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Abstract

The purpose of this study was to implement a program designed to promote diabetes prevention activities among preadolescents in a rural southern setting using a day camp intervention. Participants in the study were eleven youth from a rural Alabama county who participated in a week-long half-day camp administered by local and community volunteers. Change scores were used to compare pre- to post- to follow-up measures for camp participant responses. Program results consistently demonstrated that the day camp was theoretically sound and that program activities positively impacted behavioral antecedents. This study demonstrated the feasibility of conducting a diabetes prevention day camp in a rural environment. Insights from this intervention can assist planners in rural environments to tailor similar initiatives in rural settings. Given the complicated nature of behavior change, a day camp approach of this length does not modify the behaviors of participants. Behavior changes may take considerably longer to initiate.

Keywords

Alabama; Behavior modification; Non-insulin-dependent diabetes – Prevention; Preadolescents; Prevention; Rural; Rural children; Type 2 diabetes

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The purpose of this study was to implement a program designed to promote diabetes prevention activities among preadolescents in a rural southern setting using a day camp intervention. Participants in the study were eleven youth from a rural Alabama county who participated in a week-long half-day camp administered by local and community volunteers. Change scores were used to compare pre- to post- to follow-up measures for camp participant responses. Program results consistently demonstrated that the day camp was theoretically sound and that program activities positively impacted behavioral antecedents. This study demonstrated the feasibility of conducting a diabetes prevention day camp in a rural environment. Insights from this intervention can assist planners in rural environments to tailor similar initiatives in rural settings. Given the complicated nature of behavior change, a day camp approach of this length does not modify the behaviors of participants. Behavior changes may take considerably longer to initiate.

Keywords: type 2 diabetes, prevention, rural, preadolescents

INTRODUCTION

Recent media reports have highlighted a trend in the number of America's youth being diagnosed with diabetes. The majority of these diagnosed cases are individuals with type 2 diabetes. Diabetes mellitus has various forms; the causes and diagnosis of these forms are quite different from each other. Diabetes develops when the body does not produce, cannot secrete, or effectively use its insulin, a hormone secreted by the pancreas. Insulin is required to metabolize carbohydrates, proteins, and fats needed to perform normal cell energy functions. If too much glucose is in the bloodstream, insulin is released to guide glucose into cells. Insufficient insulin results in higher than normal blood glucose levels (Holcomb, et al., 1998). Type 2 diabetes has typically been diagnosed in individuals 40 and older; youth diagnosed with type 2 diabetes typically demonstrate similar risk

profiles. They are overweight, have higher levels of blood pressure, exhibit Acanthosis nigricans, are hyperglycemic, and have a family history of the disease (Braithwaite & Taylor, 2001). Diagnosis of type 2 diabetes is now presenting as early as 10 years of age in some cases (Rowell, Evans, Quarry-Horn, & Kerrigan, 2002). Rates of diabetes in children and adolescents are showing consistent increases across the country (Fagot-Campagna, et al., 2000; Rowell, Evans, Quarry-Horn, & Kerrigan, 2002).

The number of youth with type 2 diabetes that have a first-degree familial history of diabetes ranges from 45% to 80% (Trissler, 1999). Dietary habits and sedentary lifestyle also place adolescents at greater risk for type 2 diabetes. Upon diagnosis of type 2 diabetes, the typical course of treatment for youth is diet and physical activity modifications with a possible need for oral medication (Braithwaite & Taylor, 2001).

The purpose of this pilot study was to implement a community program designed to promote diabetes prevention activities among preadolescents in a rural southern setting. Evaluation of the program was conducted to confirm whether student scores showed positive changes on behavioral antecedent measures. A secondary function of the program was to examine the feasibility of a day camp approach in this rural setting.

