

PERCIEVED RISK FOR DEVELOPING TYPE 2

DIABETES

IN ADOLESCENTS

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ABSTRACT OF THE THESIS

Perceived Risk in Adolescence for Developing Type 2 Diabetes

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The purpose of this study was to examine the relationships between the dependent variables of dietary intake and physical activity and of the independent variables (a) knowledge of risk factors for type 2 diabetes (T2DM) and (b) perceived risk. The researcher further planned to examine the relationship between perceived risk and knowledge of risk factors by testing two mediational models with the variables of dietary intake and physical activity. The Children's Health Belief Model (Bush and Iannotti, 1990) was used in this study as the conceptual framework for testing the theoretical relationships.

Participants were recruited from two private high schools and two Boy Scout troops in the New York City area. One high school (all girls) has approximately 400 students. The other high school (all boys) has approximately 500 students. The final sample consisted of 80 participants: males ($n=35$) and females ($n=45$) aged from 13-18 years ($M=16.1$, $SD=1.14$). The participants were Caucasian ($n=62$, 77.5%), Hispanic ($n=6$, 7.5%), Black ($n=2$, 2.5%) and Asian ($n=2$, 2.5%).

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.

The findings in this study did not support the theoretical and empirical relationships between the independent variables of knowledge of risk factors for T2DM and perceived risk and the dependent variables of dietary intake and physical activity. However, the additional findings found significant relationships between the subsets of perceived risk; dietary intake and physical activity. The relationships may have not been identified in the tests of hypotheses because of the low alpha coefficients of the Knowledge of Risk Factors for T2DM and the Health Beliefs for T2DM instruments. Gender and BMI also appear to play a significant role in perceived risk. Implications for nursing practice were addressed.

Preface

Doctoral study and dissertation research were one of the most difficult times of my life. Thankfully, I was not alone through the process. I would like to thank my dissertation committee, my husband and my family.

To Dr. Lucille Eller, my chairperson and advisor, I cannot express my heartfelt appreciation. Your dedication and tutorage assisted me throughout the process. I know and have come to understand what research and scholarly writing are because of your patience and guidance. I would also like to thank the other members of my dissertation committee: Drs. Richard Contrada, Karen D'Alonzo, and Charlotte Thomas-Hawkins for their expert guidance.

To my husband Anthony for the love and the support he provided me that helped me to persevere through this most difficult process, to my son Michael and daughter Nicoletta for understanding when I could not always be available. To my Mother, Father and sisters, Connie, Nickie, Judy and Marygrace, without whose support and assistance with my children I would never have even considered taking on such a monumental task. Finally, to my sister-in-law Anna, for all the help and support she gave throughout. I will always be grateful to all of them.

I also extend my deepest gratitude to the financial supporters of my dissertation: Sigma Theta Tau International Honor Society of Nursing Alpha Tau and Mu Upsilon Chapters, The Rutgers University College of Nursing Alumni Association.

Dedication

This research is dedicated to my husband who believed in me and supported me through many difficult times during this process.

“Never give up, never, never, never.” Winston Churchill.

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CHAPTER I

The Problem

Diabetes mellitus is one of the most common chronic diseases among children and adolescents in the United States (U.S.). Currently about 150,000 young people less than 18 years of age, or about one in every 400 to 500, have been diagnosed with diabetes (Centers for Disease Control and Prevention [CDC], 2005). In the past two decades, the incidence of type 2 diabetes (T2DM) among U.S. children and adolescents has risen markedly (Search for Diabetes in Youth, 2005). CDC researchers estimate that T2DM accounts for 8% to 46% of all new cases of diabetes (type 1 and type 2). In addition, the magnitude of T2DM in this population is probably underestimated because youths may have few if any symptoms and the necessary blood tests needed for diagnosis are often not ordered because of the lack of symptoms (CDC, 2005; Fagot-Campagna, Pettitt, Engelgau, Burrows, Geiss & Valdez. 2000).

Several studies have demonstrated the increased prevalence of T2DM in adolescents. Dabelea and colleagues (1998) noted that the prevalence of T2DM in boys between the ages of 10-14 years rose from 0% between 1967-1976 to 1.4% between 1987-1996. Prevalence for the same time periods for 15-19 year-old boys increased from 2.43% to 3.78%. In girls, ages 10-14, the prevalence of T2DM increased from 0.72% between 1967-1976 to 2.88% between 1987-1996. In 15-19 year-old females, the prevalence of T2DM increased from 2.73% to 5.31% for the same time period (Dabelea et al., 1998).

One of the earliest epidemiological reviews of T2DM was conducted by Fagot-Campagna et al., (2000) among the North American Pima Indians. The researchers

studied a sample of 5274 North American Pima Indians in Arizona age 19 years and under over a 30 year period (1967-1996). Over the study period, 125 of 5274 children from birth to 19 years of age (2.4%) developed T2DM. During the last four years of the study (1992- 1996), the prevalence rate of T2DM was 22.3 per 1000 among 10-14 year-olds and 50.9 per 1000 for adolescents between the ages of 15-19. These figures represent a 4- to 6-fold increase in prevalence in both age groups from 1967 to 1996.

Pinhas-Hamiel and Zeitler (1996) conducted a review of 1027 medical records of children and adolescents newly diagnosed with T2DM referred to a regional, university-affiliated pediatric diabetes center in the U.S. between 1982 and 1995. The investigators observed an increase in the incidence of T2DM from 4% before 1992 to 16% in 1994. Among adolescents 10-19 years of age, T2DM accounted for 40% of diagnoses of diabetes in 1994 compared to 3-10% of cases during the 1982-1992 periods. The investigators did not identify the racial or ethnic background of the participants.

Data from the most recent epidemiological review of pediatric T2DM (Search for Diabetes in Youth, 2006) support the notion that T2DM is on the rise among children and adolescents. The investigators identified 6379 U.S. children and adolescents with Type I and II diabetes in 2001 in a population of approximately 3.5 million (Search for Diabetes in Youth, 2006). Among individuals 10-19 years old, there were 2.80 cases per 1000, with one out of every 357 diagnosed with diabetes. Data from this study indicate that among youth with diabetes, the prevalence of T2DM varied by race and ethnicity. The overall prevalence of T2DM by percent was 6% for Non-Hispanic White adolescents. Markedly higher percentages of cases of T2DM were found in other racial/ethnic groups: 22%, for Hispanics, 33%, for Blacks, 40% for Asian-Pacific Islanders, and 76% for

American Indians. In addition to differences in the prevalence of T2DM by race and ethnicity in the 10-19 year-old group, gender differences were also identified. Black and American Indian females had the highest prevalence, which was 1.45 per 1000 and 2.18 per 1000 respectively (Search for Diabetes in Youth, 2006).

Given the magnitude of the problem, research approaches are clearly needed to identify factors that will promote T2DM risk reducing behaviors. Knowledge of risk factors and perceived risk for chronic illness have been associated with risk reducing behavior in adults (Kamhon & Wei-Der, 2004; Farmer, Levy & Turner, 1999). There is little to no data regarding adolescents' knowledge of risk factors for T2DM, their perceived risk for the illness, and their level of engagement in risk reducing behaviors. Empirical data have demonstrated that adults who are knowledgeable about their risk factors are more likely to perceive a personal risk for diabetes (Farmer et al., 1999; Chilton, Hu & Wallace, 2006). There are no published reports regarding the complex interrelationships among adolescents' knowledge about risk factors for T2DM, their perceived risk for the condition, and their level of engagement in behaviors to reduce their risk.

This study examined the interrelationships among knowledge of risks of T2DM, perception of personal risk factors for T2DM, and risk reducing behaviors among adolescents. Therefore, in this study, the researcher examined adolescents' level of knowledge of risk factors for T2DM, specifically family history of T2DM and obesity. The researcher also hypothesizes that adolescents' perception of risk of T2DM may mediate the relationship between their knowledge of risk factors and their risk reducing behaviors which include proper nutrition and physical activity.

Discussion of the Problem

Risk factors for T2DM in adults, children, and adolescents include minority status, obesity, sedentary lifestyle, and a family history of T2DM (Libman & Arslanian, 2003, American Diabetes Association, 2006). Research in adult populations suggests that knowledge of risk factors for disease may motivate adolescents to adopt health behaviors to avoid or delay the onset of “disease” (Kamhon & Wei-Der, 2004; Farmer et.al.1999). Moreover, there are a number of studies in adults that have examined their knowledge of risks of diabetes and revealed that knowledge of family history of diabetes was significantly related to perceived risk (Farmer et al., 1999; Chilton et al., 2006; Kamhon & Wei-Der, 2004; Montgomery, Erblich, DiLorenzo & Bovbjerg, 2003). While knowledge and perception of risk for T2DM have been examined in adults (Farmer et al., 1999; Chilton et al., 2006) there are no studies that have investigated adolescents’ knowledge of risk for T2DM. Studies have explored adolescents’ knowledge of risk factors for chronic diseases including osteoporosis (Anderson, Chad & Spink, 2005) and heart disease (Vale, 2000). Findings from these studies revealed that adolescents and young adults have some knowledge regarding risk factors and prevention for specific diseases. On the other hand, a study of knowledge of cancer risk factors in adolescents found that cancer knowledge was poor among Mexican adolescents (Perez-Contreras, Betania, Riz-Velasco, Schiavon-Ernani, Cruz-Valdez Hernandez & Lazcano-Ponce, 2004). Empirical data regarding adolescents’ knowledge of T2DM risk factors, perception of their risk for T2DM, level of engagement in risk reducing behaviors and the relationship among these variables is sorely needed.

Knowledge of Family history of T2DM

Research in adults has shown that family history of T2DM is a significant risk factor for the development of the disease (ADA, 2006). Chilton et al, (2006) examined health-promoting lifestyle and diabetes knowledge in Hispanic American adults using a convenience sample of 40 adults. The authors found that more than one-half of the sample correctly identified that having diabetes themselves placed their children at risk for developing the disease.

According to the American Diabetes Association (ADA, 2000), between 74%-100% of all individuals with T2DM have a first or second degree family member with T2DM, and 45%-80% have at least one parent with T2DM. Although family history is not a modifiable factor, knowledge of family history was found to predict perceived disease-specific risk in adults for various diseases including diabetes (Montgomery et al., 2003). Farmer et al., (1999) reported a significant, positive relationship between knowledge of risk of family history and one's perception of risk for diabetes in adults.

Knowledge of obesity as a risk factor for T2DM

Research in adult populations with diabetes suggests one risk factor for T2DM in adolescents may be obesity. In a study of the relationships between knowledge of the health risks of obesity and perceived risk, knowledge of risks of obesity influenced perceived risk for chronic disease (Kamhon & Wei-Der, 2004). Moreover, data analysis also revealed a significant positive relationship between obesity health risk knowledge and BMI in men. Males who were more knowledgeable that obesity is a risk factor for chronic diseases were in the top-normal BMI range (i.e., BMI = 24.99) (Kamhon & Wei-Der, 2004). Gross, Gary, Browne & La Veist, (2005) examined the relationship between

college seniors' knowledge of obesity and their perceived risk for chronic disease. Findings revealed that males of higher socioeconomic status perceived a risk for chronic disease if the father was overweight. In the same study, females had an increased perception of risk for weight-related disease if their mother was overweight. No such studies have been conducted in adolescents. However, these studies suggest those adolescents who have knowledge of obesity as a risk factor for T2DM may perceive risk for the disease. It was posited in this study that there would be an association between the knowledge that obesity is a risk factor for T2DM and perception of risk for the disease in the adolescent.

The prevalence of overweight children and adolescents in the U.S. has increased over the last decade. According to the National Health and Nutrition Examination Survey 2003-2004 (NHANES 2003-2004), 17% of children and adolescents ranging in age from 2-19 years were designated either overweight or obese. Overweight adolescents are more likely to become obese as adults and obese adults are at increased risk of T2DM (Healthy People 2010, 2007).

The National Health Examination Surveys (NHES) (Troiano & Flegal, 1998), which focused on the growth and development of adolescents (12–17 years of age), included data on the prevalence of obesity for all races. During the period of NHESII (1963-1965), the percentage of overweight adolescents of all races was 4.6 % for males and 4.5% for females. By NHANES III (1988-1994), the percentage of overweight adolescents between 12-17 years of age had increased to 11.4% for males and 9.9% for females (Troiano & Flegal, 1998). In the NHANES III (1988-1994), in 12-19 year olds the percentage of overweight youths was 10.5 whereas in the 2003-2004 NHANES

survey demonstrated an increase in overweight youths to 17.4%. NHANES 2003-2004 overweight estimates indicate that since 1994 the number of overweight youths increased to even higher levels. This sustained increase suggests that this generation of youths will be at risk for overweight- and obese-related complications including T2DM. Ninety-nine percent of adolescents in this country have a high dietary intake and are exceeding the recommended dietary daily requirements (Troiano & Flegal, 1998). The typical American adolescent's diet consists of 35% added fats and 15% added sugars, both of which are well above recommended levels (Munoz, Krebs-Smith, Ballard-Barbash, & Cleveland, 1997). Clearly, adolescents are engaging in behaviors that increase their risk of obesity. The knowledge of obesity as a risk factor may be an important prerequisite for perception of risk for T2DM and obesity prevention/reduction (Kamhon & Wei-Der, 2004). Adolescents who are knowledgeable about obesity as a risk for diabetes may be more likely to make lifestyle changes in diet and physical activity to reduce obesity. This study examined the relationship between knowledge of obesity as a risk factor, perceived risk and risk reducing behaviors.

Risk-Reducing Behaviors: Dietary intake and physical activity behaviors

Research in adult populations suggests that knowledge of obesity and family history as risks for diabetes and one's perception of these risks may be important predictors of appropriate dietary intake and physical activity. In adult populations, knowledge of risks for diabetes is a prerequisite for appropriate dietary intake behaviors. For example, among adults with diabetes, those who reported lower perceived risk of complications related to their diabetes were less likely to attend appointments with their dietician (Spikmans, Brug, Doven, Kruizenga, Hofsteenge & van Bokorst-van Schueren,

2003). This suggests that there may also be a relationship between perceived risk and the risk-reducing behavior of well-balanced diet in adolescents.

The link between children's knowledge of risk and well-balanced diet was demonstrated in the Child and Adolescent Trial for Cardiovascular Health (CATCH) study (Luepker, Perry, McKinlay, Nader, Parcel & Stone, 1996). Children 8-11 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. This intervention study demonstrates a relationship between knowledge and the risk reducing behavior of well-balanced diet in children. It is posited that there may be an association between adolescents' knowledge of risk for T2DM and well-balanced diet.

Physical activity

In 2006, the Youth Risk Behavior Surveillance Survey (YRBSS) found that only 35.8% of 9-12 graders engaged in vigorous physical activity (defined as that which increases heart rate) for a total of 60 minutes a day 5-7 days a week. It is important to gain an understanding of the effects of knowledge of risk for T2DM and perception of this risk in adolescents for this condition. The link between children's knowledge of risk and physical activity was demonstrated in the Child and Adolescent Trial for Cardiovascular Health (CATCH) study (Luepker et al., 1996). Children in the intervention group were provided with knowledge about cardiac risk and appropriate physical activity to prevent cardiac disease. Results from the study demonstrated an increase in moderate to vigorous physical activity in physical education classes and

significantly higher self-reported vigorous activity among children in the intervention group.

