to this question varied but indicated internalization of the information presented through real-life application. Selected responses are listed in Table 6. Presenters directed students to be very specific during classroom discussions in an effort to identify specific behaviors that could be adapted to make a more active lifestyle.

Diet	Eat healthier snacks Eat less sugar Don't eat as much junk food Eat the right foods Eat a balanced diet Eat better after school Don't drink lots of soda Eat less fattening food Drink more water Drink low fat milk	Instead of picking up an sweet, pick up an apple for a snack Lay off the snack cakes Eat less candy Eat more vegetables Water, milk, and diet drinks Eat less oils, sour cream, and cake Quit eating candy bars Eat out of all the food groups Eat more grapes
Exercise	Walk more often Exercise more Play baseball Bicycling/ Ride my bike more Watch less TV Go outside and play more Play more basketball Laps up and down my hill Walk my dogs after school Ride horses Go walking every day Running Marching band and chores	Walk to my friend's house 1 mile away Exercise every chance I get Lift weights Run around my house Play more games with my brother Play ball Pushups Chase my dog Jog up and down my road Skateboard Go hiking in the woods Swim Turn off the TV and go for a walk
Other	Exercise and eat right Lose weight Exercise and be more active in sports and not watch so much TV or watch so much junk food	Watch what you eat and after you eat, exercise Try not to get overweight Eat more fruits and vegetables and exercise

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Discussion

Overall, the data collected and analyzed indicate an increase in knowledge in students grades 7 – 12 participating in educational programs focused on diabetes prevention. Although for some questions the correct responses did decrease slightly between the post and retention tests, there was consistently a net gain overall. Repetition of the testing tool was probably helpful for some students, as some wording and vocabulary were not age appropriate for the lower grade levels. In general, the middle school students were more receptive than the high school students to the program presentation and suggestions for lifestyle change.

The question added to the post and retention tests that asked students to name something they could do to reduce their risk of getting diabetes indicated increased knowledge and application of that knowledge to set realistic goals. During the presentation, students were asked to set specific goals. Presenters worked with the students to be very specific when setting goals to help them make statements like “eat a sandwich and drink milk after school instead of chips and a soda” instead of just “eat healthy.” While many students were successful in stating specific goals, the majority of students limited their answers to exercising more and eating healthy. As a whole, the goals students made were very positive and related to the program content and discussion. Students continued to provide healthy goals on the retention test, indicating sustained knowledge and application learned from the education program.

Unfortunately, the time allowed for the completion of this study did not allow for any follow-up. The true indicator of increased knowledge for the purposes of disease prevention would be changes that are actually implemented into the daily routine. While most students appeared to be interested in the subject and motivated at the time of the program, it is unlikely that significant changes were implemented following only one session of relatively passive learning. As noted previously, programs that are able to successfully promote the implementation of healthy lifestyle changes include more contact in terms of time and significant active participation.¹² Due to the time limitations imposed by the classroom schedule, active participation was very limited. Participants were encouraged to ask questions throughout the program and discuss the topic with presenters. Positive feedback included obvious interest in

the subject (based on body language, questions, and participation) and comments from students when we returned to the schools for various programs that they were trying to cut back on eating junk food. One student even commented that she told her mom to stop buying soft drinks because she did not want the empty calories!

The taste test was very successful in introducing many students to low fat milk. The introduction of low fat milk has been an issue with the community's nutrition coalition in recent years because using low fat milk is such an easy way to significantly reduce calorie and fat intake. However, many people are afraid to purchase new products because they are afraid of disliking the product and wasting money. The taste test indicated that many teenagers would actually prefer a reduced fat (2%) or low fat (1%) milk, which benefit their overall nutritional status. The regular soda, as predicted, was preferred, although some people did prefer the diet soda, and several students commented, "they always wondered what the diet stuff tasted like." Taste tests are a fun way to allow people to try new foods, without wasting money on products they do not like and encourage greater variety in foods eaten.

Limitations experienced during this study could be avoided to some extent in future programs of similar nature. Concern regarding the appropriateness of the testing tool for the younger grades should have been addressed by the application of a readability test and by piloting the tool. Some of the difficulty observed with the test may have been the result of mainstreaming students with learning disabilities into the classes the program was presented to, which is an uncontrollable limitation. The issue of confusion with teachers regarding which classes were to participate in programs may have been alleviated through better communication with the school and earlier planning. However, experience working with the schools included in this study indicates that these suggestions are very difficult to instigate. It is estimated that only up to two classes (up to 40 students) could have attended the program more than once. The inclusion of a box or space on the test for students to check if they had participated in the program more than once would have allowed for the identification of these students so that tests from the second program exposure could have been excluded from the results.