Review of Literature

Theoretical Application in Prevention Efforts

Theories are an integral part in program development; they can be used to plan, implement, or evaluate a program. They help to examine a behavior and determine why an undesirable behavior exists and how one can potentially change it. Theories that have been used in prevention programs include the Social Cognitive Theory, the Health Belief Model, and the Socioecological Model. An ecological perspective on health looks at all the systems that impact health behaviors: intrapersonal factors, interpersonal factors, institutional factors, community factors, and public policy. The Social Cognitive Theory, also known as the Social Learning Theory, looks at the interaction between a person's behavior, environment, and beliefs that affect future behavior. Concepts or constructs associated with this theory are behavioral capability, expectancies, reciprocal determinism, emotional coping responses, self-efficacy, reinforcement, and observational learning. The Health Belief Model looks at perceptions regarding health. The constructs of this theory are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. A person's outlook, whether positive or negative, will have an impact on performance of a health promoting behavior (Glanz, Lewis, & Rimer, 2002). The use of some of these theories is evident in obesity prevention and cardiovascular prevention programs that address the same risk factors that are present for diabetes.

CATCH was an intervention designed to test the effectiveness of a school-based program to reduce cardiovascular risk factors in elementary school children. Constructs from the Social Cognitive Theory served as the foundation for intervention activities. The third through fifth grade curriculum used stories, skill-building activities, and role modeling around dietary and physical activity awareness. In addition, the fifth grade tobacco curriculum discussed facts, negative consequences, influences, and the benefit of not using tobacco. Findings from the evaluation showed a reduction among the intervention group in saturated fat and cholesterol. Other positive results showed improved knowledge and self-efficacy scores as well as higher measures on selected food intention measures and perceived social reinforcement for healthy food choices. Perceived support and self-efficacy measures examining physical activity was inconsistent and was shown

to have sporadic effects. Program results were still present at time of follow-up three years after completion of the program (Perry et al., 1997; Nader et al., 1999; Edmundson et al., 1996).

Another program targeting youth that had a strong theoretical background was Planet Health. This program was a 16-lesson, population-based obesity intervention targeting 1,295 middle school students. Change theories served as the theoretical framework for this study. The four behavioral changes that the program focused on were reduction in television viewing and consumption of high-fat foods as well as increased physical activity and consumption of fruits and vegetables. Planet Health included a classroom curriculum and physical education component that was designed to provide cognitive and behavioral skills, strengthen perceived competence, and support behaviors. A reduction in obesity was seen over a 2-year period in the intervention group in girls; obesity rates increased in the control group (Gortmaker et al., 1999b).

Eat Well and Keep Moving was a school-based, longitudinal, diet and physical activity intervention program. Integrated into the regular school curriculum, this 13-lesson program targeted students in grades four and five. The theoretical framework for this program was the Social Cognitive Theory and behavioral choice theories. The curriculum was designed to enhance behavior and cognitive skills, strengthen perceived competence, increase knowledge, and influence positive substitute behaviors. Behavioral changes that this intervention focused on were decreasing consumption of high fat foods and television viewing and increasing fruit and vegetable intake and physical activity. Students at the intervention schools reduced their percentage of total energy from fat. An increased knowledge of diet and healthy activities was also found in these same students (Gortmaker et al., 1999a).

Go Girls! was a nutrition and physical activity intervention designed for inner-city, low income, overweight African American adolescent females. The theoretical framework for this program was the Social Cognitive Theory as well. Go Girls! was designed to increase efficacy and outcome expectations for losing weight, eating healthier, and decreasing sedentary lifestyle. The goals of this after-school program were to increase fruit and vegetable intake and physical activity and decrease fast-food intake and television viewing. Each session was composed of a behavioral activity, physical activity, and preparation and tasting of low-fat recipes (Resnicow et al., 1999). High attendees had significantly higher nutrition scores on behavioral assessments than low attendees. High attendees were significantly more likely to perceive dietary changes at completion of the program. They also reported lower total kilocalories and lower percentage of energy from fat compared to the low attendees. High attendees showed a small decrease in body fat and an increase in HDL, whereas low attendees had reverse results (Resnicow et al., 2000).

