Objectives and instructions for completing the evaluation and statements of disclosure can be found on page 130.

Correlates among Perceived Risk for Type 2 Diabetes Mellitus, Physical Activity, And Dietary Intake in Adolescents

Natalie Fischetti

In the last two decades, the number of new cases of type 2 diabetes mellitus (T2DM) among U.S. adolescents has increased (Fagot-Campagna et al., 2000; SEARCH Study Group, 2006), which may be related to the lack of health-promoting behaviors, such as a balanced diet and adequate physical exercise. This descriptive correlational study examined the relationship between perceived risk for T2DM, dietary intake, and physical activity in adolescents (N = 80) 13 to 18 years of age. The Children's Health Belief Model (Bush & Iannotti, 1990) was the conceptual framework used for testing the theoretical relationships. Participants completed the following instruments: 1) Knowledge of Risk Factors for T2DM, 2) Health Beliefs for T2DM, 3) Godin-Shepard Leisure-Time Exercise Questionnaire (Godin & Shepard, 1997), and 4) the Demographic/Medical Questionnaire. Significant relationships were found between perceived risk, a subset of the Health Beliefs for T2DM scale, and the health promoting behaviors of dietary intake and physical activity. Implications for health-promoting nursing practice related to adolescent perception of risk and health-promoting behaviors of dietary intake and physical activity are addressed.

Diabetes mellitus is one of the most common chronic diseases among children and adolescents in the United States (Centers for Disease Control and Prevention [CDC], 2011). Approximately 215,000 young people under 20 years of age (0.26% of the under-20 population) are diagnosed with type 1 and type 2 diabetes mellitus (T2DM) (CDC, 2011). There has been a notable increase in the number of new cases of T2DM among U.S. children and adolescents in the last two decades (CDC, 2011; SEARCH Study Group, 2006).

In a 2002-2005 epidemiological review of U.S. pediatric T2DM in a population of approximately 3.5 million, investigators identified 3,600 children and adolescents with T2DM annually (CDC, 2011; SEARCH Study Group, 2006). Among individuals 10 to 19 years of age, there were 18.6 cases of T2DM per 100,000 (CDC, 2011; SEARCH Study Group, 2006). This results in 0.26% of the under-20-year-old population, whereas 11.3% of all individual over the age of 20 are estimated to have diabetes (American Diabetes Association [ADA], 2012). These figures do not take into account the 78 million people who are prediabetic and the 7 million people who are considered to be undiagnosed.

The increased incidence of diabetes may be related to the lack of health-promoting behaviors, such as inadequate physical exercise and not maintaining a balanced diet (CDC, 2011; Farmer, Levy, & Turner, 1999). In a study of 481 adults, perceived risk for chronic illness was associated with health-promoting behaviors (Farmer et al., 1999). Empirical data demonstrated that adults who are knowledgeable about their risk factors are more likely to perceive a personal risk for diabetes (Chilton, Hu, & Wallace, 2006; Farmer et al., 1999). Little to no data exist regarding adolescents' perceived risk for T2DM and their level of engagement in health behaviors. This study examined the relationship of adolescents' perceptions of risk factors and health promoting behaviors of diet and physical activity.

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Conceptual Framework

The Children's Health Belief Model (CHBM) and the empirical literature guided this study (Bush & Iannotti, 1990; Palermo & Drotar, 1996). The CHBM is based on the original components of the Health Belief Model with the addition of the elements of *perceived risk* and *readiness to take action* (Becker, 1974). Perceived risk is defined as the person's perceived "susceptibility" or "vulnerability" to a condition (Becker, 1974; Janz & Becker, 1984). Readiness to take action includes the level of threat posed by the health problem as determined by the individual's perceived risk (Rosenstock, 1974) as cited by Bush & Iannotti, 1990).

Developmental theories, including the Cognitive Developmental Theory (CDT) and the Behavioral Intention Theory (BIT), both of which focus on different social and physical aspects of adolescents' environment, are incorporated into the CHBM (Bush & Iannotti, 1990). With the increased numbers of adolescents diagnosed with T2DM (SEARCH Study Group, 2006), studies are needed to examine adolescents' perceived risk and health-promoting behaviors, including diet and physical activity. An understanding of the relationship of perceived risk and health-promoting behaviors of diet and physical activity in adolescents can guide nursing interventions to reduce the risk of T2DM in this population.

Background

Family history, obesity, unhealthy diet, ethnicity, race, age, and inactivity are considered risk factors for the development of T2DM. The adoption of health-promoting behaviors can delay or avoid the development of T2DM. Risk perception is considered a necessary step in adopting health-promoting behaviors (Becker, 1974; Jones, Roche, & Appel, 2007; Kim et al., 2007).