Conclusions

The students participating in the nutrition programs in this study were successful in demonstrating an increase in knowledge on the subject of diabetes. The taste test was also

successful in introducing many students to low fat milk. Students were also successful in collaborating with presenters and each other to think of an abundance of healthy snack ideas and easy ways to be more physically active. Coordinating these programs with the schools provided a way to reach a large number of students with a message for healthy habits to prevent diabetes without singling any students out. The feedback given by presenters, students, and teachers was overwhelmingly positive.

Recommendations

Reinforcement of the information presented during this study is essential to promoting sustained behavioral change in the community. Offering programs targeted specifically at children and young adults have the potential to be especially beneficial if healthy habits proven to reduce the risk of disease are established early in life. Incorporating such programs through schools has the potential to impact a large number of people, as attendance is required. Further programs need to allow for some kind of follow up, such as a series of programs or a survey sixth to eight months following the program to identify any self-reported lifestyle changes. Environmental change to support healthy habits, especially at school, is crucial to influencing behavior change. Adequate opportunity for physical activity and healthy food choices at school is important. Simple steps such as offering low fat milk, plenty of fruits and vegetables, and low fat food choices can help shape a child's acceptance of and preference for healthy foods.

Parental involvement in the education process is another critical step in facilitating behavior change to decrease risk factors for chronic disease because parents serve as highly influential role models, as cited previously. Community-wide intervention to increase awareness of risk factors for chronic disease can be implemented in a variety of settings but would best be implemented with some degree of coordination so that programs delivered at different locations and to varying age groups would reinforce the same general messages to promote health.

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APPENDICES

APPENDIX A

Testing Tools

Diabetes Prevention Pretest

Do not write your name on this paper. Please answer each question by circling an answer.

1. Have you heard of diabetes or do you know someone who has diabetes? **Y** **N**
2. **True or False:** Over 16 million Americans have diabetes.
3. **True or False:** Type 2 diabetes used to be seen only in older adults but now children are getting it as well.
4. **True or False:** The increase in diabetes in the U.S. is largely due to increased body weight (people weigh more and more people are overweight or obese).
5. Circle two (2) risk factors that increase the risk of developing type 2 diabetes:
 - a. Overweight
 - b. Eating too much sugar
 - c. Parent or sibling has diabetes
 - d. Contact with someone who has diabetes
6. What are two harmful long-term complications of diabetes?
 - a. Cancer
 - b. Kidney failure
 - c. Liver disease
 - d. Blindness
7. How is diabetes treated? (Circle all that apply)
 - a. Diet and exercise
 - b. Pills
 - c. Surgery
 - d. Insulin shots
8. Is there a cure for diabetes? **Y** **N**
9. Identify three things that you can do to lower your risk of developing diabetes.
 - a. Eat less sugar
 - b. Exercise regularly
 - c. Lose weight if you are overweight
 - d. Don't eat carbohydrates
 - e. Eat a balanced diet with food from all the food groups
 - f. Stay away from people that have diabetes
10. **True or False:** This county has a higher rate of diabetes (more people have it) than other parts of Tennessee, putting you at a higher risk of getting diabetes.

Diabetes Prevention Posttest

Do not write your name on this paper. Please answer each question by circling an answer. Use the form on the back for taste test results.

1. Have you heard of diabetes or do you know someone who has diabetes? **Y** **N**
2. **True or False:** Over 16 million Americans have diabetes.
3. **True or False:** Type 2 diabetes used to be seen only in older adults but now children are getting it as well.
4. **True or False:** The increase in diabetes in the U.S. is largely due to increased body weight (people weigh more and more people are overweight or obese).
5. Circle two (2) risk factors that increase the risk of developing type 2 diabetes:
 - a. Overweight
 - b. Eating too much sugar
 - c. Parent or sibling has diabetes
 - d. Contact with someone who has diabetes
6. What are two harmful long-term complications of diabetes?
 - a. Cancer
 - b. Kidney failure
 - c. Liver disease
 - d. Blindness
7. How is diabetes treated? (Circle all that apply)
 - a. Diet and exercise
 - b. Pills
 - c. Surgery
 - d. Insulin shots
8. Is there a cure for diabetes? **Y** **N**
9. Identify three things that you can do to lower your risk of developing diabetes.
 - a. Eat less sugar
 - b. Exercise regularly
 - c. Lose weight if you are overweight
 - d. Don't eat carbohydrates
 - e. Eat a balanced diet with food from all the food groups
 - f. Stay away from people that have diabetes
10. **True or False:** This county has a higher rate of diabetes (more people have it) than other parts of Tennessee, putting you at a higher risk of getting diabetes.