One can posit from the CATCH study that there may be an association between knowledge of the importance of physical activity to reduce the risk of obesity and to prevent T2DM, and participation in physical activity in the adolescent as well.

In view of the rising rate of adolescent obesity, it is important to determine if adolescents' level of knowledge about risk factors for T2DM is related to their perception of risk which, in turn, influences their risk reducing behaviors including appropriate dietary intake and physical activity in adolescents.

Perceived Risk

Perception of risk, a psychological concept, is considered one of the first necessary steps toward adopting health-promoting behaviors (Becker, 1974). Perceived risk has been empirically and theoretically linked to the performance of health promoting behaviors (Janz & Becker, 1984). The vast majority of empirical studies examined perceived risk in adults. It has been shown that adults who perceive themselves at risk for developing a disease are more likely to participate in health promoting behavior to reduce the risk of developing the disease (Janz & Becker, 1984). Gochman (1972) examined perceived vulnerability to illness in children and adolescents. Gochman (1972) examined health beliefs in 774 children between the ages of 8-17. Specifically he examined components of the Health Belief Model, including perceived vulnerability (risk), intention to take health action, perceived benefits and motivation. An additional variable that was examined was dental trauma experiences. He found that perceived vulnerability (risk), perceived benefits, and dental trauma experiences were significant predictors of

intention to visit the dentist ($F= 17.43, p < .0001$). This study provides empirical evidence that perceived risk is linked with at least one health promoting behavior (visiting the dentist). Only one published study in adolescents examined perceived risk for disease and injury and included T2DM (Ey, Klesges, Patterson, Hudley, Barnard & Alpert, 2000). Findings from this study revealed that knowledge of the mother's diabetes was not predictive, while knowledge of the father's diabetes was predictive of perceived vulnerability to diabetes for both male and female adolescents ($OR=8.79$; 95% CI, 0.97-79.29). There is likewise some evidence in the adult population (Farmer et al., 1999; Chilton et al., 2006) that there is a relationship between knowledge of family history of diabetes and perceived risk.

Adolescence signifies a maturational turning point wherein adolescents acquire new roles and responsibilities, one of which is taking measures to care for their own health. Although historically adolescents have been less likely to develop T2DM, there are now increasing numbers of adolescents diagnosed with T2DM (Search for Diabetes in Youth, 2006). An understanding of the mediating effect of perceived risk on the relationship between knowledge of risks for T2DM and risk reducing behaviors in adolescents can guide interventions to reduce the risk of T2DM in this population. This study examined the relationships between perceived risk, knowledge of risk factors for T2DM, dietary intake and physical activity.

Statement of the problem

Does perceived risk act as a mediator between the independent variable knowledge of risk factors (family history and obesity) for T2DM and dependent variables dietary intake and physical activity in adolescents?

Sub-Problems

The research questions are:

1. What is the relationship between knowledge of risk factors for T2DM and dietary intake?
2. What is the relationship between knowledge of risk factors for T2DM and physical activity?
3. What is the relationship between knowledge of risk factors for T2DM and perceived risk for developing T2DM?
4. What is the relationship between perceived risk and dietary intake?
5. What is the relationship between perceived risk and physical activity?
6. What is the relationship between knowledge of risk factors for T2DM and dietary intake when perceived risk is controlled for statistically?
7. What is the relationship between knowledge of risk factors for T2DM and physical exercise when perceived risk is controlled for statistically?

Definition of terms

Adolescence. Adolescence begins with the onset of physiologically normal puberty, and ends when an adult identity and behavior are accepted. Adolescence was defined in this study as the period of development that corresponds roughly to the period between the ages of 10-19 years, and is consistent with the World Health Organization's definition of adolescence (Canadian Paediatric Society, November, 2003). Adolescence was operationalized using The World Health Organization definition which includes the 10-19 year-old age range to define adolescence.

Behavioral factors

Physical Activity. Physical activity is defined in this study as any bodily movement produced by skeletal muscles resulting in energy expenditure (CDC, 2006). Children and adolescents should engage in at least 60 minutes of moderate intensity physical activity which includes walking briskly, or biking for pleasure or transportation, swimming, engaging in sports and games, participating in physical education most, preferably all, days of the week (Healthy People 2010, 2006). In this study, physical activity was operationalized as the score on the Godin-Shepard Physical Activity Questionnaire (1985).

Dietary Intake. Dietary intake is defined in this study as total calories consumed, and the percentage of fats and percentage of sugars consumed in a 24-hour period. This was operationalized using a repeated 24-hour dietary recall method (Nelson et al., 1989).

Knowledge of Overweight/Obesity as a risk factor for T2DM

Knowledge is defined in this study as awareness or familiarity gained by experience of a person, fact or thing (Oxford Dictionary & Thesaurus, 1996).

Overweight or obese is defined in this study as weight at or above the sex and age specific 95th percentile of the Body Mass Index based on CDC Growth Charts: United States (Healthy People 2010, 2006). The CDC doesn't separate overweight and obesity in children and adolescents. Knowledge of overweight/obesity was operationalized as participants' knowledge of their Body Mass Index classification (normal weight, overweight, obese) based on CDC Growth Charts: United States (Healthy People 2010, 2006) and a response that obesity is a risk factor for T2DM on the Knowledge of Risk Factors for Developing T2DM Survey.

Knowledge of Family history of T2DM as a risk factor for T2DM

Family history of T2DM is defined as having a first- or second-degree relative who has T2DM (ADA, 2000). Participants' knowledge of family history as a risk factor as well as knowing their own family history for T2DM was operationalized as the response on the Knowledge of Risk Factors for Developing T2DM Survey.

Definition of Theoretical Concepts

Perceived risk. Perceived risk is defined as the person's perceived "susceptibility" or "vulnerability" to a condition (Becker, 1974; Janz & Becker, 1984). Perceived risk for T2DM was operationalized as the score on the Beliefs About T2DM Health Survey.

Delimitations

Male and female adolescents, 10-19 years of age, were recruited for this study through private schools and Boy Scout troops.

Inclusionary criteria for the study are:

1. Male or female
2. 10-19 years of age

Exclusionary criteria for the study:

1. History of type 1 or T2DM.
2. History of any chronic disease.
3. Pregnancy

Significance of the Study

T2DM in adolescents is clearly on the rise. It is estimated that among children diagnosed with diabetes, as many as one-half may have T2DM (CDC, 2005). This may be a conservative estimate given the findings reported earlier in this paper (Search for Diabetes in Youth, 2006) that as many as 75% of pediatric diabetics had T2DM. According to Rowell, Evans, Quarry-Horn & Kerrigan (2002), family history of T2DM, obesity, dietary intake, and physical activity play a large role in the development of T2DM. Three of the four main risk factors for T2DM are modifiable factors. Knowledge of risk factors and perceived risk have been linked to the performance of health-promoting behaviors in adults. There is a paucity of research that examines adolescents' knowledge of the risk factors for T2DM and their perceived risk for T2DM. Therefore, in order to address this growing health problem, it is important to determine if perceived risk mediates the relationship between knowledge of risk factors and risk-reducing behaviors, i.e., appropriate dietary intake and physical activity in adolescents. This study was the first to examine whether there is a relationship between; perceived risk, knowledge of risk factors for T2DM (which include obesity and family history of T2DM) and risk reducing behaviors (dietary intake and physical activity).

CHAPTER II

Review of the Literature

This study examined the relationship between knowledge of risk factors for T2DM and dietary intake as well as the relationship between knowledge of risk factors for T2DM and physical activity. Empirical and theoretical literature will be presented in this chapter. The first section presents empirical literature regarding knowledge of risk factors, dietary intake and physical activity. The second section is a review of the theoretical and empirical literature for perceived risk followed by empirical support.

Knowledge of Risk Factors for T2DM

As discussed previously, the importance of one's knowledge of risk factors for certain chronic diseases (osteoporosis, heart disease, cancer) is evident in the empirical literature for the adolescent population (Anderson et al., 2005; Vale, 2000; Perez-Contreras et al., 2004). However, there are no studies found that specifically examine the knowledge of risk factors for T2DM in adolescents. Knowledge of risk factors for T2DM has been investigated among adults (Farmer et al., 1999; Chilton et al., 2006).

Knowledge of Family History as a Risk Factor for T2DM

Farmer et al. (1999) examined the degree to which 481 adult siblings of individuals with diabetes (ages 35-74) perceived risk for T2DM and were knowledgeable about diabetes complications. Factors significantly associated with perceived risk for developing T2DM included knowledge of a parent with diabetes ($p < 0.01$), gender and age ($p < 0.01$) and perception of seriousness of diabetes ($p < 0.05$, multivariate; $p < 0.01$, univariate). Knowledge of complications of the disease was not associated with perceived risk. While this study was conducted in an adult population, the study findings support

the hypothesis that knowledge of parental history of T2DM may be an important predictor of perceived risk for T2DM in adolescents. The study reported here examined whether the knowledge of family history of T2DM is associated with the adolescents' perception of risk for developing T2DM.

Chilton et al. (2006) examined Hispanic American adults' knowledge levels regarding diabetes including the knowledge that personal diabetes places other family members at risk. This study also examined the relationship among demographic characteristics including age, education, income, gender, and knowledge of diabetes risk in a sample of 40 Hispanic Americans. The mean age of participants was 32.9 years. While the participants had a low level of general knowledge regarding diabetes, more than one-half knew that if they had diabetes, they could pass it on to their children. This supported findings from Farmer et al., (1999) regarding knowledge of parental history. Chilton et al., (2006) also found age and educational level were significantly associated with knowledge of DM ($r = .36$ and $r = .33$ respectively, both $p < .05$) but gender and income were not. While education was positively related to knowledge of diabetes in this study, participants, overall, had a low level of knowledge of diabetes. The inconsistency in the Farmer et al., (1999) and Chilton et al., (2006) studies may reflect the low level of acculturation in Chilton's study that may have hindered the participants from seeking education about diabetes.

Family history for T2DM is considered a risk factor for developing the disease and, therefore, it is important to examine adolescents' knowledge of their own predisposition for T2DM. A family history in at least one parent is found in 45-80% of adolescents with T2DM. Interestingly, diabetes in the parent may not be identified until

the adolescent is diagnosed. Findings from the Farmer et al. (1999) and Chilton et al. (2006) studies suggest that knowledge of the family history risk for diabetes may be a significant predictor of one's perceived risk for the disease in adolescents.

One study in adolescents examined their perceived vulnerability to chronic conditions (Ey et al., 2000) and included T2DM as one of the conditions in the questionnaire. Findings from this study revealed that adolescents' knowledge of their mother's diabetes was not predictive of perceived vulnerability while knowledge of their father's diabetes was predictive of perceived vulnerability to diabetes for both male and female adolescents. The effect of gender on perceived risk for developing T2DM was examined in this study.

Knowledge of obesity as a risk factor for T2DM

Obesity in children and adolescents is defined as having a body mass index (BMI) at or above the sex- and age-specific 95th percentile of BMI based on Centers for Disease Control (CDC) Growth Charts: United States (CDC, 2000). According to Gortmaker et al., (1993), the likelihood that the obese adolescent will remain overweight increases with age, degree of obesity, and history of parental obesity. It has been estimated that 75% of obese adolescents will continue to be overweight into their adulthood. An elevated BMI significantly increases the potential for T2DM. The excess adipose tissue itself assumes the role of a new endocrine organ and is believed to be the cause of the obesity-related illness, not the excess weight itself (Prentice & Jebb, 2001). Obesity is well documented as one of the leading causes of T2DM (CDC, 2004). Thus, knowledge of obesity as a risk factor for T2DM may be an important prerequisite to engagement in T2DM risk

reduction behaviors. There are currently no studies found that examine knowledge of obesity as a risk factor for T2DM in adolescents.

Gordon-Larsen (2001) examined the relationships between obesity-related knowledge, attitudes and behaviors to determine how these factors influence obese female adolescents. The sample included 32 obese and 32 non-obese female adolescents, ages 11-15. Results indicated that knowledge and attitudinal factors had only a nominal impact on obesity. Rather, it was activity-related behavioral factors that were significant.

The influence of knowledge of the health risks of obesity on perceived risk, positive behavior change and the tendency to remain obese have been studied in the adult population by Kamhon and Wei-Der (2004). This study focused on the relationship between obesity and obesity health risk knowledge. Health risk knowledge was defined as “an individual’s awareness of harmful health consequences that obese people are liable to incur (p. 907)”. A secondary analysis was carried out on data from 4161 individuals over the age of 35 years, collected from the Cardiovascular Disease Risk Factors Two-Township Study (CVDFACTS) between July 2000 and December 2001. A question on the health risk perception instrument asked subjects if obesity would cause diabetes. The researchers used a quartile regression technique and found that, in men, the correlation coefficients (0.05-0.65) were positive and statistically significant. Males who were more knowledgeable that obesity is a risk factor for chronic diseases had top-normal BMIs (BMI = 24.99). These findings indicated that health risk knowledge was significantly and positively associated with BMI in males. In women, however, the health risk knowledge coefficient fluctuated around zero in all quartiles, indicating that health risk knowledge

was not associated with BMI in women. This finding supports the Gordon-Larsen (2001) study result that females did not associate health risk with obesity.

A cross sectional survey (Gross et al., 2005), examined 318 African-American college seniors' knowledge of obesity as it related to perceived risk for chronic disease. The participants were asked if they perceived that their weight placed them at risk for heart disease, cancer, and diabetes. Only sixteen percent of participants perceived risk of any disease due to their weight. Of those who perceived themselves at risk for disease due to weight, 12.3% perceived themselves at risk for diabetes. There was no difference between non-obese males and females for perceived risk of disease due to weight. Among those individuals who had a BMI greater than 30kg/m^2 , women were significantly more likely to perceive themselves at risk for chronic disease than males ($p=0.01$). In this study, 77.3% of females perceived themselves at risk compared to only 40% of males (40%). When a multivariate analysis was performed to identify factors associated with perceived risk, gender was identified as a significant factor. For males in the study, incomes $> \$20,000$ per year, a father who was overweight, being overweight as a child and body awareness were associated with perceived risk due to excessive body weight. The researcher suggested these factors were influential in the perception of risk among these male participants. In females, only being overweight as a child and body awareness were associated with perceived risk for disease due to weight and perceived risk of weight was a significant predictor of perceived risk for disease [$(\beta=-5.65, (-9.02, -2.29), p<0.01)$]. These findings suggest that weight related experiences during childhood and body awareness influenced perceived risk for disease for males (CI=95% $p<0.05$). It can be inferred from this study that personal knowledge of one's weight status may

significantly increase an adolescent's likelihood that he or she will perceive a risk for T2DM. The findings also suggest that perceived risk may vary by gender in adolescents. In the aforementioned study, disease reducing behaviors were not explored. In the study reported here, gender differences in knowledge of T2DM risks and perceived personal risk were examined. No studies have been conducted to study the relationship between knowledge of risk factors of T2DM and perceived risk in the adolescent. It was posited in this study that there would be a significant relationship between knowledge of family history and obesity as risk factors for T2DM and perceived risk.