In the last few decades, obesity in adolescents has significantly increased

in the U.S. (CDC, 2010), which is a risk factor for T2DM. The National Health and Nutrition Examination Survey (NHANES) study indicated that obesity among adolescents 12 to 19 years of age increased from 5% (1976 to 1980) to 18.1% (2007-2008). Obese adolescents are more likely to become obese adults, and both obese adolescents and adults are at increased risk of T2DM (CDC, 2010). A study of the relationship of college seniors' knowledge of obesity and their perceived risk for chronic disease (N = 318) found that males of higher socioeconomic status perceived a risk for chronic disease ($p < 0.05$) if the father was overweight (Gross, Gary, Browne, & La Veist, 2005). Females had an increased perception of risk for weight-related disease if they were overweight as a child ($p < 0.01$). This study suggests that adolescents who have an understanding of obesity as a risk factor for T2DM may perceive risk for the disease.

Adolescents in this country have high-calorie and high-fat dietary intakes. The recommended daily requirements is 1,400 to 3,200 calories depending on their level of activity. (Office of Disease Prevention and Health Promotion, 2010). The typical American adolescent's diet consists of 33.5% fats, and the recommended percentage of fats is 25% to 35%. Yet it is not the percentage of fats that causes the problem with obesity; it is the quality of fats that adolescents select. Foods high in saturated fats should be less than 10% of their total calories (Office of Disease Prevention and Health Promotion, 2010). Matthys, DeHenauw, Bellemans, De Maeyar, and De Backer (2006) found that adolescent's average daily saturated fat intake was 14%, which was 4% more that the recommended allowance of 10%. Adolescents intake of fruits and vegetables is also below the guidelines, which recommend 1.5 cups of fruits and 1.5 to 4 cups of vegetables per day (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

The Child and Adolescent Trial for Cardiovascular Health (CATCH) study demonstrated the link between children's knowledge of risk and well-balanced diet (Luepker et al., 1996). Children 8 to 11 years of age were provided with knowledge about cardiac risk and well-balanced diet using a food recall in the intervention group. Subjects in the intervention group demonstrated a significant decrease in total fat, saturated fat, and cholesterol intake ($p < 0.01$) leading to a probable decrease in cardiac risk. These adolescents are engaging in behaviors that decrease their risk of obesity. Adolescents who are knowledgeable about obesity as a risk factor for diabetes may perceive the risk and be more likely to make health-promoting changes in their diet to reduce the development of T2DM.

Along with diet, adolescents and their families can modify physical activity to reduce the risk of T2DM. In 2013, the Youth Risk Behavior Surveillance Survey (YRBSS) found that only 27.1% of 9th through 12th graders engaged in vigorous physical activity, that was defined as that which increases heart rate for a total of 60 minutes a day 5 to 7 days a week (CDC, 2013). The link between children's knowledge of risk and physical activity was also demonstrated in the CATCH study (Luepker et al., 1996). Children in the CATCH study received information about the link between cardiac risk and proper physical activity, and it resulted in an increase in physical activity in this group.

Research Questions

The following two research questions were part of a larger study (Fischetti, 2009) that explored the additional variable of knowledge of risk factors for T2DM (family history and obesity).

- What is the relationship between perceived risk and dietary intake?
- What is the relationship between perceived risk and physical activity?

Method

A cross-sectional descriptive correlational design was used with a sample of adolescents recruited from two private high schools and two Boy Scout troops in the New York City area. The Boy Scout troops were small, with five students in each troop and predominately Caucasian. One high school (all girls) had approximately 400 students, while the other high school (all boys) had approximately 500 students. These schools were private, independent Catholic high schools, and the students were predominately Caucasian (see Table 1). Permission was obtained from the school principals and Boy Scout leaders. A letter sent home with the students and scouts explaining the study and requesting consent from a parent or guardian. The adolescents' written assent was also obtained. The Institutional Review Board approval was obtained from Rutgers, the State University of New Jersey; and the College of Staten Island, City University of New York before data collection commenced.

Table 1.
Demographic Data (N = 80)

Variable	*n*	%
Gender		
Male	35	43.8
Female	45	56.3
Racial background		
Caucasian	62	77.5
Black	2	2.5
Hispanic	6	7.5
Asian	2	2.5
Mixed	8	10

Sample

The sample included 86 students from 13 to 18 years of age whose parents signed consents and students signed assents. Exclusion criteria included any adolescent with a history of Type 1 or 2 diabetes, history of a chronic disease, or pregnancy. Six participants were excluded from analyses because they reported a history of chronic disease. The final sample consisted of 80 respondents. Participants included 35 male and 45 female students (see Table 1).