Dance for Health was designed for low-income, African American and Hispanic adolescents to increase physical activity. This 12-week, school-based intervention focused on the intrapersonal aspects of the Socioecological model. Dance for Health's purpose was to determine if it would have an effect on aerobic capacity, weight maintenance, and attitudes toward physical activity and fitness. Aerobic dance activities were held three times a week and a culturally specific health education component was incorporated in the classroom for 30 minutes. Health education lessons focused on nutrition, exercise, obesity and unhealthy weight regulation practices, smoking prevention, substance abuse, stress management, and peer pressure. A significant decrease was found in BMI, heart rate, and timed mile run. In addition, attitudes became more favorable towards physical activity for females than males (Flores, 1995).

GEMS was a pilot study focusing on prevention of excess weight gain and obesity in pre-adolescent African American females. The theoretical framework for this program was the Social Cognitive Theory. This 12-week, after-school study was composed of three groups: a child-

targeted intervention focusing on nutrition and physical activity, a parent-targeted intervention focusing on nutrition and physical activity, and a comparison group focusing on self-esteem. The objectives for the nutrition component of the study were to choose a nutritionally balanced eating plan, increase water consumption, reduce sweetened beverage intake, promote nutrition-related healthy behaviors, and recognize health-compromising behaviors. Objectives for the physical activity component were to increase frequency of physical activity, decrease frequency of sedentary behaviors, and promote self-efficacy in physical activities. Results indicated that the two active intervention groups demonstrated an increase in minutes of moderate to vigorous physical activity, a decrease in servings of sweetened beverages, and an increase in servings of water (Beech et al., 2003).

One theory that has yet to be tried in obesity, cardiovascular, or diabetes prevention programs is the Possible Selves Theory. The Possible Selves Theory (Markus & Nurius, 1986) hypothesizes that there is a link between cognition and motivation. There are three constructs in this theory: ideas of what individuals might become, what individuals would like to become, and what individuals are afraid of becoming. The motivation is derived from cognitive processes and these processes involve hopes, fears, goals, and threats which are the motivational considerations in program planning. Possible selves are the result of past experiences and positive and negative images presented (Oyserman, Gant, & Ager, 1995). This theory has been used in the development of adolescent pregnancy prevention programs and antismoking campaigns (Nagy, 2002; Freeman, Hennessy, & Marzullo, 2001).

Burnet, Plaut, Courtney, and Chin (2002) suggested using an approach that combines constructs from several traditional health theories. Program components that they suggested for diabetes prevention programs included components on knowledge, risk awareness, self-efficacy, role models, parental involvement, community partnership, and reward/reinforcement. Several diabetes prevention programs have incorporated these targets in their programs.

Review of Diabetes Prevention Programs

Several type 2 diabetes programs have taken place in the southwest portion of the United States and have focused on the Hispanic population. McKenzie and colleagues (McKenzie, O'Connell, Smith, & Ottinger, 1998) developed an educational intervention program for Hispanic American children at risk for developing type 2 diabetes. This eight week education program also had a screening and parental component. Classes were held each Saturday morning and thirty-seven students between 7-12 years of age participated in the program (n=37). The program was evaluated based on attendance (transportation was provided), analysis of risk factors, homework completion, knowledge of diabetes and nutrition, and post-program evaluation by the parents. Over half of the participants were present during all the sessions. Parents reported learning more from this program than for programs designed for adults. Changes in diet for both parent and child resulted from this program. Additional changes included increased knowledge about the Food Guide Pyramid (Center for Nutrition Policy and Promotion, 2004), reading food labels, and fat content in food.

Another diabetes prevention program was the Bienestar Health Program. Fourth grade Hispanic American children in poor school districts in Texas were the target population for this program (n=102). The main goal of this school-based prevention program was to decrease body fat and/or decrease dietary fat intake in children. Additional goals were increasing vegetable and fruit intake, improving health knowledge, self-efficacy, self-esteem, and increasing physical activity. The program had four components: a 28-lesson classroom intervention, a parental component that

included individual dietetic consultations, school cafeteria training, and after-school care. A review of the findings showed a decrease in dietary fat intake, an increase in fruit and vegetable intake and an increase in diabetes health knowledge (Trevino, et al., 1998). Although the program did not decrease percentage of body fat and increase levels of physical activity in the participants, Bienestar was beneficial in providing diabetes prevention education and improving health habits in an at-risk group of youth in the Southwest.