Was this information helpful/ something you will you think about after we leave?

Please list one thing in your daily routine that you will try so that you can lower your risk of getting diabetes.

Taste Test: Circle the letter for the sample you liked best.

Milk: **A** **B**

Soda: **C** **D**

Diabetes Retention Test

At least 1 week after program

Do not write your name on this paper. Please answer each question by circling an answer.

1. Have you heard of diabetes or do you know someone who has diabetes? **Y** **N**
2. **True or False:** Over 16 million Americans have diabetes.
3. **True or False:** Type 2 diabetes used to be seen only in older adults but now children are getting it as well.
4. **True or False:** The increase in diabetes in the U.S. is largely due to increased body weight (people weigh more and more people are overweight or obese).
5. Circle two (2) risk factors that increase the risk of developing type 2 diabetes:
 - a. Overweight
 - b. Eating too much sugar
 - c. Parent or sibling has diabetes
 - d. Contact with someone who has diabetes
6. What are two harmful long-term complications of diabetes?
 - a. Cancer
 - b. Kidney failure
 - c. Liver disease
 - d. Blindness
7. How is diabetes treated? (circle all that apply)
 - a. Diet and exercise
 - b. Pills
 - c. Surgery
 - d. Insulin shots
8. Is there a cure for diabetes? **Y** **N**
9. Identify three things that you can do to lower your risk of developing diabetes.
 - a. Eat less sugar
 - b. Exercise regularly
 - c. Lose weight if you are overweight
 - d. Don't eat carbohydrates
 - e. Eat a balanced diet with food from all the food groups
 - f. Stay away from people that have diabetes
10. **True or False:** This county has a higher rate of diabetes (more people have it) than other parts of Tennessee, putting you at a higher risk of getting diabetes.

Please list one thing in your daily routine that you will try so that you can lower your risk of getting diabetes.

APPENDIX B

Middle School Lesson Plan

Diabetes Prevention Lesson Plan – Middle School

Audience: middle school – 7th and 8th grade history classes (45 min class period)

Goals:

- Increase awareness in target audience of type 2 diabetes, its risk factors and high prevalence in the region, and its consequences.
- Promote understanding of and desire to institute lifestyle changes that will decrease the risk of developing type 2 diabetes.

Objectives:

- Students will be able to state at least two risk factors for diabetes.
- Students will be able to state 2 long-term complications of diabetes.
- Students will identify and discuss lifestyle interventions (i.e., maintaining a healthy weight, eating a balanced diet, staying physically active) that can decrease their risk of developing type 2 diabetes.
- Students will participate in a taste test to try low fat milk, diet soda, and reduced fat crackers.

Materials:

- Pretest
- Posttest
- Food for taste test
- Diabetes risk factor pyramids
- Overheads: risk factors for diabetes; complications of diabetes

Instructions:

1. **Introduce self and other classmates presenting, topic, and outline** (“Today we’re going to talk a little bit about what diabetes is and why we want to prevent it. We are going to look at some different parts of the world that you may have studied, and see why some areas have more or less diabetes. Then we are going to talk about what you can do to prevent diabetes. We will finish with a taste test.”)
2. **Can anyone tell me what diabetes is (or what happens to your body that makes you get diabetes)?**

When you get diabetes, your body doesn’t handle the sugar that comes from the foods you eat correctly, so that all that sugar stays in your blood stream instead of going into the cells for them to have energy. Having high blood sugar causes symptoms, like being really thirsty, having to go to the bathroom a lot, blurry vision, and being really tired, to name a few. *Unfortunately, we do not have a cure for diabetes, so once you have it, you have it.*

There are 2 kinds of diabetes, called type 1 and type 2. Type 2 is the kind that people get as they get older or if they are really overweight, have a family history, etc., and right now we

are going to talk about type 2 diabetes and how you can prevent it by eating better and exercising more.