Subjects' ages ranged from 13 to 18 years (*mean* = 16.1, *sd* = 1.14); 18 were in 9th grade, 10 were in 10th grade, 31 were in 11th grade, and 21 were in 12th grade. The sample was primarily Caucasian (n = 62, 77.5%) (see Table 1). Thirty-two students (40%) had a family history of T2DM. Based on CDC (2006) criteria, the majority (n = 56, 70%) had a healthy body mass index (BMI) (5th to 85th percentile); based on BMI, 16 students (20%) were considered overweight (85th to 95th percentile), and 6 (7.5%) were obese (95th percent or greater) (see Table 2).

Instruments

Four instruments were used, including the Beliefs about T2DM Health, the Godin Leisure-Time Exercise Questionnaire, two 24-hour

Table 2.
Body Mass Index (BMI) Percentile (*N* = 80)

BMI Percentile		
5th (Underweight)	2	2.5
5th to 85th (Healthy weight)	56	70
85th to 95th (overweight)	16	20
95th and Above (Obese)	6	7.5

dietary recalls, and a demographic questionnaire. Because there were no adolescent instruments to evaluate perceived risk in the adolescent for T2DM, an adult instrument – "Risk Perception Survey for Developing Diabetes" (Walker, Kalten, Mertz, & Flynn, 2003) – was revised to evaluate perceived risk in adolescents. The Beliefs about T2DM Health in Adolescents is a new 14-item instrument adapted and developed by the researcher. The items include information about optimistic bias, worry, personal control, dread, and unknown risk. An example question of an optimistic bias question is: "Compared to other people of my same age and sex (gender), I am *less* likely than they are to get diabetes." An example question of worry question "I worry about getting diabetes." An example of a personal control question is: "If I am going to get diabetes, there is not much I can do about it." The item responses are "strongly agree," "agree," "disagree," and "strongly disagree." The answers were scored 1 for "strongly agree" to 4 for "strongly disagree." An example of a dread question is "diabetes is very life threatening" to "not life threatening at all." The item responses for "diabetes is very life-threatening" = 1 to "not life-threatening at all" = 7. This particular item is then reverse scored. The higher the scale score, the more risk is perceived. The dimensionality of 14 items in the Beliefs about Type 2 Diabetes Health instrument was analyzed using maximum likelihood factor analysis. Items with loading of 0.40 and higher were retained in their respective factor. The rotated solution yielded five interpretable factors explaining 58.6% of the variance in Beliefs about Type 2 Diabetes Health: personal control, worry, optimistic bias, unknown risk, and dread. Reliability coefficients ranged from 0.47 to 0.79. Two factors – personal control and unknown risk – were found to have less-than-satisfactory reliabilities at 0.47 and 0.47, respectively; it was decided that although these two factors did not have strong reliabilities because this was a newly developed instrument the researcher determined that theoretically, the questions needed to remain as part of the scale for the proposed study. Future refinement of the tool may be necessary.

The Godin Leisure-Time Exercise Questionnaire, used to evaluate physical activity, is a 4-item self-administered instrument that measures usual leisure time exercise habits (Godin & Shepard, 1985). The first three questions ask for the number of times per week an individual participates in a) strenuous exercise, b) moderate exercise, and c) mild exercise. The total score of the first three questions is called the "leisure scale." Examples of each of the types of exercise are given. The fourth question asks how often within a 7-day period the individual engages in leisure-time activity that causes the individual's heart to beat rapidly. The item responses are "often," "sometimes," "never," and "rarely." This is called the "sweat score." A total score was computed by totaling all four questions. In adult studies, reliability coefficients ranged from 0.24 to 0.84, and a study done with school-age children, the instrument performed well with an alpha of 0.81 (Godin & Shepard, 1997), and in this study, the alpha was 0.56. Two 24-hour dietary recalls were used to evaluate adolescents' food intake following the National Health and Nutrition Examination Survey (NHANES) 2002 method. The participants were asked to complete one 24-hour intake from the prior day, and one 24-hour intake from the previous weekend. The dietary recall asked the participants to provide both meals and snacks eaten during that 24-hour period. The weekday recall was chosen because eating habits of adolescents changes on weekends (Gortmaker, Cheung, Peterson, Chomitz, & Cradle, 1999). The participants were provided with food models to estimate the portion size.