Dietary Intake

Efforts to prevent obesity and the related risk of T2DM must include an emphasis on both a healthy dietary intake and being physically active. Only 1% of adolescents in this country are meeting all the recommended dietary daily requirements (Munoz et al., 1997). Discretionary fat and added sugar account for 40% of the child's energy intake (Munoz et al., 1997). There is a pattern of children meeting only one or none of the recommended intake of fruits, vegetables, dairy products and grains. Munoz et al., (1997) found 16% of children and adolescents did not meet the recommended amounts for any food group while only 5% met the recommendations for four or more food groups. It appears that most children and teens are not meeting the national recommendations, and the foods their food choices are higher in fat and added sugars leading to increased weight gain and an increased risk of developing T2DM (Troiano & Flegal, 1998).

In order to initiate dietary changes to reduce the development of T2DM, the adolescent must first have knowledge that poor dietary intake is a risk factor in disease causation (Vale, 2000). Knowledge alone may not be enough for modification of health

behavior, like appropriate dietary intake. In this study, it is posited that knowledge of obesity as a risk factors for T2DM is associated with perceived risk for T2DM which, in turn, is related to the extent to which adolescents engage in risk reducing dietary intake behaviors.

A study by Spikmans et al. (2003) examined perceived risk and dietary intake to determine the possible reasons for nonattendance at diabetic nutritional clinics. Guided by the Health Belief Model, the authors investigated reasons why individuals with diabetes do not make use of the dietician. Variables examined in the study included risk perception, body-mass index, self-rated health, health locus of control, satisfaction with the dietician, feelings of obligation to attend, and compliance with visits to other healthcare providers. Of the 293 individuals who participated in the study, 166 were attendees and 127 were non-attendees. Non-attendees were defined as a patient who missed at least one visit with the dietician. The data were collected by both telephone interview and from the patient record. The average age of participants was 48.4 years, the mean length of time the participants had diabetes was 10.4 years, and the mean BMI for the sample was 28.9. Participants were divided into two groups; “attendees” (n=166) and “non-attendees” (n=127). Findings indicated that participants who reported lower perceived risk of complications related to their diabetes were more likely to be “non-attendees” ($t=3.0$, $d.f.=289$, $p < 0.05$). This suggests that perceived risk may be directly related to risk-reducing behaviors.

In another study of 63 males and females between the ages of 18-21 years, Vale (2000) examined the perceived importance of cardio-protective health behaviors. Seventy-six percent of the participants identified a “healthy diet” as an important health

behavior to prevent heart disease, and 87% indicated that prevention was important to them. These findings suggest that participants may be aware of the relationship between diet and risk for heart disease and supports the need for an examination of adolescents' knowledge of risks for T2DM, their perceptions of risk for this condition, and their actual dietary intake risk reducing behaviors.

The link between children's knowledge of risks for cardiac disease and behavior change was demonstrated in the Child and Adolescent Trial for Cardiovascular Health (CATCH) study (Luepker et al., 1996). This randomized controlled field trial included 5106 third graders. The intervention group was provided with knowledge about cardiac risk and well-balanced diet using a food recall that established daily eating patterns. The intervention group demonstrated a significant decrease in total fat ($p=.001$), saturated fat ($p=.005$) and cholesterol intake ($p=.05$). The findings from this intervention study demonstrate a significant relationship between knowledge of risks for cardiac diseases and the risk reducing behavior of well-balanced diet in children and support the hypothesis that there may be an association between knowledge of risk for diabetes and dietary intake to prevent T2DM.

Physical Activity

Regular physical activity is associated with a lower risk of developing diabetes (Healthy People 2010, 2006). According to the CDC (2002), nearly half of America's youth are not vigorously active on a regular basis. Nationwide, 46% of students do not attend physical education (PE) classes on one or more days in an average week and only 33% of students attend PE classes daily.

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, 2002). Regular moderate physical activity, as defined by the U.S. Department of Health and Human Services, is a pattern of activity that is performed most days of the week, preferably performed daily. Exercising five or more days of the week for at least 30 minutes meets the goal of regular physical activity (CDC, 2002). Troiano, Briefel, Carroll & Bialostosky (2000) have suggested that decreased activity may be even more of a contributing factor to obesity than increased calorie consumption in the adolescent population.

While it is important to be physically active for prevention of disease, there were no studies that solely examined the link between diabetes risk perception and physical activity. Several studies have examined physical activity as a behavior that could delay or prevent chronic disease. A study by Hunter and O’Dea (1999) examined perceptions of cardiovascular disease, cancer and osteoporosis risk in mid-aged women with and without behavioral changes (diet, physical activity and smoking) and hormone replacement therapy (HRT). The sample included 103 mid-aged women, ages 49-55, who were asked about their likelihood of developing these diseases if they improved their health behaviors compared to the use of HRT for five years. Results indicated that 30% of women considered themselves at equal risk for all three diseases. The researchers found that the women’s perception of risk for developing disease was reduced by approximately 10% for cardiovascular disease and approximately 8% for osteoporosis by improving health behaviors. Risk perception resulted in improved health behaviors which were found to be statistically significant in preventing both cardiovascular disease

($t=4.70$, $df=85$, $P=<0.001$) and osteoporosis ($t=5.81$, $df=71$, $P=<0.001$). The authors found that women believed improving their health behaviors (smoking, diet and physical activity) would alter their risk of developing cardiovascular disease and osteoporosis. The study did not break down the individual effects of smoking, diet and physical activity but one can extrapolate that risk perception for developing disease may be related to an increase in physical activity behaviors.

A study done by Peltzer (2000) examined risk awareness of five different health problems (heart disease, lung cancer, mental illness, breast cancer, high blood pressure) and four health behaviors, one of which was physical activity in a sample of 793 Black university students chosen at random. The students' ages ranged from 18-25 years. The findings revealed risk awareness was not associated with exercise as a health behavior. Multiple regression analysis showed that belief that regular exercise is important ($\beta=2.72$, $t=7.148$, $p<.001$) and gender (men exercised more than women) ($\beta=.098$, $t=2.571$, $p<.010$) significantly predicted exercise behaviors. It is possible that the participants did not perceive risk because they already believed that regular exercise was important and were already exercising. In another study, Vale (2000) examined whether prevention of heart disease was important to adolescents. In the study an open-ended question asked "What can someone do to prevent heart disease?" Seventy-six percent identified regular exercise as a preventative measure. The authors noted that this finding suggests that participants were aware of the relationship between regular exercise and heart disease and supports a need to examine adolescents' physical activity behaviors, given their perception of risk for T2DM. This may demonstrate that knowledge of risk factors

increases perceived risk which, in turn, motivates the individual to participate in the risk reducing behavior of physical activity.

The link between knowledge, perceived risk and physical activity was also supported in the previously mentioned CATCH intervention study (Luepker et al., 1996). Children in the intervention group were provided with knowledge about cardiac risk and proper physical activity to prevent the disease. In the intervention group, there was a significant increase in moderate to vigorous physical activity in physical education classes in comparison to the control groups ($p < .02$). 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). This study demonstrates a significant relationship between knowledge of risk for cardiovascular disease, and risk reducing behavior of physical activity, and supports the need to examine perception of risk as one mechanism, i.e., mediator, for explaining the effect of knowledge of risks of T2DM on engagement in physical activity risk-reducing behaviors in adolescents.

Perceived Risk

When examining the psychological nature of the adolescent, early studies describe the “personal fable” (Elkind, 1978) as the most accepted view of the adolescent psyche. This view presented the theoretical proposition that adolescents have an exaggerated sense of uniqueness (egocentrism), which leads them to believe that they are immune to the natural laws that relate to adults. The personal fable is linked to the adolescent’s perceived invulnerability to harm and adolescent risk taking. More recent empirical studies do not support the personal fable (Millstein & Halpern-Felsher, 2002; Quadrel et al., 1993). In fact, Milstein and Halpern-Felsher (2002) found that younger

adolescents perceived themselves at greater risk than did older adolescents ($F(3,573) = 5.1, p = .002$). Millstein and Halpern-Felsher (2002) proposed that higher perceived risk may be related to what younger adolescents have been taught about the risk of specific behaviors. With maturation and experience, the older adolescent realizes that these risky behaviors may not always lead to a negative outcome.

The terms “perceived risk” and “perceived susceptibility” are used synonymously in the literature (Janz and Becker, 1984). Jacobs (2002) defines susceptibility as “an individual’s feelings or perceptions of being harmed, whether actual or anticipated, for which one has some control over the behavior” (p. 7). Perception of risk is considered a prerequisite step in the adoption of health-promoting behaviors (Becker, 1974). The majority of published research in this area focuses upon perceived risk in adults. It has been demonstrated that adults who perceive themselves at risk for developing a disease are more likely to participate in risk reducing behaviors to reduce the risk of developing the disease (Janz & Becker, 1984; Schwarzer & Renner, 2000).

The Health Belief Model (HBM) has been the most widely used theory to study perceived risk (van der Plight, 1998). Perceived risk for illness and disease in adults has been examined extensively. Relationships between chronic diseases and perceived risk have been demonstrated in breast cancer (Champion, 1993, 1998, 1999), colon cancer (Jacobs, 2002), and peripheral arterial disease (Hayden, 2003). However, few studies in the adolescent literature examined perceived risk for illness, and no studies were found that solely examine perceived risk for developing T2DM. Bush and Iannotti (1990) adapted the Health Belief Model for use with children and adolescents, and developed the Health Belief Model for Children and Adolescents (CHBM). This model integrates

components from the Health Belief Model, Social Cognitive Theory, Cognitive Development Theory and Behavioral Intention Theory to explain children's illness behavior, expectations and intentions (Bush & Iannotti, 1990) (see Figure 3). Unlike the original HBM, the CHBM examines the child's health behavior within a personal and social environmental context. Bush and Iannotti (1990) retained all of the elements of the HBM (Becker, 1974) and argued that a comprehensive developmental model should include personal, social and environmental influences. Bush and Iannotti (1990) tested the CHBM using path analysis to examine medication compliance in children in five common health areas including colds, fever, upset stomach, nervousness and trouble sleeping. The sample included 270 urban children ranging in age from 8 to 14 stratified by socio-economic status, grade level, gender and primary care taker. The model was effective in predicting children's intention to take action (health behaviors) in response to common health problems (common cold, fever), accounting for 63% of the variance. Severity of illness ($\beta=0.46$) and benefit of taking medicine ($\beta=0.39$) were the strongest predictors. Weaker but significant predictors were illness concern ($\beta=0.11$) and perceived vulnerability ($\beta=0.17$). Bush and Iannotti (1990, 1993) noted two key developmental findings relating to primary caretakers' attitudes and children's attitudes regarding medication readiness. Although the primary caregiver did exert some influence on the child's readiness and expectation to take medicine (sum of paths=-0.10), the children's own cognitions and attitudes exerted a stronger influence (sum of paths = -0.25) than the primary caregiver's attitude. It appears that the children's own cognition and attitudes were the strongest predictors of appropriate medication use.

The Health Belief Model for Children and Adolescents, which is the same as the CHBM, was tested in a study (Palermo et al., 1996) that examined postoperative pain in 28 children ages 7-17 years of age. The participants rated their expected pain after surgery, anticipatory anxiety and expected helpfulness of pain medicine. The variables that were significant predictors of children's postoperative pain were age ($R^2 = .14$, $F(1.26) = 4.23$, $p < .05$), total analgesia (R^2 change = .19, $p < .01$) and anticipatory anxiety (R^2 change = .26, $p < .003$). This study validated the impact of cognitive/affective and environmental factors in the Children's Health Belief model. It was expected that the model would be similarly useful in evaluating the relationship between cognitive factors and behavior in this study.

Theoretical Framework

This study was guided by the CHBM and the empirical literature. The CHBM theory is based upon the original components of the HBM including the element of "readiness to take action". Readiness to take action includes the "the level of threat posed by the health problem as determined by the individual's perception of the problem's severity and perception of vulnerability to it" (Becker, 1974). In this study the researcher is examining the Readiness Factor, perceived illness threat (risk) for developing T2DM. Bush and Iannotti (1990) incorporated the HBM and developmental theories. The Cognitive Developmental Theory (CDT) "emphasizes the role of developmental changes in cognitive processes that influence children's understanding of social and physical events (p70)". CDT is considered a Modifying Factor in the CHBM. In this study the researcher is studying the cognitive/affective domain of knowledge of family history and knowledge of obesity for developing T2DM. Also incorporated into the CHBM is the

Behavioral Intention Theory (BIT), which stresses particular behaviors and “indicates that behavior intentions are the best available predictor of behavior” (Bush & Iannotti, 1990, p.70). This theory was utilized in the CHBM as Behavior Factors. In this study the researcher is examining the Behavior Factors of physical activity and dietary intake.

The purposes of this study were three-fold. The first was to test the CHBM proposition that modifying factors influence readiness by examining whether knowledge of family history and obesity risks of T2DM are significantly related to perceived risk of T2DM. The second purpose of the study, based on findings from the empirical literature was to examine the relationships between perceived risk and dietary intake and physical activity. The third purpose of this study, based on the CHBM and the empirical literature, was to test the mediating effect of perceived risk on the relationship between knowledge of T2DM risk factors and T2DM risk reducing behaviors (dietary intake and physical activity) in a sample of adolescents (see Figures 2 & 3).

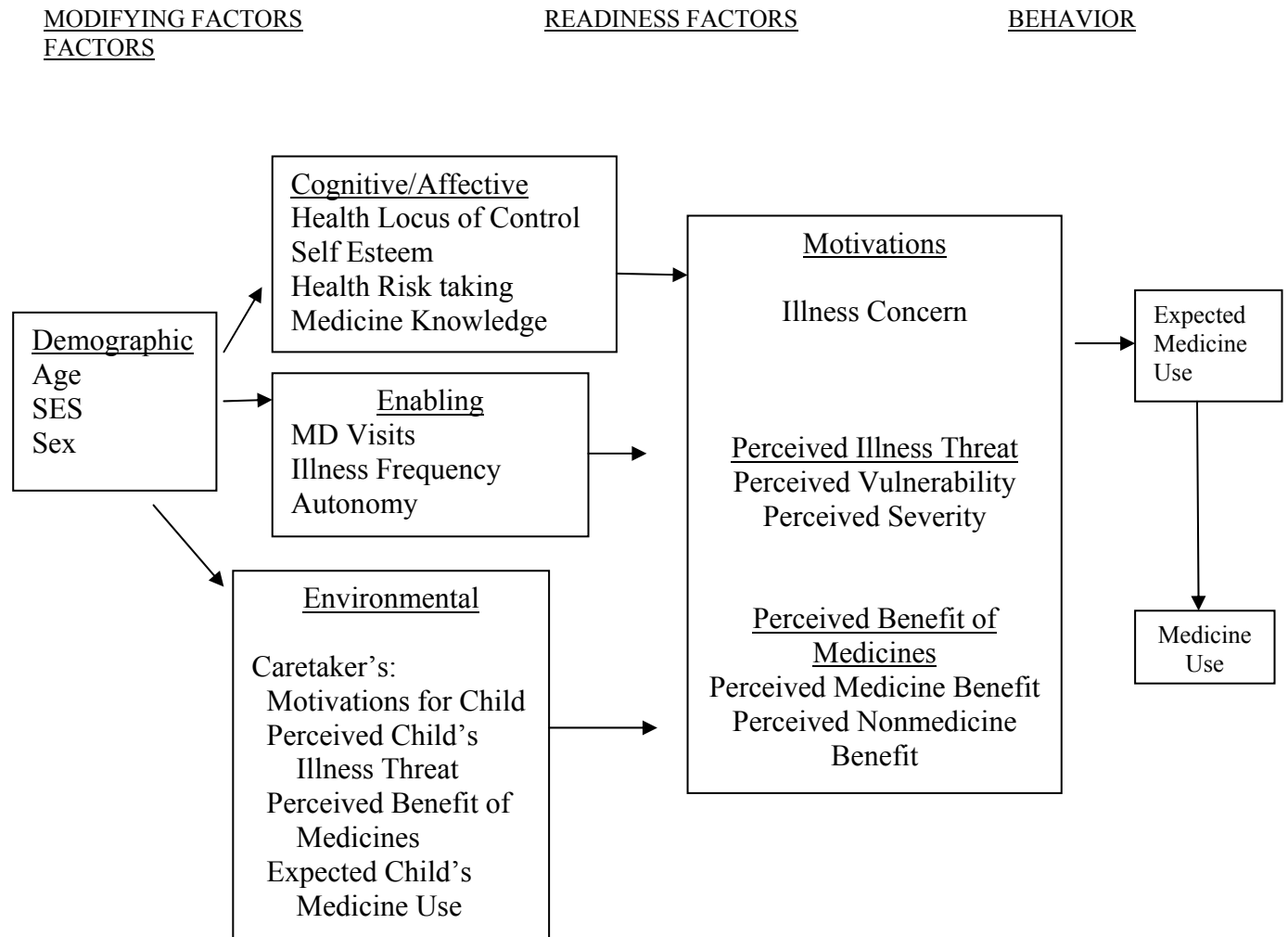


Figure 1: The Children's Health Belief Model (Bush & Iannotti, 1990).