One published study described a diabetes prevention program that targeted at-risk northern inner city youth (Grey, et al., 2004). Two New Haven, Connecticut middle schools with high rates of obesity (at least 40% of the children were obese) were chosen and randomized as a control or experimental school. This 16-week afterschool program involved 41 participants with a designated family member and introduced nutrition education and physical activity as well as coping skills training. Program measures consisted of clinical assessments at baseline and 12 months, and psychosocial assessments at baseline, 3 months, 9 months, and 12 months. Results found that health behavior outcomes, usual food choices and dietary knowledge improved in the experimental group. The control group improved activity self-efficacy. Parents and grandparents in the experimental group improved overall health behaviors as well (Grey, et al., 2004).

Description of the Community

The Southern Black Belt Region of the United States is composed of 11 states extending from Texas to Virginia (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia). Black Belt communities are typically rural, economically depressed, have small populations, and have higher percentages of minorities, particularly African Americans (Davis, 2000). Data shows that the Southern Black Belt's poverty rate is 14.06%; the national poverty rate is 12.38%. Additionally, the Census reports nearly one in five rural residents live in poverty and over one-third of that population living in poverty are youth (University of Georgia Initiative on Poverty and the Economy, 2009).

Rural communities face barriers that can contribute to poor health outcomes. These include income, family and social support, few food stores, limited access to healthy food in stores as well as cost of food, cultural norms, transportation issues, physical infrastructure (e.g., sidewalks, parks, street lights), and education (Atkinson, Billing, Desmond, Gold, & Tournas-Hardt, 2007; Probst, Moore, & Baxley, 2005). Other services that appear to be limited in rural areas include substance abuse treatment for children and teens, afterschool programs, tutoring programs, mentoring programs, and enrichment programs (Belanger & Stone, 2008). Montgomery and colleagues (1996) reported a link with poverty and child health after reviewing national data over a 14-year period. Children living in households considered 'poor' were more likely to be in ill health compared to those living in households with higher incomes. Other studies report that rural areas have high rates of physical inactivity among men, self-reported obesity among women, high rates of adolescent smoking, and live at greater distances from health services (Glasser, et al, 2003).

Description of Selected Black Belt Community

Twenty-one rural counties in Alabama are located in the Black Belt region. According to the U.S. Census Bureau, the 2001 population estimate for the county in this study was 20,901. The two main racial groups in the county consist of Caucasians (55.9%) and African Americans (43%), while Hispanics are a growing segment of the population. Within the residential population of those who are 18 years of age and younger, approximately 50% (2,701) of the population was in elementary

school (Grade K through Grade 8) and 26% (1,398) were in high school (Grade 9 through Grade 12). The 2000 median household income was $26,254. Grandparents served as caregivers for over half of the population (59%). In addition, 1999 data reported 24.9% of the individuals in the county were below the national poverty level (U.S. Census Bureau, 2004).

METHODS

Subjects

A university and community partnership promoting health and wellness programs for county schools conducted an assessment of the health status of adolescents in the region (N=190). The assessment identified diabetes as a priority area with 30% of the students having a first-degree family history of type 2 diabetes. This was no surprise since adult rates of diabetes were also unusually high. Subsequently, the community partnership, county elders, and local health officials worked with university faculty and graduate students to plan a program to address diabetes prevention.

Participants in the Type 2 Diabetes Prevention Day Camp were sixth grade students who participated in a diabetes risk survey in March 2004. The survey focused on risk factors of type 2 diabetes: demographics, smoking, body image, television viewing patterns, diet, physical activity, and after school behaviors. Two additional items were recorded when the student turned in their completed survey, height and weight. Two weeks before the students were to take part in the survey, a seven-item parent questionnaire along with informed consent materials were sent to parents. The parent instrument asked about family history of diabetes, parent weight status, perception of child's weight, parent physical activity, and diet.