The investigator developed demographic form consisted of 9 items that addressed gender, age, year in high school, race or ethnicity, family history of T2DM, and health history. Each subject's height and weight was assessed for BMI. Height was measured using a seca 206 Body Measuring Tape – an automatic metal tape measure. This tape measure has a 1" to 78" range with 1/8" inch graduations. Weight was measured using a seca 318 medical floor scale. Mobile and lightweight, accuracy is automatically accomplished by adjusting to 0 (null balance) at every weighing, and its graduation is 0.2 lbs for a precise weight (seca North America, Medical Scales and Measuring Devices, MD).

Data Analysis

The final sample contained 80 subjects. Data from the study demographic and health history form – the Godin-Shepard Activity Instrument Beliefs about Type 2 Diabetes Health – were entered into the Statistical Package for Social Sciences (SPSS), version 11 (2001). Descriptive statistics and Pearson *r* correlations procedures were employed to answer the research questions.

Results

Perceived Risk for T2DM And Dietary Intake

There was no correlation found between perceived risk for T2DM and dietary intake. The Pearson product-moment correlation was $r = -0.072$ ($p = 0.265$). However, there was a significant positive association between the perceived risk subscale "dread" and carbohydrate intake ($r = 0.282$, $p = 0.01$). There was a significant inverse association between perceived risk subscale "dread" and fat intake ($r = -0.262$, $p = 0.02$) (see Table 3).

Perceived Risk for T2DM And Physical Activity

A significant inverse association was observed between perceived risk for T2DM and strenuous activity. The Pearson product moment correlation was ($r = -0.251$, $p = 0.02$) and a significant inverse association was noted between total leisure and perceived risk for T2DM ($r = -0.224$, $p = 0.04$). There were also two significant positive correlations, one between total leisure and dread (not known) ($r = 0.225$, $p = 0.046$) and the other between mild activity and personal control ($r = 0.237$, $p = 0.03$) (see Table 4).

Discussion

The findings that adolescents who perceived diabetes as a dreaded health risk was positively associated with carbohydrate intake and negatively associated with fat intake suggests that adolescents who dreaded

Table 3.
Perceived Risk for Type 2 Diabetes Mellitus and Dietary Intake

	Kilocalorie Mean	Protein Mean	Carbohydrate Mean	Fat Mean
Perceived Risk Composite	r = -0.072, p = 0.53	r = -0.083, p = 0.47	r = 0.036, p = 0.75	r = -0.070, p = 0.54
Dread	r = -0.074, p = 0.51	r = -0.022, p = 0.08	r = 0.280, p = 0.01*	r = -0.262, p = 0.02*
Known	r = 0.213, p = 0.06	r = -0.092, p = 0.42	r = -0.039, p = 0.73	r = 0.014, p = 0.90
Personal Control	r = -0.077, p = 0.495	r = 0.083, p = 0.46	r = 0.042, p = 0.71	r = -0.042, p = 0.71
Worry	r = -0.221, p = 0.05	r = -0.005, p = 0.96	r = 0.063, p = 0.57	r = -0.140, p = 0.22
Optimistic Bias	r = 0.034, p = 0.77	r = 0.086, p = 0.45	r = -0.031, p = 0.58	r = 0.018, p = 0.83

*Correlation is significant at the 0.05 level.

Table 4.
Perceived Risk for Type 2 Diabetes Mellitus and Physical Activity

	Total Leisure Activity	Mild	Moderate	Strenuous	Sweat Score
Perceived Risk Composite	r = -0.224, p = 0.05*	r = -0.140, p = 0.25	r = -0.140, p = 0.222	r = -0.251, p = 0.03*	r = 0.174, p = 0.19
Dread	r = -0.225, $p \leq 0.05$	r = 0.016, p = 0.888	r = 0.111, p = 0.33	r = 0.171, p = 0.13	r = 0.088, p = 0.44
Known	r = 0.70, p = 0.54*	r = 0.134, p = 0.24	r = 0.177, p = 0.118	r = 0.050, p = 0.66	r = -0.015, p = 0.90
Personal Control	r = 0.213, p = 0.06	r = 0.237, p = 0.03*	r = 0.142, p = 0.21	r = 0.134, p = 0.236	r = 0.213, p = 0.06
Worry	r = -0.154, p = 0.17	r = -0.042, p = 0.71	r = -0.015, p = 0.90	r = -0.196, p = 0.08	r = 0.142, p = 0.21
Optimistic Bias	r = 0.060, p = 0.60	r = -0.051, p = 0.65	r = 0.124. p = 0.28	r = 0.198, p = 0.08	r = -0.137, p = 0.23

*Correlation is significant at the 0.05 level.

diabetes perceived that fat intake may contribute to obesity. Adolescents may have believed that eating fats was more likely to lead to obesity and potentially T2DM; thus, the adolescent perceived the risk and ate less fat. If this is true, then adolescents are not knowledgeable regarding the role of carbohydrates in the development of T2DM. These findings are supported in a study of 168 adolescents that assessed fat knowledge and intake (Venter & Winterbach, 2010). The researchers' finding suggests that the nutritional information that was presented to the participants at school had a positive association to their fat intake and knowledge ($p < 0.05$). This study did not address the issue of carbohydrate intake.