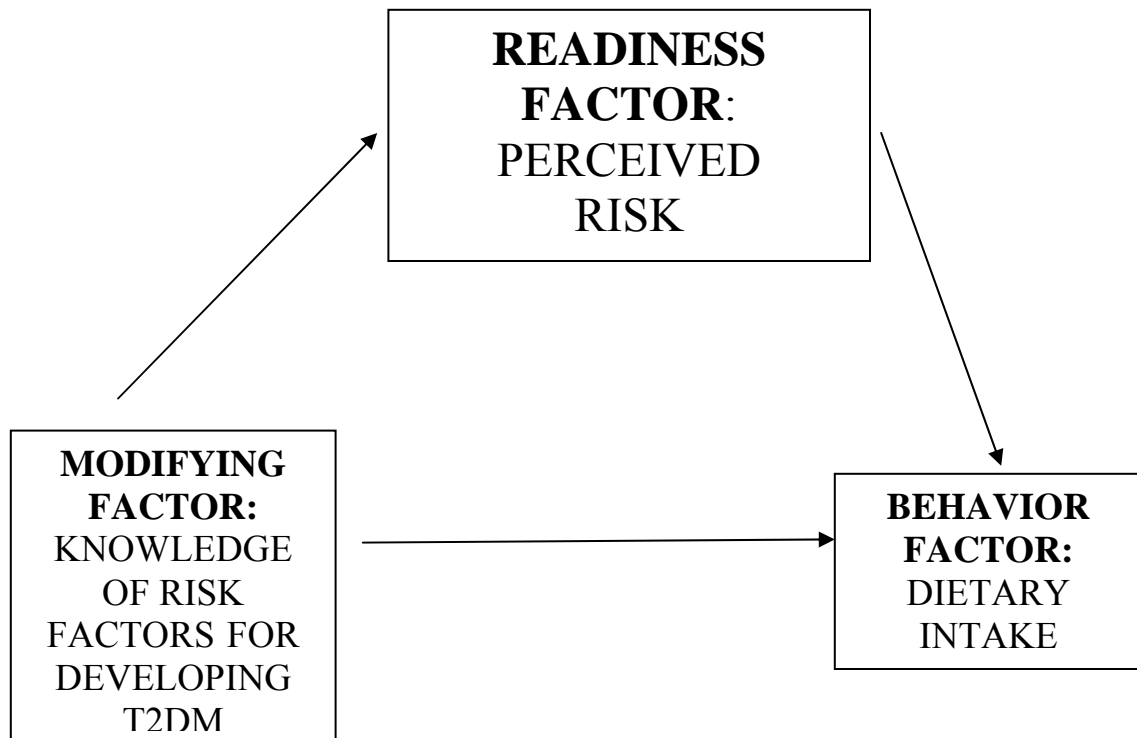


Figure 2: Mediational Model of the relationship between knowledge of risk factors for developing T2DM and dietary intake with perceived risk as the mediating variable.

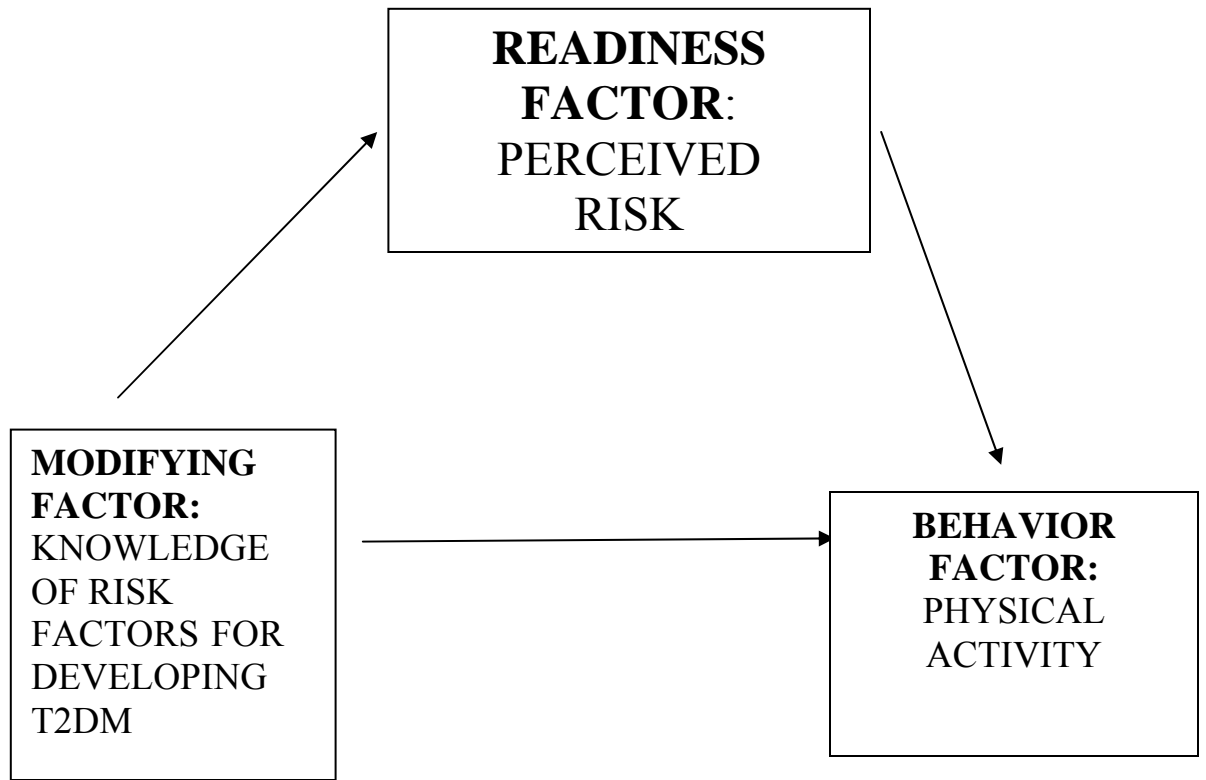


Figure 3: Mediational Model of the relationship between knowledge of risk factors for developing T2DM and physical activity with perceived risk as the mediating variable.

CHAPTER III

Methods

A cross-sectional descriptive design was used for this study. Consistent with assumptions for a correlational design (Brink & Wood, 1998), this study examined the relationships among the dependent variables of perceived risk, dietary intake and physical activity and the independent variable of knowledge of risk factors for T2DM. The proposed relationships discussed above are theoretically supported by the Children's Health Belief Model (Bush & Iannotti, 1990). The plan in this study was to examine the relationship between perceived risk and knowledge of risk factors for T2DM by testing two mediational models (Baron & Kenny, 1986) with the variables of dietary intake and physical activity developed through theory and research. These variables were examined, as they naturally exist. This section will include a discussion of the research setting, sample, instruments, procedure for data collection, and the plan for data analysis.

Research Setting

The research settings were two private high schools and two Boy Scout troops in the New York City area. One high school (all girls) has approximately 400 students. The other high school (all boys) has approximately, 500 students. These schools are private independent catholic high schools; the students are predominately middle-class and Caucasian.

The Sample

A convenience sample of male (n=34) and female (n=34) students was recruited. Students ranged from 13-19 years of age. Inclusion criteria were as follows: (1) male or female high school student, (2) age 13-19 years, (3) English-speaking.

Students with a history of Type 1 or Type 2 diabetes, a current pregnancy, or any chronic disease were excluded from the study.

Power Analysis

The sample size was calculated using Cohen's (1987) sample size justification for a multiple linear regression. The number needed to achieve 80% power in the analysis, with two independent variables (predictors), an alpha of 0.05, and a moderate effect size is $n = 67$. The researcher did oversample by 10-15% to accommodate for possible attrition during data collection, analyses and for outliers. The final sample was 80 subjects.

Instruments

Demographic/Medical History Questionnaire

The demographic/medical history questionnaire (see Appendix A) developed by the researcher consists of 9 items which address: gender, age, year in high school, race/ethnicity, family history of type 2 diabetes, and health history. The investigator assessed each subject's height and weight. Height was measured using a SECA 206 Body Measuring Tape. This is 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. The researcher chose this scale for its several reasons: 1) it is a mobile and lightweight unit, 2) accuracy is accomplished automatically, it adjusts to zero (null balance) at every weighing, 3) its graduation is .2 lbs for a precise weight.

The Godin Leisure-Time Exercise Questionnaire

The Godin Leisure-Time Exercise Questionnaire is a 4 item self-administered instrument used to measure 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 which causes the individual’s heart to beat rapidly. The item responses are “often”, “sometimes”, “never”, and “rarely”. This is called the “sweat score.” Finally a total score can be computed by totaling all four questions.

Several studies examined internal consistency of the Godin-Shepard subscales. The two studies in adults reported marginal to low reliability coefficients (.24 to .84). However, in school-age children, the instrument performed well ($\alpha = .81$), supporting its use in the proposed study (Godin & Shepard, 1997).

Godin and Shepard (1985) established test-retest reliability over a two-week period in a sample of 53 healthy adults. Pearson Product Moment Correlation coefficients were reported for light exercise ($r=0.48$), moderate exercise ($r=0.46$), strenuous exercise ($r=0.94$), total leisure score ($r=0.74$) and sweat score ($r=0.80$).

Jacobs et al. (1993) established test-retest reliability over a two-week period in a sample of 28 males and 50 females, ages 20-59 years old. Correlation coefficients were light exercise, $r=0.24$, moderate exercise, $r= 0.36$ strenuous exercises, $r= 0.84$, total leisure score, $r=0.62$ and sweat score $r= 0.69$.

In the only published study with adolescents, Sallis et al. (1993) established test-retest reliability for the Godin-Shepard total score over a two-week period in a sample of 319 male and female 5th, 8th and 11th grade students. Correlation coefficients varied by

age, and were $r=0.69$ for 5th grade students, $r=0.80$ for 8th grade students, and $r=0.96$ for 11th grade students. For the total sample, test-retest reliability was 0.81. These studies support the use of the Godin-Shepard total score in this study.

Validation studies were conducted by Godin and Shepard (1985) by correlating maximum oxygen consumption and body fat using Pearson Product Moment correlations with the activity data of the Godin Leisure-Time Exercise Questionnaire. A significant positive correlation would indicate reduction in body fat related to higher caloric intake. Significant correlations would be unlikely at less than strenuous exercise. The sample consisted of individuals between the ages of 18-65 years old. There were 163 men and 143 women who participated in the study. For light exercise the correlation between the Godin-Shepard Leisure Time Exercise Questionnaire scores and maximum oxygen consumption was $r= 0.04$, and between the questionnaire and body fat was $r=0.06$, with no significance for either correlation. For moderate exercise, correlations were $r= 0.03$ for maximum oxygen consumption and $r= 0.08$ for body fat, also with no significance. For strenuous exercise, the correlation with maximum oxygen consumption was $r= 0.38$ and with body fat $r= 0.21$; both were significant at $p < 0.05$. These findings support the validity of the Godin-Shepard Leisure-Time Exercise Questionnaire.

Jacobs et al. (1993) established validity of the Godin-Shepard Leisure-Time Exercise Questionnaire by correlating leisure scores and the sweat score to: 1) Caltrec [an accelerometer which measures caloric expenditure (CAL)]; 2) a 4-week physical activity history derived from the Minnesota Leisure-Time Physical Activity Questionnaire (FWH); 3) Treadmill Time (TRM); 4) percentage of body fat (BF); 5) forced expiratory volume (FEV); and 6) maximum oxygen consumption (VO₂ max). The

sample consisted of 26 males and 50 females between the ages of 20-59 years of age. Validity of the leisure and sweat subscales of the Godin-Shepard Leisure Time Exercise Questionnaire was supported using the Caltrec. Correlation between the Caltrec and leisure score was $r = 0.32$ and between Caltrec and sweat $r = 0.29$; both were significant at $p < 0.05$, supporting validity. Using the FWH, correlation with leisure was $r = 0.36$ and sweat was $r = 0.31$; both were significant at the $p < 0.05$ level, also supporting the instrument's validity. Using the TRM, the correlation with the leisure score $r = 0.57$ and with the sweat score was $r = 0.52$; both were significant at the $p < 0.05$ level, supporting the instrument's validity. Using the BF, the correlation with the leisure score was $r = -0.43$ and with the sweat score was $r = -0.40$; both were significant at the $p < 0.05$ level. The correlation between VO2 max and the leisure score was $r = 0.56$ and correlation with the sweat score was $r = 0.57$, both significant at the $p < 0.05$ level, supporting the instrument's validity. Using the FEV the correlation with the leisure score was $r = 0.03$ and correlation with the sweat score was $r = -0.11$, both were nonsignificant.

Sallis et al. (1993) established validity of the Godin Shepard Leisure-Time Exercise Questionnaire by correlating total questionnaire scores with other measures of activity. The sample consisted of 102 male and female students in 5th, 8th and 11th grades. The correlation between the instrument and the Activity Rating Scale was $r = 0.32$ and between the instrument and the Klocal/d (kilocalorie expenditure index) was $r = 0.39$; both were significant at the $p < 0.05$ level. These findings support the validity of the Godin-Shepard Leisure-Time Exercise Questionnaire in school-age children.

Knowledge of risk factors for T2DM in Adolescents

Beliefs about Type 2DM Health in Adolescents

There are no instruments available to study the perceived risk for T2DM or to examine the knowledge of risk factors for T2DM in the adolescent. The researcher investigated adult tools that were available and found a tool “The Risk Perception Survey for Developing Diabetes” (RPS-DD) developed by Walker, Mertz, Kalton, Flynn (2003) to measure personal risk perception for developing diabetes in healthy adults. In addition, the researcher revised parts of this previously developed adult instrument “Risk Perception Survey for Developing Diabetes” (Walker et al., 2003). Two instruments were created “Beliefs about Developing T2DM in Adolescents” and the “Knowledge of risk factors for T2DM”. The instruments were sent to four experts in the area of perceived risk and diabetes for review then pilot tested in an adolescent population.