Does anyone know someone that has diabetes?

3. Discuss diabetes –causes, prevalence, increase in children and adolescents, region. Be brief!

Over 16 million (write on board) Americans have diabetes. A lot of these people don't even know they have diabetes, so they can't try and control it with the foods they eat or by taking medicine.

Does anyone know how you get diabetes?

Causes – *genetics, obesity*, activity (or inactivity) level, possibly stress. It is not caused by eating too much sugar, being around people with diabetes (it's not contagious).

Because Americans are starting to get heavier and heavier, so that more and more people are overweight, more and more people are getting diabetes. Also, more children and teenagers – people just a little bit older than you – are getting diabetes because they are very overweight.

4. Risk factors are things that increase a person's chance of getting a disease. What are some risk factors for diabetes? (Use overhead)

<i>Family history</i>	<i>Racial background</i>	<i>Overweight or Obesity</i>
<i>Sedentary lifestyle</i>	<i>Gestational diabetes</i>	<i>Age</i>

More people are overweight now than at any other time in history, and so we are seeing more and more diabetes, even in children and teens. Johnson County has a more diabetes for its population than the region or the state. That means that everyone here is at risk for getting diabetes.

5. Can anyone think of some reasons that we have more diabetes now than in the past? How have our lifestyles changed from the beginning of the century?

Let's look at a map – some countries, like China, and most of Asia, as well as parts of Europe where people walk everywhere (like in the cities there) don't have as many people with type 2 diabetes. When people move to the US, they have the same risk prevalence of disease as we Americans do. Why?

One of the biggest reasons, we think, is that people in those countries are more active everyday, because they don't drive everywhere, and they tend not to eat as much as Americans do. Why does it matter how much you eat? (We said a few minutes ago that being overweight is a big risk factor for diabetes). They also tend to eat different foods – more fruits and vegetables, and complex carbs like pasta and whole grain breads.

Can you think of Johnson County in the past, like maybe when your parents, grandparents, or great-grandparents were kids? What did they do differently than you do today? Many of the people that used to live in Johnson County were farmers. So let's compare how much exercise a farmer gets, and how much exercise, say, a store clerk or a secretary gets. While all three are good jobs to have, the farmer is going to be basically exercising all day long! What did your grandparents do when they got home from school in the afternoons? Do you think they played video games or watched TV while they had a snack? NO – they had to go help their parents on the farm, so they worked every morning before they went to school and when they got home.

Another big difference is the foods we eat and what people used to eat. Who likes hamburgers and French fries? Most of us do... but here is definitely such a thing as too much of a good thing! People today eat a lot of high fat foods like fast food and junk food, not enough fruits, vegetables, and high fiber foods, and lots of things like white bread, potato chips, cookies, candy, and foods that in general have a lot of calories but not very good nutrition. And then what happens when we eat lots of junk food and don't exercise very much? That's right – you gain weight, and that, on top of not getting good nutrition and being sedentary – increases your risk for getting diabetes!

6. Let's talk for a few minutes about why we want to take good care of ourselves and try to prevent diabetes. Does anyone know what problems diabetes can cause?

OR – I'm going to tell you some of the things that diabetes can cause when you have it for a long time and don't take care of it.

Use overhead:

Long-term complications –	<i>kidney disease and failure</i>	<i>blindness</i>
	nerve damage (= foot amputation)	heart disease
	poor wound healing	periodontal disease

7. How do people with type 2 diabetes control the disease, since control is so important?

Diet – What do they have to “watch”? (carbs, also fat b/c of heart disease)

Exercise – helps the body use sugar in the blood to lower blood sugar and maintain healthy weight

Medication – pills (help body use insulin it makes more effectively or makes body produce more insulin); insulin via injection or pump

8. So the big question is: How do you prevent diabetes? Think back to what we said earlier about risk factors for diabetes. Which of these do you think you can do anything about?

Yes it's worth trying to prevent – just look at the list of complications!!! It is expensive to treat, difficult to control, and *incurable*. We do know for sure that making a few changes in your lifestyle – what you do everyday – can dramatically reduce your risk of getting type 2 diabetes. The best thing you can do is try to exercise and not get overweight in the first place. Making healthy food choices is very important and can taste good too.