BMI (body mass index) classifications for this study were made using the recommendations that calculation for children include weight, height, age, and gender (Centers for Disease Control and Prevention, 2003). Individuals who had a BMI category of at risk for overweight or overweight coupled with a first-degree family member with a history of type 2 diabetes were the primary recruits of the program (n=33). There were 25 slots available for the summer camp due to space limitations. Parents of children who met eligibility criteria were invited to register their child for the program; 11 families enrolled their child. Participants were 11 and 12 years of age; 10 were African American and one was Caucasian; four were male and seven were female. There was reasonable parental involvement in the day camp; six of the camp participants' mothers attended the parent session.

Community Resources

The type 2 diabetes prevention program was a community effort between the county diabetes prevention partnership, the local school system, local health department, community based organizations, health and medical professionals in the community, and the university. Funding for the program was provided by grants awarded from the Appalachian Diabetes Control and Translation Project, the Rural Alabama Health Alliance (RAHA), Eta Sigma Gamma National Professional Health Education Honorary, The University of Alabama Graduate Student Association, and donations from the community.

Camp Setting

The day camp was held at the county fitness center located on the grounds of the county medical center. The facility was chosen because it was centrally located between the northern and southern

parts of the county. Participants in the camp were allowed to use the facility free of charge during the program.

Camp activities were conducted in the morning hours for one week in late June. One parent session was offered on the fourth day of the day camp in the morning while a second session was held that afternoon. During their two-hour session, parents received the same workbook as their child and their information session was based on components from the student curriculum. The staff for the day camp included members of the diabetes partnership and graduate students from the University of Alabama. Supplies for the camp were donated by area grocery stores, the health department, a local community based organization, the university, and the diabetes partnership. In addition, a church in the southern part of the county provided free transportation to participants from that area.

Tailoring the Curriculum

The curriculum used for the day camp was based on Jump Into Action, a type 2 diabetes prevention curriculum designed for Hispanic children in a school setting (Holcomb, et al., 1999). Over 2,800 fifth grade students and 86 teachers in 31 elementary schools in urban and rural areas of Texas used the curriculum. Curricular materials include a student workbook, teacher's manual, and survey. The workbook discussed definitions, types, causes, risks, complications, incidence, facts, myths, and prevention of type 2 diabetes (Holcomb, et. al., 1998). The research design for the Jump Into Action program was a pretest, immediate posttest, and four week follow-up posttest design. Five major scales were analyzed: knowledge, self-efficacy, dietary behaviors, eating high-fat dairy foods, and exercise behaviors. Significant effects following posttest were found for diabetes cause knowledge, diabetes biology knowledge, exercise regimen knowledge, food fat content knowledge, dietary self-efficacy, exercise self-efficacy, frequency of eating healthy foods, and frequency of exercise related behavior changes ($p = .000$). Positive effects from posttest to follow-up were identified and showed changes in measures examining the causes of diabetes, exercise self-efficacy, and diet self-efficacy ($p = .000$, $p = .000$, $p = .001$ respectfully) (Holcomb, et al., 1998).

The author was contacted and he allowed us to use the curricular materials. The materials were modified to accommodate African American and Caucasian children participating in a day camp setting. Whereas each lesson in the school-based curriculum had only one specific daily content area with associated activities, the design for the day camp addressed three content areas (diabetes knowledge, nutritional changes, and physical activity) on a daily basis. Activities for the camp were chosen based on time restrictions, availability of supplies, and activities that were compatible with the theoretical constructs selected for the current program.

The conceptual configuration for this study incorporated constructs from several theories. Although the Jump Into Action curriculum relied heavily on constructs from the Social Cognitive Theory, constructs from the Health Belief Model and the Possible Selves Theory were also applied to this program. It was proposed that self-efficacy, behavioral capability, perceived susceptibility, perceived severity, goal setting, and fear impact an individual's physical activity, nutritional practices and diabetes knowledge, ultimately determining diabetes risk.

Program activities were conceptually linked to constructs of interest to help validate activity selection. In this manner, all of the major activities were justified from a theoretical perspective. For example, the lesson that discussed the complications of diabetes was linked to a construct from the Health Belief Model (perceived severity). Similarly, an instructional activity on taste testing of new foods was tied to the construct from Possible Selves (fear).