Content Validity

The instruments were reviewed by four experts in the fields of nursing, psychology and medicine. There was one overall change to both instruments. The title of the surveys was changed to contain the words “type 2 diabetes” instead of diabetes alone since two experts felt that failure to differentiate between the diseases could substantially alter the response the adolescent may chose. There were several changes on the “Knowledge of risk factors for T2DM” instrument. One expert requested the addition of four questions regarding metabolic syndrome since it is a syndrome associated with the development of T2DM. There was one change to the perceived risk instrument “Beliefs about T2DM”. The words “to me” were added to the statement “My

worrying about getting diabetes is very upsetting”. This was done to personalize the possibility to the adolescent rather than having it as a general response to worry. Once the changes to the tool were completed the tool was pilot tested.

Pilot Study

Sample

A pilot study was conducted to assess the instruments for their psychometric properties. A convenience sample of 203 high school students (25 girls/177 boys) in the New York area was utilized for the pilot study. Institutional cooperation was secured from each high school and it was approved by the Institutional Review Boards (IRB) of Rutgers, the State University of New Jersey and the College of Staten Island. The subjects were selected from volunteers at the school using a recruitment letter that was sent home with the student explaining the study, along with the parental and student consent forms (see Appendix B and Appendix C). There was great difficulty in the return of the parental consents to the school. One school decided to make the completion of the consents part of their curriculum, the IRB waived parental consents and only an assent from the student was needed. The other school chose to continue with parental consents. Participation was completely anonymous. The surveys were administered during homeroom period. Students who chose not to participate engaged in their usual activities. The completed surveys were placed in a manila envelope by the students and the envelope was collected by the investigator.

Pilot Study Data Analysis

Given the disproportionate number of boys in the sample an independent-samples *t-test* was conducted to evaluate whether there were baseline differences between sexes.

The test was nonsignificant, indicating there were no baseline differences. Since there was no difference between the genders the data were combined and a factor analysis was conducted. The dimensionality of 14 items in the Beliefs about Type 2 Diabetes Health instrument was analyzed using maximum likelihood factor analysis employing SPSS version 11 (2001). Two criteria were used to determine the number of factors to rotate: the scree plot and the interpretability of the factor solution (Green & Salkind, 2003). The scree plot indicated that the instrument was not unidimensional. Based on the plot, the factors were then rotated using a Varimax rotation procedure. The acceptable eigenvalue of the variables that determined the five factor solution was 1.0. Items with loading of .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. Only one item loaded on two factors: personal control and worry. It was decided that the more theoretically appropriate placement of the factor was personal control.

Confirmatory factor analysis was also carried out on the second instrument, The Knowledge of Risks for Developing Type 2 Diabetes Scale. The dimensionality of 15 items was analyzed using maximum likelihood factor analysis. Two criteria were used to determine the number of factors to rotate: the scree plot and the interpretability of the factor solution (Green & Salkind, 2003). The scree plot indicated that the instrument was not unidimensional. Based on the plot the factors were rotated using Varimax rotation procedure. The rotated solution yielded three factors explaining 59.4% of the variance: race, endocrine abnormalities and physiological factors.

After completing the factor analysis, reliability coefficients were obtained. In the first instrument, Beliefs about Type 2 Diabetes Health, three factors demonstrated very strong alphas. Optimistic bias, a two item factor, demonstrated an alpha of .79. Dread, a three item factor demonstrated an alpha of .77 and worry, a two item factor demonstrated an alpha of .61. As this is exploratory research, these reliability coefficients are satisfactory. The final two factors personal control and unknown risk were found to have less than satisfactory reliabilities at .47 and .47 respectively, it was decided that although these two factors did not have strong reliabilities, theoretically, they needed to remain as part of the scale for the study.

The second instrument, Knowledge of Risks for Developing Type 2 Diabetes was also subjected to reliability testing. The Cronbach's alpha reliability for the 15 item scale was satisfactory at .80.

24 hour Dietary Recall

According to Nelson (1989) the best use of the 24-hour recall method is 7 to 10 day dietary recalls. It has been found that this is not a practical matter. A single 24-hour recall was used in all the NHANES studies until 2002 when one 24-hour dietary recall was amended to two 24-hour dietary recalls. Based on personal communication from Nurgul Fitzgerald Ph.D., R.D., Assistant Professor/Extension Specialist Department of Nutritional Sciences Rutgers, the State University (Personal Communication, December 4, 2007) the guidelines for the NAHNES studies are two 24-hour dietary recalls. In the proposed study, two 24-hour dietary recalls, one weekday and one week-end day, were used since dietary options for intake can change on weekends (Gortmaker, Cheung, Peterson, Chomitz & Cradle, 1999).

In one validation study conducted by Lytle et al., (1993), 24-hour dietary recall was carried out with a self-selected sample of 49 third-grade children and their parents. This data collection was part of the Child and Adolescent Trial for Cardiovascular Health study. A trained staff member observed children and parents during mealtime at school. The parents observed and recorded what the children ate at home. The following day, children were asked to provide a 24-hour dietary recall interview. Children's ability to recall what they consumed during a 24-hour period was compared with observational data collected during the same period. Recalled and observed data were compared using mean energy and nutrient analysis. Recalled and observed nutrients using Spearman rank correlations ranged from .45 to .79. There was a 77.9% agreement across all meals in the food items children recalled having consumed compared with what the adults actually observed them consuming. The researchers' conclusion was that 24-hour recall assisted by food records is a valid method for assessing the dietary intake of children as young as 8 years old. The 24- hour dietary recall data were analyzed using the Foodworks Version 10.1.

Procedures for Data Collection

The researcher obtained permission from the principal at each data collection site to meet with the students during a free classroom period to explain the purpose of the study, the expected time required (approximately one hour) to complete the questionnaires, including the Demographic/Medical History Questionnaire, Godin-Shepard Leisure Exercise Questionnaire Revised, two 24-hour dietary recalls, and the Knowledge of Risk for Developing Type 2 Diabetes, and Beliefs about Type 2 Diabetes Health. The researcher obtained the participant's height and weight, following the

completion of study instruments, to calculate BMI. Once the principal provided permission, the researcher met with the students in the school auditorium to explain the study. The students who gave assent to participate in the study, were sent home with a letter explaining the study and requesting one of the parents' or guardians' consent. The researcher returned at an agreed upon date for the commencement of data collection. The researcher worked with groups of 2-20 students at a time for data collection. The data collection occurred during lunch periods. For students who gave assent and whose parents or guardians granted consent, these forms were collected and placed in a separate envelope prior to the administration of questionnaires. This process took approximately 35 minutes per group.

The Institutional Review Board of Rutgers, the State University of New Jersey, and the College of Staten Island, City University of New York approved this study before the collection of data commenced. Prior to administering the instruments to the participants, the participants were assigned a numerical code that was linked to the corresponding name in the study logbook. Completed forms were kept in a locked file cabinet. The logbook and consents were kept in a separate locked file cabinet to ensure confidentiality. Only the investigator had access to this information. Data from the study demographic and health history form, Godin-Shepard Activity Instrument, Knowledge of Risk for Developing Type 2 Diabetes, Beliefs about Type 2 Diabetes Health were entered into the Statistical Package for Social Sciences (SPSS), version 11 (SPSS, 2001) by the investigator on a password protected computer, cleaned and scored when appropriate, and analyzed. Descriptive and inferential statistical procedures were employed to test the hypotheses.

Plan for Data Analysis

The plan for data analysis was to compute descriptive statistics of the study variables the behavioral instruments and demographic data. The researcher then examined reliabilities of the: Godin Shepard Leisure-Time Exercise Questionnaire Revised, 24 Hour Dietary Recall, Knowledge of Risk Factors for Developing Type 2 Diabetes, and Beliefs about Type 2 diabetes Health.

The following hypotheses were tested:

Hypothesis 1: There will be a positive correlation between knowledge of risk factors for T2DM and dietary intake.

This hypothesis was tested using Pearson's Product Moment correlations. The significance for hypothesis 1 was $P \leq .05$.

Hypothesis 2: There will be a positive correlation between knowledge of risk factors for T2DM and physical activity.

The hypothesis was tested using Pearson's Product Moment correlations. The significance for hypothesis 2 was $P \leq .05$.

Hypothesis 3: There will be a positive correlation between knowledge of risk factors for T2DM and perceived risk.

The hypothesis was tested using Pearson's Product Moment correlations. The significance for hypothesis 3 was $P \leq .05$.

Hypothesis 4: There will be a positive correlation between perceived risk and dietary intake.

The hypothesis was tested using Pearson's Product Moment correlations. The significance for hypothesis 4 was $P \leq .05$.

Hypothesis 5: There will be positive correlation between perceived risk and physical activity.

The hypothesis was tested using Pearson's Product Moment correlations. The significance for hypothesis 5 was $P \leq .05$.

Hypothesis 6: Perceived risk will mediate the relationship between knowledge of risk factors and dietary intake.

It was proposed that the mediational model would be tested using a series of three regression equations as specified by Baron and Kenny (1986). In this model perceived risk (the mediational variable) would be regressed on knowledge of risk factors for T2DM (the independent variable). The second equation would regress dietary intake (the dependent variable) on knowledge of risk factors for T2DM (the independent variable). The third equation would regress dietary intake (the dependent variable) on knowledge of risk factors for T2DM (the independent variable) and perceived risk (the mediating variable).

According to Baron and Kenny (1986) the following conditions must be met for mediation to occur. Knowledge of risk factors for T2DM (the independent variable) must effect perceived risk (the mediating variable) in the predicted direction in the first equation. In the second equation, knowledge of risk factors for T2DM must affect dietary intake (the dependent variable) in the predicted direction in the second direction. Finally, in the third equation perceived risk (the mediating variable) must affect dietary intake (dependent variable) in the predicted direction in the third equation.

If all of these conditions are met, the effect of knowledge of risk for T2DM (the independent variable) on dietary intake (the dependent variable) must be less in the third

equation. Perfect mediation would occur if knowledge of risk factors for T2DM (independent variable) no longer has a significant effect on dietary intake (the dependent variable) when perceived risk (mediating variable) was controlled for in the third equation.

Hypothesis 7: Perceived risk will mediate the relationship between knowledge of T2DM and physical activity.

The mediational model was tested using a series of three regression equations as specified by Baron and Kenny (1986). In this model the first equation regressed would be perceived risk (the mediational variable) on knowledge of risk factors for T2DM (the independent variable). The second equation would regress physical activity (the dependent variable) on knowledge of risk factors for T2DM. The third equation would regress physical activity (the dependent variable) on both knowledge of risk factors for T2DM (the independent variable) and perceived risk (the mediating variable).

According to Baron and Kenny (1986) the following conditions must be met for mediation to occur. Knowledge of risk factors for T2DM (the independent variable) must effect perceived risk (the mediating variable) in the predicted direction in the first equation. In the second equation knowledge of risk factors for T2DM must affect physical activity (the dependent variable) in the predicted direction in the second direction. Finally, in the third equation perceived risk (the mediating variable) must affect the physical activity (dependent variable) in the predicted direction in the third equation.

If all of these conditions are met the effect of knowledge of risk for T2DM (the independent variable) on physical activity (the dependent variable) must be less in the third equation. Perfect mediation would occur if knowledge of risk factors for T2DM (IV) no longer has a significant effect on physical activity (the dependent variable) when perceived risk (mediating variable) was controlled for in the third equation.

Chapter 4

Analysis of Data

The purpose of this study was to examine the relationship between two dependent variables, (a) dietary intake and (b) physical activity, and each of the independent variables (a) knowledge of risk factors for T2DM and (b) perceived risk for T2DM. In addition, the relationship between perceived risk and knowledge of risk factors for T2DM was also tested. The researcher further planned to examine the mediating effect of perceived risk on the relationship between knowledge of risk factors for T2DM and dietary intake and the mediating effect of perceived risk on the relationship between knowledge of risk factors for T2DM and physical activity. A convenience sample of 86 students was recruited from two private high schools and two Boy Scout troops in the New York City area. Students' ages ranged from 13-18 years. Instruments used included the investigator-developed Health Beliefs for Developing T2DM scale and the Knowledge of Risk Factors for Developing T2DM scale, the Godin-Shepard Leisure-Time Exercise Questionnaire (Godin & Shepard, 1985), two 24-hour dietary recalls and a demographic/medical history questionnaire. Six participants were excluded from analyses because of a history of chronic disease. The final sample consisted of 80 respondents.

Participants included 35 male and 45 female students. This chapter presents the findings that resulted from the analyses of data.

Statistical Description of the Variables

Demographic Data

Subjects' ages ranged from 13-18 years ($M = 16.1$, $SD = 1.14$). There were eighteen 9th graders, ten 10th graders, thirty-one 11th graders, and twenty-one 12th graders. The sample was primarily Caucasian (n=62, 77.5%) (see Table 1). There were 32 students (40%) who had a family history of T2DM. The majority (n=56, 70 %) had a healthy BMI; based on BMI 16, (20%) students were considered overweight and 6(7.5%) were obese (see Table 1).

Table 1

Demographic Data (N=80.0)

Variable	N	%
<u>Gender</u>		
Male	35	43.8%
Female	45	56.3%
<u>Racial Background</u>		
Caucasian	62	77.5%
Black	2	2.5 %
Hispanic	6	7.5%
Asian	2	7.5%
Mixed	8	10%
<u>BMI Percentile</u>		
5 th (Underweight)	2	2.5%

5 th to 85 th (Healthy Weight)	56	70%
85 th to 95 th (at Risk for Overweight)	16	20%
95 th and Above (Overweight)	6	7.5%

On the Knowledge of Risk Factors for T2DM, which measured what the adolescent knew about the risk factors for T2DM, scores ranged from 4 to 11 (M=7.01,SD=1.56), the mean suggests a moderate level of knowledge for the overall for the sample. On the Health Beliefs for Developing T2DM, which measured if the adolescent perceived themselves to be at risk for T2DM, scores ranged from 9 to 25 (M=17.12, SD=3.07), the mean suggests low perceived for the overall sample. The Godin-Shepard Leisure-Time Exercise Questionnaire, which measured how often the adolescent participated in leisure-time exercise, the scores ranged from 1-4 (M= 1.7, SD=.98), the mean score indicates a moderate level of leisure time activity. These findings are summarized in Table 2.

Table 2

Descriptive Statistics of Study Variables (N=80)

Variable	Range	M	Mdn	SD
Knowledge of Risk Factors for T2DM	4-11	7.01	7.00	1.56
Health Beliefs for Developing T2DM	9-25	17.12	17.00	3.07
Godin-Shepard Leisure-Time Exercise Questionnaire	1-4	1.71	1.0	.98

Psychometric Properties of the Instruments

All of the instruments demonstrated coefficient alphas for internal consistency reliability lower than .70. Nunnally (1994) stated .70 is the minimum acceptable level for instrument reliability. The Knowledge of Risk Factors for T2DM had a coefficient alpha of .65, which was lower than the alpha .80 observed in the pilot study with a similar population. The Health Beliefs for T2DM had a coefficient alpha of .59, which was higher than the pilot study alpha of .46. The Godin-Shepard Leisure-Time Exercise Questionnaire had a coefficient alpha of .56, lower than that reported in the study of school-age children in which the instrument performed well (alpha = .81), (Godin & Shepard, 1997). Table 3 summarizes these findings.