9. What are some things that YOU might do to lower YOUR risk of diabetes?

(Wait for responses, lead if necessary with: Well... we said that countries that exercise more, or eat less fat and junk food have less diabetes. What are some things you could change about the foods you eat to make them healthier? What are some ways you could get some more exercise?)

Diet: *Eat foods from all of the food groups for a balanced diet*, like it says to on the food guide pyramid

Decrease fat (use less butter or margarine, cheese sauce, gravy, eat less junk food),
Control Calories: eat more fruits and veggies; eat whole fruits instead of just drinking juice; try a veggie pizza instead of pepperoni; snack on low fat popcorn, cereal, yogurt, or fruits and veggies instead of chips, candy, sweets, or eating a whole box of mac and cheese or bologna sandwiches when you get home. Try using 1% milk instead of whole milk. Drink less soda and Kool-Aid, and don't drink more than 2 glasses of juice a day on a regular basis – drink water, tea (preferably unsweetened!), and milk.

Increase physical activity: play sports, at school or at home with friends; take the stairs; walk the dog; help your parents clean; rake the leaves and other yard work; walk down to get the mail; play at recess; hike or play with friends and family, church group, etc. on the weekends or after school; participate in gym class; do sit-ups, pushups, jumping jacks, etc. while you watch TV.

One of the best things that you can do is try to stay at a normal weight for your height as you are growing, and then when you stop growing as a teenager, make sure you stay active so that you don't become overweight.

10. Next we are going to have a taste test, and then we will finish up with a little questionnaire to see if you have learned anything. (Ask if anyone is allergic to any foods, since the taste test will contain milk and possible wheat, nut, or soy ingredients)

Taste test – first of all, it is very important that all of our trash gets in the garbage can, because if we leave a mess, than we won't be able to come back and give you guys snacks anymore! We are going to pass out the quiz because we need you to circle answers on the back for which foods you liked best. You can work on your quiz, if you like, if you finish the taste test before everyone.

Instructions for quiz: Your teacher is going to pass out a quiz now. Please *do not write your name, the date, or anything at the top of the paper.* (this is very important!!!) This quiz is just like the one you took the other day, except that I want you to think of on little change you can do that we mentioned today, like drinking low fat milk, a better snack choice, playing outside more, etc. When you are done, raise you hand and one of use will collect it.

Pass out individual cups, (labeled: MILK a = 2%, b=1%; SODA a= diet, b = regular, and trail mix snack) to students at their desks. More time consuming for us, but will probably work better and decrease risk of spills.

11. Collect tests, make sure all trash gets in garbage, and thank the students for their participation.

If time permits, review material with students. **After collecting the quiz**, you may go over the correct answers with them.

Other questions:

- What are some symptoms of diabetes? (see page 2)
- What part of their diet does someone with diabetes really have to watch? (carbs)
- How do you know if diabetes is controlled? (fingerstick blood sugar testing at home)
- Can anyone explain to me what diabetes is?
- Can diabetes be prevented? (yes!!!)
- Let's name some easy things each of you can do to reduce your risk of getting diabetes – (take multiple answers)
- What new things did you learn today?
- Who thinks they might try making one or two changes to help prevent diabetes?

APPENDIX C
High School Lesson Plan

Diabetes Prevention Lesson Plan – High School

Audiences: *high school – family and consumer science classes (1 ½ hour classes)*

Goals:

- Increase awareness in target audience of type 2 diabetes, its risk factors and high prevalence in the region, and its consequences.
- Promote understanding of and desire to institute lifestyle changes that will decrease the risk of developing type 2 diabetes.

Objectives:

- Students will be able to state at least two risk factors for diabetes.
- Students will be able to state 2 long-term complications of diabetes.
- Students will identify and discuss lifestyle interventions (i.e., maintaining a healthy weight, eating a balanced diet, staying physically active) that can decrease their risk of developing type 2 diabetes.
- Students will participate in a taste test to try low fat milk, diet soda, and reduced fat crackers.

Materials:

- Pretest
- Posttest
- Food for taste test
- Diabetes risk factor pyramid
- Overheads: risk factors for diabetes; complications of diabetes; what is diabetes?