Instrumentation

Active parental permission was required for students to participate in the camp and to respond to evaluation tools. All evaluation materials were approved by the University Institutional Review Board.

The impact evaluation examined changes in knowledge and attitudes for diabetes, nutrition, and physical activity. The study utilized a one group pre-test, post-test, four-week follow-up design. A 32-item survey was administered during the first day of the program. Students were administered a post-survey on the last day of the program. This survey included the original items from the pretest and three additional questions that addressed intentions. Four weeks later, participants were asked to complete a follow-up survey that included the original 32 items and seven new items.

Eight items focused on knowledge of diabetes. Each correct response was scored 1, incorrect responses were scored a 0; responses were summed to produce a diabetes knowledge score. Three questions assessed nutrition knowledge with possible scores on the measure ranging from 0 to 3. Four items assessed knowledge of physical activity; scores on this measure ranged from 0 to 4. Change scores were used to assess program impact where negative scores indicated improvement and positive scores indicated losses. The post survey and the follow-up survey included two items that asked about intentions to use the skills learned in the camp. These two items were coded as dichotomous choices and summed; scores could be either 2 or 4 where a score of 4 denoted high intentions to use skills learned in the day camp and a score of 2 indicating that they did not intend to use the skills. A final question on the surveys inquired about the child's involvement in physical activity. Scores on this item ranged from 1 to 3 with higher scores indicating greater involvement in physical activity.

RESULTS

Quantitative measures were analyzed using SPSS 12.0.1. Descriptive statistics were conducted on camp participant and parent measures. Change scores were calculated comparing pre to post to follow-up measures for camp participant measures. Due to the small sample size it was not appropriate to conduct extensive statistical analysis.

Knowledge of Diabetes

Change scores from pre to post assessment indicated that eight participants had gains on diabetes knowledge; two had no change, and one a loss. Gains on this measure ranged from 1 to 5. Change scores from post to four week follow-up showed that one camp participant had gains, one had no change, and nine had losses. Results suggest that participants increased their diabetes knowledge from the first day to the fifth day of the camp, and that there were losses on this measure between the end of camp and the four-week follow-up. Further examination of the data showed that although more than 25% of the participants returned to baseline levels nearly half (45%) did show retention on knowledge indicators. This information is presented in Table 1.

Knowledge of Nutrition

Change scores from the pre to post assessment identified that five participants had gains on nutrition knowledge, five had no change, and one had a loss. Change scores from post to follow-up showed that two participants had gains, seven had no change, and two had losses. Closer examination of baseline scores showed that participants knew a lot about nutrition; three had the highest possible score and three could only improve by one point on the scale. The remaining four generally showed improvement. Although the results indicate that there were small changes

on nutrition knowledge scores from post-survey to follow-up survey, there was little room for improvement for the majority of children and is indicative of a ceiling effect. This information is presented in Table 2.

Table 1. Change Scores on Diabetes Knowledge*

Participant	Pre Score	Pre to Post Change	Post to Follow-up Change
1	3	-5	+1
2	6	0	0
3	2	-4	+2
4	6	+1	+1
5	3	-4	+2
6	5	-1	+1
7	3	-4	+1
8	6	0	+2
9	4	-2	-2
10	1	-5	+5
11	4	-1	+1

*Negative scores indicate gains. Positive scores indicate losses.

Table 2. Change Scores on Nutrition Knowledge *

Participant	Pre-Score	Pre to Post Change	Post to Follow-up Change
1	1	-2	0
2	2	-1	0
3	2	0	-1
4	1	-2	0
5	1	0	-1
6	3	0	0
7	3	+1	0
8	2	0	0
9	3	0	0
10	0	-3	+1
11	2	-1	+1

*Negative scores indicate gain. Positive scores indicate losses.

Knowledge of Physical Activity

Change scores from pre to post indicated that seven participants had gains on physical activity knowledge, three had no change, and one had a loss. Change scores from post to follow-up revealed that three had gains, three showed no change, and five had losses on physical activity knowledge. Although these findings suggest that from the post to follow-up that half of the students showed some knowledge loss, losses were not substantial and generally were no more than one point.