Table 3

Coefficient Alpha Reliabilities for Study Variables (N=80)

Instruments	α (coefficient alpha)
Knowledge of risk factors for T2DM	.65
Health Beliefs for T2DM	.59
Godin-Shepard Leisure-time Exercise	.56

The pre-analysis stage consisted of identification of survey packets by number. SPSS version 11 (SPSS, Inc., 2001) was used for data analysis. The data were then entered into the computer and a data set was created. The computer data set which included individual responses from the Demographic Data Sheet and response categories from the Knowledge of Risk Factors for T2DM, Health Beliefs about Developing TDM and the Godin-Shepard Leisure-time Exercise instruments (Godin & Sheppard, 1985)

were printed and verified for accuracy of the questions with the original surveys (Tabachnick & Fidell, 2001). Data cleaning was performed by inspecting for inconsistencies in the data, outliers and for the accuracy of data using descriptive statistics. The data revealed one inconsistency, a value outside the code range. The value was checked against the original survey answer and corrected. The data file was created and quantitative analysis was conducted. There were twelve missing data points. There was no pattern observed, therefore missing data were replaced with the mean using the SPSS MVA (Missing Value Analysis) feature.

Results of Hypothesis Testing

Hypotheses 1, 2, 3, 4, and 5 were tested using the Pearson Product-moment correlation coefficient. One-tailed tests of significance were used to test these directional hypotheses. Hypotheses 6 and 7 were to be tested using a series of multiple regression analyses as specified by Baron and Kenny (1986). SPSS Version 11.0 for Windows was used for all statistical analyses.

Hypothesis 1

Hypothesis 1 stated: there will be a positive correlation between knowledge of risk factors for T2DM and dietary intake. The Pearson product-moment correlation was $r = .021(p = .429)$. Thus, the correlation was not statistically significant and Hypothesis 1 was not supported.

Hypothesis 2

Hypothesis 2 stated: there will be a positive correlation between knowledge of risk factors for T2DM and physical activity. The Pearson product-moment correlation were $r = .093(p = .215)$ for strenuous exercise, $r = .135(p = .126)$ for moderate exercise,

$r = -.002(p=.495)$ for mild exercise, $r = .090(p=.224)$ for total leisure and $r = .112(p=.171)$ for the sweat score. Thus, the correlation was not statistically significant and Hypothesis 2 was not supported.

Hypothesis 3

Hypothesis 3 stated: there will be a positive correlation between knowledge of risk factors for T2DM and perceived risk. The Pearson product-moment correlation was $r = -.138(p=.123)$. Thus, the correlation was not statistically significant and Hypothesis 3 was not supported.

Hypothesis 4

Hypothesis 4 stated: there will be a positive correlation between perceived risk for T2DM and dietary intake. The Pearson product-moment correlation was $r = -.072(p=.265)$. Thus, the correlation was not statistically significant and Hypothesis 4 was not supported.

Hypothesis 5

Hypothesis 5 stated: there will be a positive correlation between perceived risk for T2DM and physical activity. The Pearson product-moment correlation was $r = -.224(p\leq.024)$. Thus, the correlation was statistically significant in a negative direction and Hypothesis 5 was not supported.

Hypothesis 6

Hypothesis 6 stated: perceived risk will mediate the relationship between knowledge of risk factors for T2DM and dietary intake.

The mediational model that would have been tested is a series of three regression equations as specified by Baron and Kenny (1986). In this model the first equation

regressed would be perceived risk (the mediational variable) on knowledge of risk factors for T2DM (the independent variable). The second equation would regress dietary intake (the dependent variable) on knowledge of risk factors for T2DM (the independent variable). The third equation would regress dietary intake (the dependent variable) on knowledge of risk factors for T2DM (the independent variable) and perceived risk (the mediating variable).

According to Baron and Kenny (1986), the following conditions must be met for mediation to occur. Knowledge of risk factors for T2DM (the independent variable) must affect perceived risk (the mediating variable) in the predicted direction in the first equation. In the second equation, knowledge of risk factors for T2DM must affect dietary intake (the dependent variable) in the predicted direction in the second equation. Finally, in the third equation perceived risk (the mediating variable) must affect dietary intake (dependent variable) in the predicted direction.

If all of these conditions are met, the effect of knowledge of risk for T2DM (the independent variable) on dietary intake (the dependent variable) must be less in the third equation. Perfect mediation would occur if knowledge of risk factors for T2DM (independent variable) no longer has a significant effect on dietary intake (the dependent variable) when perceived risk (mediating variable) is controlled for in the third equation.

Since there were no significant positive correlations between the variables, the Baron and Kenny (1986) criteria were not met and the mediational model could not be tested.

Hypothesis 7

Hypothesis 7 stated: perceived risk will mediate the relationship between knowledge of risk factors for T2DM and physical activity.

The mediational model that would have been tested is a series of three regression equations as specified by Baron and Kenny (1986). In this model the first equation regressed will be perceived risk (the mediational variable) on knowledge of risk factors for T2DM (the independent variable). The second equation will regress physical activity (the dependent variable) on knowledge of risk factors for T2DM. The third equation will regress physical activity (the dependent variable) on both knowledge of risk factors for T2DM (the independent variable) and perceived risk (the mediating variable).

According to Baron and Kenny (1986) the following conditions must be met for mediation to occur. Knowledge of risk factors for T2DM (the independent variable) must affect perceived risk (the mediating variable) in the predicted direction in the first equation. In the second equation knowledge of risk factors for T2DM must affect physical activity (the dependent variable) in the predicted direction in the second direction. Finally, in the third equation perceived risk (the mediating variable) must affect the physical activity (dependent variable) in the predicted direction in the third equation.

If all of these conditions were met the effect of knowledge of risk for T2DM (the independent variable) on physical activity (the dependent variable) must be less in the third equation. Perfect mediation would occur if knowledge of risk factors for T2DM (independent variable) no longer has a significant effect on physical activity (the dependent variable) when perceived risk (mediating variable) was controlled for in the

third equation. Since there was only one correlation between the variables, the Baron and Kenny (1986) criteria were not met and the meditational model could not be tested.

Additional Analyses

Although no hypotheses were supported, a number of correlation coefficients were found to be significant. Significant correlations predominantly occurred between variable subscales and demographic variables.

Physical Activity and Calories

Significant positive associations were observed between caloric intake and all levels of physical activity, including strenuous activity $r = .261, p \leq .05$, moderate activity $r = .407, p \leq .01$, mild activity $r = .301, p \leq .01$, and total leisure $r = .346, p \leq .01$.

Physical Activity and Gender

Significant negative associations were observed between gender and all levels of activity, including strenuous activity and gender $r = .386, p \leq .01$, moderate activity and gender $r = .398, p \leq .01$ and mild activity and gender $r = .333, p \leq .01$. There was a significant difference in perceived risk and gender. A Mann-Whitney test demonstrated a difference between males and females; $U = 504.0, p \leq .004$ for strenuous activity, $U = 508.5, p \leq .001$ for moderate exercise, $U = 538.0, p \leq .004$ for mild exercise and $U = 483.5, p \leq .001$ for total leisure. Males ($M = 2.43, SD = .88$ mild activity, $M = 3.26, SD = 1.26$, strenuous activity, $M = 2.6, SD = .88$ moderate activity, and $M = 2.11, SD = 1.10$ total leisure) were more active than females ($M = 1.91, SD = .59$ mild activity, $M = 2.42, SD = .87$, strenuous activity, $M = 2.04, SD = .37$ moderate activity, and $M = 1.40, SD = .75$ total leisure).

Perceived Risk for T2DM and Physical Activity

A significant inverse relationship was observed between perceived risk for T2DM and strenuous activity $r = -.251, p \leq .05$ and a significant inverse relationship was found between total leisure and perceived risk for T2DM $r = -.224, p \leq .05$. There were also two significant positive correlations, one between total leisure and dread $r = .225, p \leq .05$ and the other between mild activity and personal control $r = .235, p \leq .05$.

Perceived Risk (subscales worry and known) and gender

There were two significant relationships demonstrated between perceived risk and gender. Gender was positively associated with the subscale worry $r = .320, p \leq .01$. An additional analyses using a Mann-Whitney test was done to examine gender and the subscale worry which revealed that females ($M=4.95, SD=1.39$) had higher scores on worry than males ($M=4.0, SD=1.45$). Gender and the subscale “known” (diabetes as an unknown risk) were significantly and inversely related ($r = -.262, p \leq .05$). A Mann-Whitney test was also used for gender and the subscale “known” which showed that males ($M=6.26, SD=1.75$) were more aware of unknown risk (“known” subscale) than females ($M=5.18, SD=2.6$).

Perceived Risk (known subscale) and BMI

There was a significant positive relationship between BMI and perceived risk for T2DM subscale “known” $r = .362, p \leq .05$.

Perceived Risk for T2DM (dread subscale) and Dietary Intake (carbmean and fatmean)

There was a significant positive relationship between the perceived risk subscale “dread” and carbohydrate intake $r = .280, p \leq .05$. There was a significant inverse relationship between perceived risk subscale “dread” and fat intake $r = -.262, p \leq .05$.

Perceived Risk and Family History

There was a significant difference in perceived risk and family history. A Mann-Whitney test demonstrated a $U=401.5, p \leq .002$ (family history $\underline{M}= 18.41$ $\underline{SD}=2.9$; no family history $\underline{M}= 16.1, \underline{SD}= 2.8$).

Chapter V

Discussion of the Findings

The purpose of this study was to examine the relationship between two dependent variables, (a) dietary intake and (b) physical activity, and each of the independent variables (a) knowledge of risk factors for T2DM and (b) perceived risk for T2DM. In addition, the relationship between perceived risk and knowledge of risk factors for T2DM was also tested. A second purpose of the study was to examine the mediating effect of perceived risk on the relationships between knowledge of risk factors for T2DM and 1) dietary intake and 2) physical activity. The findings are discussed in this chapter and examined in light of the theoretical framework of the Children’s Health Belief Model (Bush and Iannotti, 1990) and the empirical literature.

Variables and Hypotheses

Knowledge of Risk Factors for T2DM and Dietary Intake

Hypothesis 1 stated that there would be a positive correlation between knowledge of risk factors for T2DM and dietary intake. The hypothesis was derived from the

Children's Health Belief Model that proposed knowledge is a modifying factor that can affect behavior (Bush & Iannotti, 1990).

This hypothesis and underlying theory for this study were supported by research that indicated the individual must have knowledge that poor dietary intake is a risk factor in heart disease causation in order for them to perceive the importance of cardio-protective health behaviors (Vale, 2000). A secondary analysis of the CATCH study found that adults in the School Plus program who were provided with information about cardiac risk for their child made appropriate changes and reinforced these changes in the child's diet (Nader et al., 1999). In this study the Pearson product-moment correlation was modest and nonsignificant with an $r = .021$ ($p = .429$). The hypothesis was not supported. This is the first study to have examined this relationship between Knowledge of Risk Factors for T2DM and dietary intake in adolescents.

A possible explanation for the negative findings pertains to the Knowledge of Risk Factors Scale, specifically the question as to whether the participant was knowledgeable that "eating a healthy diet" can increase, decrease, or make no change in developing T2DM, aid in the reduction of one's risk for T2DM. In response to this question, 79 of the 80 participants correctly answered that "eating a healthy diet" decreases the risk of developing T2DM the question suggested that the participants perceived that eating a healthy diet reduces the risk of developing T2DM. The researcher believes that although these adolescents understand that in order to prevent T2DM the participant needs to eat a healthy diet, their self-reports of calories consumed indicate that their diets high in carbohydrates and fats of these same participants may not have sufficient knowledge of what constitutes a healthy diet. This is supported by the data

showing that participants in this study, while responding to a question that explored their “knowledge “ of a healthy diet as a factor that reduces the development of T2DM, predominantly ate a diet high in carbohydrates and fats. Whereas Nader et al. (1999) study examined changes in behavior after a teaching intervention regarding nutrition and these changes occurred in the adult. This study examined the knowledge of the adolescent with no educational intervention.

Knowledge of Risk Factors for T2DM and Physical Activity

Hypothesis 2 stated that there would be a positive correlation between knowledge of risk factors for T2DM and physical activity. The hypothesis was derived from the Children’s Health Belief Model proposition that postulates that knowledge, a modifying factor, can affect behavior (Bush & Iannotti, 1990). This theoretical proposition was supported by previous research that indicated that children who had knowledge of risk for cardiovascular disease exercised more vigorously (Luepker et al., 1996). In addition, Vale (2000) found that individuals identified regular exercise as a preventative measure for heart disease in adolescents and young adults. In this study, the Pearson product-moment correlations between knowledge of risk factors for T2DM and 1) overall physical activity ($r = .093, p = .215$); 2) strenuous exercise ($r = .135, p = .126$); 3) moderate exercise ($r = -.002, p = .495$); 4) mild exercise ($r = .090, p = .224$); 5) total leisure and ($r = .112, p = .171$), and the sweat score were all nonsignificant. The hypothesis, and thus theory proposition, was not statistically supported. This is the first study to examine the relationship between T2DM risk factor knowledge and physical activity in adolescents. A possible explanation as to why the hypothesis was not supported is because these participants considered themselves physically active This age

group may perceives itself to be physically active (they are all attending school and physical education classes). These physical activity tasks take place without regard to their knowledge of risk for developing T2DM, and are not in the context of reducing risk for T2DM. When examining the data, the question on the knowledge of risk factors scale “exercising regularly” was correctly identified by the participants as a risk factor of developing T2DM. Seventy-eight or 98.7 % of the participants answered correctly that exercising regularly would decrease the risk of developing T2DM. However, when examining the data from the Godin-Shepard Leisure-Activity instrument (Godin & Shepard, 1985) only 46.3% of the subjects reported that they participated in leisure time activity long enough to work up a sweat. Therefore, although virtually all of these participants understood that “exercising regularly” was important to reduce the risk of T2DM, less than half of them understood this to mean exercising to the point of “breaking a sweat”. It is also possible that although they demonstrated knowledge about the need for activity to minimize T2DM risk, there are, as of yet, unidentified barriers to modifying the behavior. It is also important to note that the relationships examined in study have been predominantly explored in adult samples, and perhaps adolescents do not cognitively process perceived risk the same way adults do. In addition the sample may not have considered themselves at risk, particularly since a majority of them were not obese or overweight, and many did not have parents with T2DM.