In the current study, there were significant associations between total leisure activity and known risk and between mild activity and personal control. These findings suggest that adolescents who participated in leisure activity perceived T2DM as a life threatening disease and that-adolescents who engaged in even mild exercise felt they had some control over the potential for developing diabetes. A significant inverse relationship was noted between strenuous physical activity and perceived risk. These findings suggest that the more the adolescent exercised, the lower their perceived risk for developing T2DM. An inverse relationship was also observed between perceived risk for T2DM and total leisure (leisure time exercise). These findings suggest that adolescents who participated in leisure activity did not perceive T2DM as a life-threatening disease.

The association between perceived risk and physical activity in children was also supported in the CATCH intervention study (Luepker et al., 1996). The CATCH intervention group was provided with knowledge about cardiac risk and proper physical activity to prevent cardiac disease. In this group, there was a significant increase in moderate to vigorous physical activity in physical education classes in comparison to the control groups ($p < 0.02$). Findings also revealed significantly higher levels of self-reported vigorous activity in the intervention group (58.6 minutes) compared to the control group (46.5 minutes per day).

Implications for Practice And Research

Significant associations between the subscale of perceived risk (dread) and dietary intake (carbohydrate and fat mean), perceived risk and the subscales of physical activity (total leisure and strenuous activity), the subscale of perceived risk (known), and the subscale of physical activity (total leisure) suggest relationships between these variables. Although adolescents in the past were relatively free from developing T2DM, there are now increasing numbers of adolescents with T2DM (SEARCH Study Group, 2006). If perceived risk plays a role in adolescents' participation in health-promoting behaviors, then nurses can assess the level of perceived risk the adolescent has and target their teaching about health-promoting behaviors to reduce the risk of T2DM in the adolescent. One way to increase their risk perception may be to educate

Instructions For Continuing Nursing Education Contact Hours

Correlates among Perceived Risk for Type 2 Diabetes Mellitus, Physical Activity, And Dietary Intake in Adolescents

Deadline for Submission: June 30, 2017

PED 1503

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Goal

The purpose of this learning activity is to provide an overview of type 2 diabetes mellitus in adolescents and its relationship to diet and exercise.

Objectives

1. List the correlates that are believed to place individuals at greater risk for type 2 diabetes mellitus.
2. Explain the relationship between diet and exercise as a possible risk for type 2 diabetes mellitus.

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adolescents about the risk factors for T2DM. Nurses who are teaching adolescents about T2DM may want to emphasize the role of carbohydrates, in addition to fats, in the development of T2DM. Teaching is also needed regarding the importance of intensity of activity as a health-promoting behavior. The results suggest that adolescents who engage in mild activity believe that they are protected from T2DM. The recommended amount of activity for children and adolescents is at least 60 minutes of moderate intensity physical activity most days of the week, and daily, if possible (CDC, 2013).

If adolescents are aware they may have a risk factor for T2DM, they may perceive themselves at risk and participate in health-promoting activities. Promoting more healthy behaviors, including dietary intake and physical activity in this age group, will have effects later in life reducing the development of T2DM and its complications. This will ultimately affect the quality of an individual's life and reduce the allocation of resources by society needed to treat those who develop T2DM.

A limitation of this study was the newly developed Beliefs about T2DM Health in Adolescents instrument. Further refinement of this tool is necessary to better evaluate perceived risk for T2DM in adolescents. The observed low coefficient alphas may have resulted from homogeneity of the sample in this study. All samples, including the Boy Scouts, were relatively homogeneous. All four samples were predominantly Caucasian participants attending private high schools. Because homogeneity of samples can lower reliabilities because of lack of variability (Nunnally & Bernstein, 1994), a more variable group should be sought to examine the psychometrics of the instruments. The present study needs to be replicated in a minority public high school sample to identify whether minorities perceive risk differently.

The results of this study fill a gap in knowledge related to adolescents' perceived risk, knowledge of risk factors, and health promoting behaviors to reduce the development of T2DM. It is important for nurses to continue to examine the role of perceived risk and health promoting behaviors for T2DM in order to reduce the development of T2DM in adolescents.

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