Instructions:

- 1. Introduce self and other classmates presenting, topic, and outline** (“Today we’re going to talk a little bit about what diabetes is and why we want to prevent it. Then we are going to talk about what you can do to prevent diabetes. We will finish with a taste test.”)
- 2. Do any of you know someone that has diabetes?** Talk briefly about their experiences – relatives, friends etc. That have DM, and what they might do to control it. You can ask these people to share more later when you talk about the 3 things people do to control diabetes.
- 3. Can anyone tell me what diabetes is (or what happens to your body that makes you get diabetes)?**

Type 1	Type 2
No insulin	Usually make more insulin than normal
Pancreas doesn’t work	Body doesn’t use insulin correctly
Usually younger age at diagnosis	Used to be only seen in adults, now seen in teens and children
Take insulin	Pills and sometimes insulin

Use Overhead: What is diabetes? That has illustration of sugar molecules in the blood stream. Explain the role of insulin in taking sugar out of the blood and into the cell by acting like a key to the cell, opening the door for the sugar to go in. Unfortunately, *there is no cure for diabetes*, so once you have it, you have it forever and need to control it.

4. Discuss diabetes –causes, prevalence, increase in children and adolescents, region

Ask “Does anyone know what causes diabetes?”

Causes – *genetics, related to body weight (overweight and obesity)*, physical activity (or inactivity) level, possibly stress. Diabetes is not caused by eating too much sugar, being around people with diabetes (it’s not contagious).

What are some symptoms of diabetes?

Symptoms (can have no symptoms) – increased thirst and trips to the bathroom, blurry vision, extreme fatigue, rapid weight loss, fruity breath, poor wound healing, increased infections

Over 16 million Americans (write on board) have diabetes. Many of these people (estimated to be as high as ½) do not even know they have it.

More people are overweight now than at any other time in history, and so we are seeing more and more diabetes, even in children and teens. Johnson County has a more diabetes for its population than regional or state averages. That means that everyone here is at risk for getting diabetes.

5. Risk factors are things that increase a person’s chance of getting a disease. What are some risk factors for diabetes? (Write on board)

Family history

Racial background

Overweight or Obesity

Sedentary lifestyle

Stress

Age

6. So what’s the big deal? Why can’t you just take medicine and not worry about diabetes? Why do people always say it can be so bad?

Use overhead:

No cure

Long term complications –

kidney disease and failure

blindness

nerve damage (= foot amputation)

heart disease

poor wound healing

periodontal disease

Expensive to treat

Requires careful control – time and dedication

7. How do people with type 2 diabetes control the disease, since control is so important?

Remember to ask and wait for an answer if you had anyone initially that said they knew someone with diabetes. Prompt with questions like – “Do they ever prick their finger?” “

Do they take medicine – pill or shot,” “Do they go to the doctor more often,” “Do they try to watch what they eat”, etc.

Diet – What do they have to “watch”? (mainly carbs – “Where do we get carbs from?

Answer: starchy foods like bread, pasta, cereal, starchy vegetables like potatoes, corn, and peas, dried beans, fruit, milk, vegetables; also fat b/c of high risk for heart disease)

Exercise – helps the body use sugar in the blood to lower blood sugar

Medication – pills (help body use insulin it makes more effectively or makes body produce more insulin); insulin via injection or pump

Some people can just watch their diet and exercise regularly, but most people have to take some kind of medication. People with type 1 always have to take insulin, but those with type 2 diabetes can take insulin as well.

How do you know if your diabetes is in control?

Fingerstick blood sugar testing. This little test can be done virtually anywhere as long as the blood sugar meter is along. All you have to do is prick your finger (which actually doesn't hurt that much) and put a drop of blood on a strip. The machine reads how much sugar is in the drop of blood, and voila! You can see how your control is. Normal blood sugar is between 80-120 before meals.

- 8. So the big question is: How do you prevent diabetes? Do you think that type 2 diabetes can be prevented? Think back to what we said earlier about risk factors for diabetes. Which of these do you think you can do anything about? Or is it really worth trying to prevent diabetes at all?**

Yes it's worth trying to prevent – just look at the list of long term complications!!! It is expensive to treat, difficult to control, and incurable.

We do know for sure that making a few changes in your lifestyle – what you do everyday – can dramatically reduce your risk of getting type 2 diabetes.