One methodological problem that might have influenced the correlation was the low coefficient alpha ($\alpha=.65$) for the 15-item Knowledge of Risk Factors for T2DM scale. This scale had previously been pilot tested in a population of high school students and had a coefficient alpha of .80. The observed low coefficient may have resulted from

homogeneity of the sample in this study. All participants were relatively homogeneous with regard to race (predominantly Caucasian participants) and high school type, (attending private high schools). In addition, 57.6% of the sample was 15 (n=25) and 16 (n=21) years old, and there may have been insufficient variance on participants' knowledge of T2DM risk factors. The Godin-Shepard Leisure-Time Exercise Questionnaire (Godin & Shepard, 1985), a four-item survey, also demonstrated low coefficient alphas of .56 in this study. Several studies examined internal consistency of the subscales. Two studies in adults varied greatly reporting weak to strong reliability coefficients (.24 to .94) in the subscales (Godin-Shepard, 1985; Jacobs et al., 1993). In another study involving school-age children, specifically fifth, eighth, and eleventh graders, the instrument performed well (alpha = .81, total sample), supporting its use in this study (Godin & Shepard, 1997). The low coefficient alphas for this study may have resulted from homogeneity of the sample. Participants were predominantly Caucasian and were attending private high schools. Homogeneity of samples can lower reliabilities because of lack of variability on study variables. (Nunnally and Bernstein, 1994).

Knowledge of Risk Factors for T2DM and Perceived Risk

Hypothesis 3 stated that there would be a positive correlation between knowledge of risk factors for T2DM and perceived risk. The hypothesis was derived from the Children's Health Belief Model, which proposed that knowledge underlies individuals' perception of problem severity and individuals' perception of their vulnerability to the problem (Bush & Iannotti, 1990, Becker, 1974). This proposition was not supported by the data. The Pearson product-moment correlation was small and statistically insignificant ($r = -.138, p = .123$). This is the first study to have examined the relationship

between T2DM risk factor knowledge and perceived risk in adolescents, and more research is needed before conclusions can be drawn with confidence. However, one possible explanation for the lack of support of the theory proposition may be that the basis for the hypothesis is grounded in empirical studies that describe perceived risk studies as an adult phenomenon since it has only been explored in adults. According to Janz and Becker, (1985) who reviewed Health Belief Model studies from 1974-1984, the study samples in the literature reviewed were adults or adolescents that were forced into an adult role (young mothers). In 81% of the studies, perceived risk was a significant predictor of health-related behaviors. Understanding that this is a psycho-social model, perhaps there are maturational processes at play. The adolescent may be knowledgeable about the risk factors but, due to other psychological factors such as having an optimistic bias, the adolescent may not act on the knowledge. The difference in the findings may simply be due to the supposition that the adolescent understands that bad things happen, but does not believe it will happen to him or her (Weinstein, 1980). Therefore, in the adolescent, the connection between knowledge and perceiving risk may be not made.

One methodological problem that might have affected the correlation was the low coefficient alpha ($\alpha=.65$) found in the 15-item Knowledge of Risk Factors for T2DM scale which, when pilot tested in a high school population, had a strong coefficient alpha of .80. The Beliefs about T2DM Health in Adolescents survey, which measured perceived risk, also demonstrated a low coefficient alpha of .59. The subscales were: personal control (alpha .47), worry (alpha .52), optimistic bias (alpha .67), known (unknown risk) (alpha .37), and dread (alpha .47). The previous pilot study showed mixed results in the surveys' internal consistency. The subscales in the pilot study demonstrated a .79

coefficient alpha for optimistic bias, a .77 coefficient alpha for dread, a .61 coefficient alpha for worry, and a .47 coefficient alpha for both personal control and unknown risk. The observed low coefficient alphas may have resulted from homogeneity of the sample in this study. All samples were relatively homogeneous; they were predominantly Caucasian participants attending private high schools. Homogeneity of samples can lower reliabilities because of lack of variability (Nunnally and Bernstein, 1994). Some items may need to be revised or added based on the item to total correlation.

Perceived Risk for T2DM and Dietary Intake

Hypothesis 4 stated that there would be a positive correlation between perceived risk for T2DM and dietary intake. The hypothesis was derived from the Children's Health Belief Model, which proposed that perceiving risk motivates individuals to modify their behaviors (Bush & Iannotti, 1990, Maiman, L.A., Becker, M.H., Kirscht, J.P., Haefner, D.P., & Drachman, R.H, 1977). Gochman (1972) examined perceived vulnerability to illness in children and adolescents. He examined components of the Health Belief Model, including perceived vulnerability (risk), intention to take health action, perceived benefits and motivation. He found that perceived vulnerability (risk), perceived benefits, and dental trauma experiences were significant predictors of intention to visit the dentist ($F=17.43, p < .0001$). This study provides empirical evidence that perceived risk is linked with health promoting behavior (visiting the dentist) in this population.

A study by Spikman et al. (2000) examined perceived risk and dietary intake to determine the possible reason for nonattendance at diabetic nutritional clinics. Guided by the Health Belief Model, the authors investigated reasons why adults with diabetes do not make use of the dietician. Findings indicated that participants who reported lower

perceived risk of diabetic complications were more likely to be “non-attendees” ($t=3.0$, $df=289$, $p < 0.05$). This suggested that perceived risk may be directly related to health promoting behaviors.

The Pearson product-moment correlation between perceived risk and dietary intake in this study was not significant ($r = -.072$, $p=.265$). Thus, Hypothesis 4 was not supported. One explanation may be that the low coefficient alphas may have resulted from homogeneity of the sample. All samples were relatively homogeneous; they were predominantly Caucasian participants attending private high schools. Homogeneity of samples can lower reliabilities because of lack of variability (Nunnally and Bernstein, 1994). Another explanation could be that Spikeman et al (2000) study examined adults who were already diagnosed with diabetes and possibly felt they had adequate knowledge to prevent associated complications of the disease. Gochman’s seminal study (1972) examined children and adolescents who already had a dental trauma and pain having that lived experience they were more likely to visit the dentist more frequently whereas the participants in this study have no history of a chronic disease and do not have that lived experience to draw upon.

Perceived Risk for T2DM and Physical Activity

Hypothesis 5 stated that there would be a positive correlation between perceived risk for T2DM and physical activity. The hypothesis was derived from the Children’s Health Belief Model, which proposed that perceived risk motivates individuals to modify their behaviors (Bush & Iannotti, 1990, Maiman et al., 1977). This hypothesis and underlying theory were supported by studies examining physical activity and chronic diseases. There were no studies that solely examined the link between diabetes risk

perception and physical activity. Studies examined physical activity as a behavior that could delay or prevent chronic disease. A study by Hunter and O'Dea (1999) examined perceptions of cardiovascular disease, cancer and osteoporosis risk in mid-aged women with and without behavioral changes (diet, physical activity and smoking) and hormone replacement therapy (HRT). High risk perception resulted in improved health behaviors including a healthy diet, reducing or stopping smoking and regularly exercising which were found to be statistically significant in preventing both cardiovascular disease ($t = 4.70$, $df = 85$, $p = <0.001$) and osteoporosis ($t = 5.81$, $df = 71$, $p = <0.001$). The authors found that women believed improving their health behaviors (stopping or reducing smoking, eating a healthy diet and participating in physical activity) would alter their risk of developing cardiovascular disease and osteoporosis.

The hypothesized link between perceived risk and physical activity in children was supported in the CATCH intervention study (Luepker et al., 1996). Children in the intervention group were provided with knowledge about cardiac risk and proper physical activity to prevent cardiac disease. In the intervention group, there was a significant increase in moderate to vigorous physical activity in physical education classes in comparison to the control groups ($p < .02$). 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).

The Pearson product-moment correlation was $r = -.224$ ($p \leq .024$). Thus, the correlation between perceived risk for T2DM and physical activity in this study was statistically significant in a negative direction; therefore hypothesis 5 was not supported. A possible explanation for this inverse relationship is that 97.5% of the participants

answered that “exercising regularly”, on the Knowledge of Risk Factors for T2DM Scale, would reduce their risk for T2DM. The participants may perceive themselves as “exercising regularly” thus they perceive no threat. They may not have perceived a threat since they considered themselves to be regularly active, thus the activity shielded them for the development of T2DM. The more the participants exercised, the less they likely perceived themselves at risk for T2DM.

Both hypothesis 6 and hypothesis 7 were not tested in this study. Hypothesis 6 stated that perceived risk for T2DM would mediate the relationship between knowledge of risk factors and dietary intake. Hypothesis 7 stated that perceived risk for T2DM would mediate the relationship between knowledge of risk factors for T2DM and physical activity. These hypotheses could not be tested because the conditions for a mediation model, as specified by Baron and Kenny (1986), were not met, as previously described.

Additional Analyses

Although no hypotheses were supported, additional statistically significant relationships were observed.

Physical Activity and Calories

Empirical studies have demonstrated that there is a relationship between dietary intake and physical activity in adolescents (Neumark-Sztainer, Story, Toporoff, Himes Resnick & Blum, 1997; Pate, Heath, Dowda & Trost, 1996). Elder and Roberts (2007) proposed several reasons for this association. One potential reason is that people who participate in regular physical activity feel motivated to eat healthier. Another is that people who are physically active feel that they can consume unhealthy foods since they

are active. In this study, significant positive associations were observed between caloric intake and all levels of physical activity, including strenuous activity $r = .261, p \leq .05$, moderate activity $r = .407, p \leq .01$, mild activity $r = .301, p \leq .01$, and total leisure $r = .346, p \leq .01$. These findings support previous studies that found a relationship between caloric intake and physical activity. Elder and Roberts (2007) noted that because adolescents are physically active, they may feel they can eat more unhealthy foods, which are typically higher in carbohydrates and fats. In this study, the adolescents' fat and dietary intake were found to be disproportionately high.

Physical Activity and Gender

Empirical studies have demonstrated gender differences in physical activity (Landsbaugh, 2007; Godin, Gaston, Anderson, Donna, Lambert, Leo-Daniel et al., 2005). Males are found to be more active than females. This study also supports that there are gender differences at all levels of physical activity, including strenuous activity and gender $r = -.386, p \leq .01$, moderate activity and gender $r = -.398, p \geq .01$ and mild activity and gender $r = -.333, p \leq .01$. This study supports that males are more active than females.

Perceived Risk for T2DM and Physical Activity

The association between perceived risk for T2DM and physical activity in adolescents is supported by the Children's Health Belief Model (Bush & Iannotti, 1990). However, findings from this study did not support a relationship between the total scores used to measure perceived risk for T2DM and physical activity. Significant relationships were, however, observed between subscales of both constructs. A significant inverse relationship was observed between strenuous physical activity and perceived risk for T2DM $r = -.251, p \leq .05$ and between total leisure (leisure time exercise) and perceived

risk for T2DM $r = -.224, p \leq .05$. These findings suggest that the more the adolescent exercised, the lower their perceived risk for developing T2DM. There were also two significant positive correlations. These were significant associations between total leisure and dread ($r = .225, p \leq .05$) and between mild activity and personal control ($r = .237, p \leq .05$). 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.

Perceived risk for T2DM (subscales worry and known) and gender

Empirical studies demonstrate a relationship between perceived risk for T2DM and gender. Findings from the Ey et al. (2000) study revealed that adolescents' knowledge of their father's diabetes was predictive of perceived vulnerability to diabetes for both male and female adolescents but knowledge of their mother's diabetes was not predictive. Interestingly, even though females perceived themselves at the same risk as boys for disease in general. According to national mortality rates for disease males, are at a higher risk than females. In the study by Gross et al. (2005), among individuals who had a BMI greater than 30kg/m^2 , women were significantly more likely than males to perceive themselves at risk for chronic disease ($p = 0.01$). In this study, 77.3% of females perceived themselves to be at risk compared to only 40% of males. When a multivariate analysis was performed to identify factors associated with perceived risk, gender was identified as a significant factor. The Gross et al. (2005) and Ey et al. (2000) studies support the findings of this study, which demonstrated a relationship between perceived risk for T2DM (subscales worry and known) and gender. Gender was positively associated with worry ($r = .320, p \leq .01$); the more the

adolescent perceived risk for T2DM, the more they worried, Females were significantly more likely to worry than males ($p = .004, t = -2.96, df = 77$) whereas, known (diabetes as an unknown risk) demonstrated an inverse relationship with gender $r = -.262, p \leq .05$. Males had significantly higher scores and knowledge of risk regarding T2DM than women. These findings suggest that although males perceive unknown risk more strongly than females, they are also less concerned about it. On the other hand females were less likely to perceive unknown risk, but worried more ($t = 2.38, p = .020, df = 77$).

Perceived risk (known subscale) and BMI

Empirical findings suggest a positive relationship between perceived risk and BMI. Kamhon and Wei-Der (2003) examined the relationship between obesity and knowledge of obesity as a health risk. The males who were more knowledgeable that obesity was a risk factor for chronic diseases had high-normal BMIs (BMI = 24.99). These findings indicated that health risk knowledge was significantly and positively associated with higher BMI in males. Perhaps if they have the knowledge that they are borderline overweight, they are also aware that obesity can lead to chronic disease.

A cross sectional survey (Gross et al., 2005), examined 318 African-American college seniors' knowledge of obesity as it related to perceived risk for chronic disease. The participants were asked if they perceived that their weight placed them at risk for heart disease, cancer, and diabetes. Only sixteen percent of participants perceived risk of any disease due to their weight. Of those who perceived themselves at risk for disease due to weight, 12.3% perceived themselves at risk for diabetes. Among those individuals who had a BMI greater than 30kg/m^2 , females were significantly more likely to perceive themselves at risk for chronic disease than males ($p = 0.01$).

The findings of this study support the relationship between BMI and perceived risk of T2DM. Adolescents with higher BMIs were more likely to view diabetes as a known risk $r = .362, p \leq .05$, demonstrating the adolescent perceived that obesity is a risk factor for T2DM.

Perceived risk for T2DM (dread subscale) and Dietary Intake (carbmean and fatmean)

There was one empirical study demonstrating a direct relationship between dietary intake and perceived risk. A study by Spikman et al. (2000) examined perceived risk and dietary intake to determine the possible reason for nonattendance at diabetic nutritional clinics. Guided by the Health Belief Model, the authors investigated reasons why individuals with diabetes do not make use of the dietician. Findings indicated that participants who reported lower perceived risk of complications related to their diabetes were more likely to be “non-attendees” ($t = 3.0, df = 289, p < 0.05$). This suggested that perceived risk may be directly related to health promoting behaviors.

This study found that adolescents who perceived diabetes as a dreaded health risk had a positive relationship between that dread and their carbohydrate intake. The more the adolescents dreaded the disease, the higher their carbohydrate intake would be $r = .280, p \leq .05$. An inverse relationship was found between dread and fat intake: the more they dreaded the disease, the lower their fat intake $r = -.262, p \leq .05$. A possible explanation for these findings is that the adolescents who dreaded diabetes perceived that obesity was the greatest risk factor for the disease. 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 the adolescent is not knowledgeable regarding the role of carbohydrates in the development of T2DM.

Perceived Risk and Family History

Finally, this study found a significant positive correlation was found between perceived risk for T2DM and family history of T2DM. A Mann-Whitney test demonstrated a $U=401.5, p \leq .002$. Adolescent who have family members with T2DM perceived risk more than adolescents with no family history. A possible explanation for this finding is that adolescents gain a more intimate knowledge of the disease and its effects because of the real life experience of knowing and /or living with someone with T2DM.

Chapter VI

Summary, Conclusions, Implications and Recommendations

Summary

The purpose of this study was to examine the relationship between two dependent variables, (dietary intake and physical activity), and each of the independent variables (a) knowledge of risk factors for T2DM and (b) perceived risk. In addition, the relationship between perceived risk and knowledge of risk factors for T2DM was also tested. The researcher further planned to examine the mediating effect of perceived risk on the relationship between knowledge of risk factors for T2DM and dietary intake, and the mediating effect of perceived risk on the relationship between knowledge of risk factors for T2DM and physical activity this was not done because anticipated hypotheses were not observed. The Children's Health Belief Model (Bush and Iannotti, 1990) was used in this study as the conceptual framework for testing the theoretical relationships (see Figure 1).