Overall, more than half of the participants had gains on physical activity knowledge by follow-up and only three participants had returned to their original low score. Table 3 presents this information.

Table 3. Change Scores on Physical Activity Knowledge *

Participant	Pre-Score	Pre to Post Change	Post to Follow-up Change
1	4	0	+1
2	2	0	-1
3	2	-1	+1
4	1	-1	-2
5	3	0	0
6	2	-1	+1
7	2	-1	0
8	3	-1	+1
9	3	-1	0
10	1	-1	+1
11	3	+1	-2

*Negative scores indicate gain. Positive scores indicate losses.

Future Intentions

Future intentions about using the skills learned in the camp were only asked on the post-survey and the follow-up survey. Examination of responses on the post-test showed that nine out of eleven of the camp participants had scores of 4; at follow-up that number increased to ten of the eleven participants. These data indicate that participants intended to employ skills they learned in the day camp. Table 4 presents this information.

Table 4. Change Scores on Intentions*

Participant	Intention Post Survey	Intentions Follow-up Survey	Intentions Change
1	4	4	0
2	4	4	0
3	4	4	0
4	4	4	0
5	2	4	-2
6	4	4	0
7	4	4	0
8	4	4	0
9	4	4	0
10	4	2	+2
11	2	4	-2

*Negative scores indicate gain. Positive scores indicate losses.

Physical Activity Behavior

A review of responses from the pre-survey to the post-survey found that three participants showed gains on physical activity, six showed no change, and two showed losses. Further examination of responses from the post-survey to the follow-up survey indicated that three camp participants showed gains on physical activity scores, six showed no change, and two had losses. These findings suggest that the program had no effect on physical activity behaviors. Table 5 presents this information.

Table 5. Change Scores on Physical Activity Behaviors*

Participant	Pre-Score	Pre to Post Change	Post to Follow-up Change
1	2	-1	0
2	3	0	+1
3	2	0	0
4	2	0	0
5	2	-1	0
6	3	+1	-1
7	2	0	-1
8	3	+1	-1
9	2	0	0
10	2	0	0
11	2	-1	2

*Negative scores indicate gain. Positive scores indicate losses.

DISCUSSION

The majority of the camp participants showed improvements on diabetes knowledge scores; however, there was a loss in the scores by follow-up. This deterioration in scores may be expected since this was probably the first time the participants were exposed to this specific type of information. A review of the nutrition knowledge scores showed that nutrition knowledge was retained through follow-up. This retention is likely due to the reinforcing nature of the nutrition information that was presented since much of this information had been taught during the school year. Physical activity scores showed a slightly different profile. Over half of the participants had gains on knowledge by follow-up. However, nearly half of the participants scored near or at the maximum score on this scale at pre-survey indicating that preexisting knowledge levels were high.

The study also examined participants' intentions to use the skills learned in the program. Participants had high intentions to use the program skills they learned at the camp in their daily lives. A review of the scores on intentions showed that participants had intentions to change their behaviors at the end of camp and at follow-up. However, there was no program effect on program participants' immediate practices addressing physical activity.

It appears that knowledge gains on the measures used were reinforcing general information on nutrition and physical education indicating a ceiling effect for those two topics. Knowledge measures in this study examined diabetes terminology, diabetes complications and seriousness, food content, and physical activity benefits. The gains on diabetes knowledge were somewhat different, it appears that this information was new to students so scores diminished by follow-up since there were no reinforcing activities during that time period.

Since intention to change is a prerequisite for actual behavioral change, one could conclude that the program effectively encouraged students to move from a state of pre-contemplation to a stage of contemplation with regard to modifying behaviors that would reduce their diabetes risk. This does not mean actual behavior change; intention is a person's readiness to perform a given behavior, and it is considered to be the immediate antecedent of behavior in a number of theoretical models (Glanz, Lewis, & Rimer, 2002).