(Write this on the board – exercise 3-5 times /week = ↓ risk of diabetes by 42%; weight loss from eating better and exercising = ↓ risk of diabetes by 58%) People who exercise 3-5 times a week can reduce their risk of getting diabetes by up to 42%. People who lose weight by eating fewer calories, making healthier food choices, and exercising regularly can reduce their risk by 58%. That means if you have 100 people that are going to get diabetes, 58 of them can prevent diabetes by losing weight through simple lifestyle changes. Isn't that exciting? *There are things you can do now to prevent chronic, incurable diseases when you are older!*

- 9. Now that we've talked a little about some things that you can do to prevent diabetes, what are some things that YOU might do to lower YOUR risk of diabetes?**

(Pass out Healthy Eating Pyramid and Daily Activity Pyramid)

We have some handouts that we are going to do as a class to help you think of changes you can make to lower your risk of diabetes. These will hopefully help you pinpoint some changes that you can make to decrease your risk of getting diabetes, since people living in Johnson County are at risk for diabetes.

The way this works is you read the questions on the left hand side of the page and circle the answer that best applies to you. After you have filled in all of the questions, then you go to the right side of the paper and follow the instructions to shade in the pyramid on the center of the page. There is a big pyramid on the back of each sheet to help you see how different foods and activities fit into your lifestyle.

(Have your pyramid filled out and use as a guide to go over with the students)

Let's talk about how your pyramids look. Does it shade in like a perfect pyramid? Or is it a little top-heavy? What were the parts that were most out of balance? Let students discuss the results of their "pyramid tests," and name some things that they could do to fix balance out the pyramids – add more exercise, not watch TV all evening since they sit all day at school, have a sandwich, fruit, and milk instead of chips and soda or fast food for an afternoon snack, try some new fruits or vegetables, add less fat to their food, etc.

Lead them on if they can't think of things, but don't give them all the answers.

Diet: *Eat foods from all of the food groups for a balanced diet*, like it says to on the food guide pyramid:

Decrease fat (use less butter or margarine, cheese sauce, gravy, eat less junk food)

Control Calories: eat more fruits and veggies; eat whole fruits instead of just drinking juice; try a veggie pizza instead of pepperoni; snack on low fat popcorn, cereal, yogurt, or fruits and veggies instead of chips, candy, sweets, or eating a whole box of mac and cheese or bologna sandwiches when you get home.

Try using 1% milk instead of whole milk.

Drink less soda and Kool-Aid, and don't drink more than 2 glasses of juice a day on a regular basis – drink water, tea (preferably unsweetened!), and milk.

Increase physical activity: play sports, at school or at home with friends; take the stairs; get an aerobics video (and do it!); walk at lunch (if they let you); hike with friends and family on the weekends or after school; participate in gym class; do sit-ups, pushups, jumping jacks, etc. while you watch TV.

Lose weight if you need to/ stay at a healthy weight: Don't fad diet – cut out foods that have lots of calories but little nutrition; increase your activity; expect to lose weight slowly.

Remember that even if you need to lose 30 pounds, it took time to gain that 30 pounds and it takes time to get it off. There is no magic cure or pill you can take, or a special diet that will melt away 30 pounds in a week. The best way to lose weight is to still eat plenty of food – follow the number of suggested servings on the pyramid, but to cut down on empty calories like fast food, junk food and unhealthy snack choices, and don't drink so much soda! ½ -1# a week doesn't sound like much, but it is!

10. Have any of you ever thought about drinking low-fat milk? We are going to provide you the opportunity to try some today. We are going to have a taste test, talk about the taste test to see which stuff you liked better, and then we will finish up with a little questionnaire. (Ask if anyone is allergic to any foods, since the taste test will contain milk and possible wheat, nut, or soy ingredients. If anyone is lactose intolerant, they may opt out of milk, but quantities will be small and should be OK!))

Instructions for quiz: We are going to pass out a quiz now. Please *do not write your name, the date, or anything at the top of the paper.* (This is very important!!!) This quiz is just like the one you took the other day, except that I want you to think of on little change you can do that we mentioned today, like drinking low fat milk, a better snack choice, playing outside more, etc. When you are done, raise you hand and one of use will collect it.

Taste test – first of all, it is very important that all of our trash gets in the garbage can, because if we leave a mess, than we won't be able to come back and give you guys snacks anymore! We are going to pass out the quiz because we need you to circle answers on the back for which foods you liked best. You can work on your quiz, if you like, if you finish the taste test before everyone.