CONCLUSION

Success has been seen in both school-based and after school programs (Grey, et al., 2004; McKenzie, O'Connell, Smith, & Ottinger, 1998; Trevino, et al., 1998). Programs that seem to work best have interactive nutrition education and physical activity components. McKenzie has recommended that diabetes prevention programs have three main foci: diabetes education, nutrition education, and exercise education (McKenzie, O'Connell, Smith, & Ottinger, 1998). Few published programs have focused on diabetes primary prevention in youth in the rural South. Rural communities have limited access or resources to provide prevention programs.

Three key limitations may have influenced this study: the curriculum, instrumentation, and the sample size. One must recognize that the curriculum used in this study was originally designed for use with a Hispanic population and it has not been tested with any other ethnic groups but use with other groups is plausible based on evidence from this program. Furthermore, the curriculum was initially used in a school setting with a longer dosage time and a substantially larger population. This concentrated effort may not have allowed students to reflect on the program content sufficiently. The camp was held on the grounds of the local fitness center housed in the county medical center. The camp staff had to schedule camp sessions around activities that traditionally took place in the fitness center as well as accommodate paying members. The opportunity to provide a larger dosage to intervention participants was not an option; community leaders expressed concerns about offering a program longer than a half-day. As such, the program worked within these limitations and provided daily educational sessions and activities that focused on diabetes, nutrition, and physical activity.

A second limitation was the instrumentation utilized in the study. The methodology did not employ methods to measure responses related to social desirability or testing effects (van de Mortel, 2008). It is possible that participants were responding in a manner to please the program interventionists or did not want the truth to be known. Another key limitation was the sample size; it was extremely small. Reasons for the lack of participants may be attributed to the novelty of the program, conflict with travel, other established summer camps, and the lack of interest. It is important to note that the maximum number of participants allowed for the program was 25 due to facility arrangements. Other studies have had success with limited participation however (Grey, et al., 2004; McKenzie, O'Connell, Smith, & Ottinger, 1998; Trevino, et al., 1998).

Programs that seem to work best have interactive nutrition education and physical activity components. This study included all those components. Success has been seen in inner city programs focusing on African American youth (Gortmaker et al., 1999a; Resnicow et al., 1999; Resnicow et al., 2000; Flores, 1995). Few published programs have focused on diabetes primary prevention in youth in the rural South, particularly African American youth. Rural communities have limited access or resources to provide prevention programs. This program was a novel idea and it met some of the needs lacking in rural areas (e.g., enrichment programs, access to healthy snacks, physical activity options).

The development of effective interventions involves planning steps that begin with pilot studies and advance to the level of clinical trials. This program was an initial step in determining the feasibility of conducting a diabetes prevention program in a rural setting with preadolescents and their families. Common measures used in all types of prevention programs have generally included assessment of knowledge, attitudes, and behaviors (Green & Kreuter, 1999; Windsor, Baranowski, Clark, & Cutter, 1994). The current study attempted to build on these established practices. Meeting the challenges of a rural setting (limited availability of resources, transportation, cultural norms, etc.) and trying to provide the necessary components of an education intervention is labor intensive and requires community commitment. Without the support of the individuals living in the community, participation from community organizations as well as the school system, and the researcher being responsive to the community needs and concerns, the program would not have been feasible. To date, the program has been implemented twice by one of the local community based organizations.

The long-term effects of diabetes dictate the need for primary prevention programs. The years of potential life lost are greater in youth due to prolonged years of morbidity and disability as a result of diabetes. Complications of diabetes include heart disease, stroke, blindness, kidney disease, retinopathy, hypertension, amputation, and neuropathy (Nesmith, 2001). The American Diabetes Association recommends screening youth for type 2 diabetes when they are at the 85th BMI percentile or above (at risk of overweight) and have any two of the following risk factors: family history of type 2 diabetes in first- or second-degree relatives, minority race/ethnicity, and signs of insulin resistance (Libman & Arslanian, 2003). Primary prevention programs should focus on at risk individuals and address the factors that put them at risk for developing type 2 diabetes. Given the long-term nature of actually modifying rates of diabetes in this population, it is important to identify programs that can effectively address modifiable risk factors.

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