Guide them through the taste test – which milk tastes like the one they usually drink? Which so they prefer? Which soda do they prefer? How are the snack bags? After everyone has finished their samples, reveal the identity of each. Who was surprised at which sample they liked best?

11. Collect tests, make sure all trash gets in garbage, and thank the students for their participation.

If time permits, review material with students. **After collecting the quiz,** you may go over the correct answers with them.

Other questions:

What are some symptoms of diabetes? (see page 2)

What part of their diet does someone with diabetes really have to watch? (carbs)

How do you know if diabetes is controlled? (fingerstick blood sugar testing at home)

Can anyone explain to me what diabetes is?

Can diabetes be prevented? (yes!!!)

Let's name some easy things each of you can do to reduce your risk of getting diabetes – (take multiple answers)

What new things did you learn today?

Who thinks they might try making one or two changes to help prevent diabetes?

APPENDIX D
Statistical Analysis

Chi square analysis of questions 1 and 2.

		Observed		Expected		X ²	p Value; $\alpha = 0.050$
Q#1	correct	not heard	heard	total	not heard	heard	total
		346	323	669	349.6	319.4	669
	incorrect	14	6	20	10.4	9.6	20
	total	360	329	689	360	329	689
							2.60
							p > 0.100
							Fail to reject Ho
Q#1	correct	not heard	retention	total	not heard	retention	total
		346	324	670	344.6	325.4	670
	incorrect	14	16	30	15.4	14.6	30
	total	360	340	700	360	340	700
							0.28
							p > 0.100
							Fail to reject Ho
Q#1	correct	heard	retention	total	heard	retention	total
		323	324	647	318.2	328.8	647
	incorrect	6	16	22	10.8	11.2	22
	total	329	340	669	329	340	669
							4.37
							0.050 > p > 0.025
							Reject Ho
Q#2	correct	not heard	heard	total	not heard	heard	total
		332	324	656	341.9	314.1	656
	incorrect	25	4	29	15.1	13.9	29
	total	357	328	685	357	328	685
							14.10
							p < 0.001
							Reject Ho
Q#2	correct	not heard	retention	total	not heard	retention	total
		332	332	664	341.1	322.9	664
	incorrect	25	6	31	15.9	15.1	31
	total	357	338	695	357	338	695
							11.13
							p < 0.001
							Reject Ho
Q#2	correct	heard	retention	total	heard	retention	total
		324	332	656	323.1	332.9	656
	incorrect	4	6	10	4.9	5.1	10
	total	328	338	666	328	338	666
							0.35
							p > 0.100
							Fail to reject Ho

Chi square analysis of questions 3 and 4.

Observed			Expected			X ²	p Value; $\alpha = 0.050$
Q#3	not heard	heard	Q#3	not heard	heard		
correct	256	315	correct	297.2	273.8	5.71	72.05 p < 0.001 Reject Ho
incorrect	100	13	incorrect	58.8	54.2	28.84	
total	356	328	total	356	328	31.31	
Q#3	not heard	retention	Q#3	not heard	retention	3.47	37.16 p < 0.001 Reject Ho
correct	256	303	correct	287.6	271.4	3.67	
incorrect	100	33	incorrect	68.4	64.6	14.57	
total	356	336	total	356	336	15.44	
Q#3	heard	retention	Q#3	heard	retention	0.31	8.83 0.010 > p > 0.001 Reject Ho
correct	315	303	correct	305.3	312.7	0.30	
incorrect	13	33	incorrect	22.7	23.3	4.16	
total	328	336	total	328	336	4.06	
Q#4	not heard	heard	Q#4	not heard	heard	10.94	110.71 p < 0.001 Reject Ho
correct	227	316	correct	282.6	260.4	11.88	
incorrect	129	12	incorrect	73.4	67.6	42.15	
total	356	328	total	356	328	45.74	
Q#4	not heard	retention	Q#4	not heard	retention	7.96	70.94 p < 0.001 Reject Ho
correct	227	305	correct	273.7	258.3	8.44	
incorrect	129	31	incorrect	82.3	77.7	26.48	
total	356	336	total	356	336	28.06	
Q#4	heard	retention	Q#4	heard	retention	0.28	8.50 0.010 > p > 0.001 Reject Ho
correct	316	305	correct	306.8	314.2	0.27	
incorrect	12	31	incorrect	21.2	21.8	4.02	
total	328	336	total	328	336	3.92	