The theoretical framework, the Children's Health Belief Model (CHBM) was based upon the original components of the Health Belief Model (HBM) including the element of "readiness to take action." Readiness to take action includes the "the level of threat posed by the health problem as determined by the individual's perception of the problem's severity and perception of vulnerability to it" (Becker, 1974, p.140). In this study the researcher examined the Readiness Factor (Figure 2), perceived illness threat (risk) for developing T2DM.

Bush and Iannotti (1990) incorporated the HBM and developmental theories into the CHBM. Cognitive Developmental Theory (CDT) "emphasizes the role of developmental changes in cognitive processes that influence children's understanding of social and physical events (p70)". CDT is considered a Modifying Factor in the CHBM. In this study the researcher posited a positive relationship between knowledge of risk factors for developing T2DM and perceived risk. Empirical literature supports this relationship (Farmer et al., 1999; Chilton et al., 2006; Ey et al. 2000; Kamhon and Weider, 2003; Gross et al., 2005).

Additionally incorporated into the CHBM is Behavioral Intention Theory (BIT), which stresses particular behaviors and "indicates that behavioral intentions are the best available predictor of behavior" (Bush & Iannotti, 1990, p.70). This theory was incorporated into the CHBM as Behavior Factors. In this study the researcher posited a positive relationship between the independent variables of perceived risk and knowledge of risk factors and the dependent Behavior Factors of physical activity and dietary intake.

Empirical literature supports relationships between knowledge of risk factors for T2DM and the health promoting behaviors of dietary intake and physical activity (Spikman et al., 2000; Vale, 2000; Luepker et al., 1996).

Based on a review of the theoretical and empirical literature, the following relationships were hypothesized: a positive correlation between knowledge of risk factors for T2DM and dietary intake; a positive correlation between knowledge of risk factors for T2DM and physical activity; a positive correlation between knowledge of risk factors for T2DM and perceived risk; a positive correlation between perceived risk and dietary intake; a positive correlation between perceived risk and physical activity; perceived risk will mediate the relationship between knowledge of risk factors for T2DM and dietary intake; and perceived risk will mediate the relationship between knowledge of T2DM and physical activity.

Participants were recruited from two private high schools in the New York City area and two Boy Scout troops. One high school (all girls) has approximately 400 students. The other high school (all boys) has approximately 500 students. Inclusion criteria were as follows: (1) male or female high school student, (2) age 13-19 years, (3) English-speaking. Students with a history of Type 1 or Type 2 diabetes, a current pregnancy, or any chronic disease were excluded from the study. The final sample consisted of 80 participants; males (n=35) and females (n=45) aged 13-18 years ($M=16.1$, $SD=1.14$). The participants were primarily Caucasian (n=62, 77.5%), and included Hispanic (n=6, 7.5%), Black (n=2, 2.5%) and Asian (n=2, 2.5%) students. Data were collected from 86 respondents; six students were excluded because of a chronic disease. Thirty-two of the students retained in the study had a family history of T2DM. The

majority of the students (n=56, 70 %,) had a healthy BMI. Based on BMI, 16 students were considered at risk (20%) and 6 were obese (7.5%).

Data were collected using 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), (4) two 24-hour dietary recalls, and (5) a demographic questionnaire.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 11 for Windows (SPSS, Inc., 2004). Alpha coefficients were calculated for each instrument. The Knowledge of Risk Factors for T2DM had a coefficient alpha of .65. The Health Beliefs for T2DM had a coefficient alpha of .59; the subscales were: personal control with a coefficient alpha .47, worry with a coefficient alpha .52, optimistic bias with a coefficient alpha of .67, known (diabetes as an unknown risk) with a coefficient alpha of .37, and dread with a coefficient alpha of .47. The Godin-Shepard Leisure-Time Exercise Questionnaire had a coefficient alpha of .56 (Godin & Shepard, 1997).

Descriptive and correlational statistics were obtained on the data. The plan used for testing hypotheses one through five included the use of the Pearson product-moment correlation. Directional hypotheses were one-tailed and the significance level was .05. The plan for testing hypotheses six and seven included a series of three multiple regression analyses. Additional analyses were conducted to provide further insights regarding knowledge of risk factors for T2DM and perceived risk and to identify further directions for research.

The first hypothesis, which stated that there will be a positive correlation between knowledge of risk factors for T2DM and dietary intake, was not supported. The second

hypothesis, which stated there will be a positive correlation between knowledge of risk factors for T2DM and physical activity, was not supported. The third hypothesis, which stated that there will be a positive correlation between knowledge of risk factors for T2DM and perceived risk, was not supported. The fourth hypothesis, which stated that there will be a positive correlation between perceived risk and dietary intake, was not supported. The fifth hypothesis, which stated that there will be positive correlation between perceived risk and physical activity, was not supported. The sixth hypothesis, which stated that perceived risk will mediate the relationship between knowledge of risk factors and dietary intake, was not tested since hypotheses one, three and four were not supported. The seventh hypothesis, which stated perceived risk will mediate the relationship between knowledge of T2DM and physical activity, was not tested since hypotheses two, three and five were not supported.

Additional findings yielded a number of positive correlations. A significant association between several subscales of perceived risk for T2DM and physical activity was demonstrated. A significant inverse relationship was observed between perceived risk for T2DM and strenuous activity and a significant inverse relationship was found between total leisure and perceived risk for T2DM. These findings suggest that the more the adolescent exercised, the lower his perceived risk for developing T2DM. There were also two significant positive correlations between physical activity and dread and physical activity and personal control. The significant relationship between total leisure and dread suggests that adolescents who participated in leisure time exercise perceived T2DM as a life threatening disease. There was also a significant positive relationship

between mild activity and personal control suggesting that adolescents who engaged in even mild exercise felt they had some control over the potential for developing diabetes.

Another significant finding demonstrated a relationship between perceived risk (subscales worry and known) and gender. Gender is positively associated with worry. The more the individual perceived risk the more they worried. Females were significantly more likely to worry than males ($p = .004$, $t = -2.96$, $df = 77$). Gender and the subscale known (diabetes as an unknown risk) Males had significantly higher scores and knowledge of risk regarding T2DM than women. These findings suggest that males perceive unknown risk more and they are also less concerned about it than women. On the other hand women were less likely to perceive unknown risk but worried more ($p = .020$, $t = 2.38$, $df = 77$).

This study also demonstrated a finding that supports the relationship between BMI and perceived risk of diabetes. The higher BMI, the more the adolescent viewed it as a known risk. This suggests that the obese adolescent perceived the risk that obesity is a risk factor for T2DM.

This study found that adolescents who perceived diabetes as a dreaded health risk had a positive relationship between that dread and their carbohydrate intake. The more these adolescents dreaded the disease, the higher their carbohydrate intake and an inverse relationship was found between dread and fat intake: the more they dreaded the disease, the lower their fat intake.

A possible explanation for these findings is that the adolescent who dreaded diabetes perceived that obesity was the greatest risk factor for the disease. 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 the adolescent is not knowledgeable regarding the role of carbohydrates in the development of T2DM.

Finally, this study found a significant positive correlation was found between perceived risk for T2DM and family history of T2DM. Adolescent who have family members with T2DM perceived risk more than adolescents with no family history. A possible explanation for this finding adolescents gain a more intimate knowledge of the disease and its effects because of the real life experience of knowing and /or living with someone with T2DM.

Conclusions

The findings in this study did not support the theoretical and empirical relationships reported in the literature between the independent variables of knowledge of risk factors for T2DM and perceived risk and the dependent variables of dietary intake and physical activity. However, the additional findings of significant relationships between the subscales of perceived risk and dietary intake and physical activity do suggest that there is some relationship. Perhaps the lack of significance when using the scale as a whole was due to the low alpha coefficients of the Knowledge of Risk Factors for T2DM and the Health Beliefs for T2DM instruments. Gender and BMI also appear to play a significant role in perceived risk.

Implications for Nursing

Perception of risk is believed to be one of the first necessary steps toward adopting health-promoting behaviors (Becker, 1974). Perceived risk has been empirically and theoretically linked to the performance of these behaviors (Janz & Becker, 1984). It

has been shown that adults who perceive themselves at risk for a disease are more likely to participate in health promoting behavioral changes to reduce the risk of developing that disease (Janz & Becker, 1984; Schwarzer & Renner, 2000). Adolescence signifies a maturational turning point wherein adolescents acquire new roles and responsibilities, one of which is taking measures to care for their own health. Although adolescents in the past were relatively free from developing T2DM, there are now increasing numbers of adolescents with T2DM (Search for Diabetes in Youth, 2006). By testing this theory, nursing could identify whether perceived risk mediates risk reducing behaviors in adolescents. If perceived risk does play 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 is to educate adolescents about the risk factors for T2DM. If the adolescent is aware that 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 the individuals' lives and reduce the allocation of services by society needed to treat those who develop T2DM.

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.

This study is also a first step in creating a valid and reliable tool to identify perceived risk in the adolescent. Further development of the tool now is necessary. The tool requires both theoretical (include Children Health Belief Model) and psychometric refinement. Through the refinement of these instruments, we may gain a better understanding of perceived risk

Recommendations

The theoretical and empirical findings of this study provide the direction for future research and theory testing. The recommendations include:

1. The 15-item Knowledge of Risks for Developing Type 2 Diabetes demonstrated low coefficient alphas in the present study. The psychometric properties of this instrument need to be addressed. The instrument needs further refinement to increase the validity and reliability of the instrument. After refinement of the instrument, further testing in the adolescent population will be required to assess its psychometric properties.
2. The 14-item Health Beliefs for Developing T2DM demonstrated low coefficient alphas in the present study. The psychometric properties need to be addressed especially the improvement of the reliability of the instrument. The instrument needs further refinement to work on increasing the validity and reliability of the instrument. After refinement of the instrument further testing in the adolescent population will be required to test its psychometric properties for reliability.

3. The observed low coefficient alphas may have resulted from homogeneity of the sample in this study. All samples were relatively homogeneous; they were predominantly Caucasian participants attending private high schools. Since homogeneity of samples can lower reliabilities because of lack of variability (Nunnally and Bernstein, 1994), a more variable group should be sought to examine the psychometrics of the instruments.
4. The present study needs to be replicated in a minority public high school sample to identify if minorities perceive risk differently.
5. Significant relationships were found between the subscales (worry and known) of perceived risk and gender. These relationships need to be further studied to explore the effect of gender on perceived risk and if interventions for boys or girls can be the same or need to be different in order for the adolescent to adopt health promoting behaviors.
6. After refinement of the Knowledge of Risks for Developing Type 2 Diabetes and the Health Beliefs for Developing T2DM instrument, additional theory-testing will be needed to determine if the questions in these instruments reflect the Children's Health Belief Model.

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APPENDICES

Appendix A
Demographic/Medical History Survey

Directions: Please check one response to each question and/ or fill in the missing blanks.

1. Age: _____
2. Sex: _____
3. Grade: _____
4. Race / Ethnicity: _____
5. Family history of Type 2 diabetes: Yes _____ No _____
6. History of any chronic disease: Yes _____ No _____
If yes please state: _____
7. Are you pregnant: Yes _____ No _____

When you finish this survey please come to researcher to complete height and weight.

Height: _____

Weight: _____

Appendix B Informed Consent

You/ your child are invited to participate in a research study that is being conducted by Natalie Fischetti who is a doctoral student in the Department at Rutgers University. The purpose of this research is to examine adolescents' beliefs about developing Type 2 diabetes.

Approximately 90 subjects between the ages of 13-19 years old will participate in the study, and each individual's participation will last approximately 50 minutes. Participation in this study includes the completion of several surveys.

The research is anonymous, which means that I will record no information about you that could identify you. This means I will not record your name, address, phone number or date of birth. If you agree to take part in the study, you will be assigned a random code number that will be used on each survey. Your name will appear only on a list of subjects, and will not be linked to the code number that is assigned to you. There will be no way to link your responses back to you. Therefore, data collection is anonymous.

The research team and the Institutional Board at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All data will be kept for three years. There are no foreseeable risks to participation in this study. You/Your child have been told that the benefits of taking part in the study will be to increase healthcare professional's understanding of adolescents' understanding of Type 2 diabetes.

Participation is voluntary. You/your child may choose not to participate, and you/your child may withdraw at any time during the study procedure without any penalty to you/your child. In addition, you/your child may choose not to answer any questions with which you/your child are not comfortable with. If you/your child have any questions about the study or study procedures, you may contact Natalie Fischetti, [email-nataliefischetti@hotmail.com](mailto:nataliefischetti@hotmail.com), phone- 917-903-1793 or by mail College of Staten Island 2800 Victory Blvd 5S106 Staten Island, New York 10310 or you can contact my advisor Lucille Eller email eller@rutgers.edu phone 973-353-5326, x503, or by mail at Rutgers the State University, College of Nursing, Ackerson Hall room 102,180 University Ave, Newark, New Jersey,07102.

If you have any questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University at:

Rutgers University, the State University of New Jersey
Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, N.J. 08901-8559
Tel: 732-932-0150 ext.2104 (Email: humansubjects@orsp.rutgers.edu)

An extra a copy of this consent is enclosed for your records. Sign below if you agree to participate in this research study:

Parent (Print) _____

Parent Signature _____

Date _____

Appendix C
Student Assent Form

You are invited to take part in a research study about type 2 diabetes. Type 2 diabetes is a condition where you have too much sugar in your blood and increased sugar in the blood can cause many types of problems. The study is conducted by Natalie Fischetti, a doctoral student at Rutgers University.

If you agree to be a participant in this study, you will be asked to complete several questionnaires. This will take approximately 50 minutes. Your name will not be on the questionnaire, but you will be asked to write your name on this form. It will not be possible to link your name with your questionnaire. This means this study is completely anonymous.

Your grades will not be affected in any way by your decision to participate or not in the study. You will not receive any benefits from participating, however, your answers will increase our understanding of what students believe and know about Type 2 diabetes.

You may decide to stop participation in the study at any time. One of your parents will also be asked to provide written permission for you to participate in the study. Your parents will be given my phone number in case they have any questions, as well as the phone number of the Office of Sponsored Programs at Rutgers University. You will also be given a copy of this form to keep.

If you agree to participate in the study, please sign below:

Student signature _____

Date _____

Student Name _____

Date _____

Appendix D
Sample Permission to Administer Survey

Dear Institutional Review Board Members,

This is a letter granting access to the students of this High School for research to be conducted by Natalie Fischetti, a Ph.D. candidate in the College of Nursing, Rutgers, The State University of New Jersey. I give my support to this candidate to access these students. I understand that participation in the research project is voluntary and anonymity will be ensured. Participants will be given the instrument in their respective homerooms. Participants will be given several questionnaires.

I am pleased to support Mrs. Fischetti in her research project. If you have any questions, please call me at

Very truly yours,

VITA

Natalie A. Fischetti

- 1958 Born December 24, Staten Island, New York
- 1976 Graduated from Notre Dame Academy, Staten Island, New York
- 1980 Diploma, St Vincent's School of Nursing, New York, New York
- 1980 Staten Island University Hospital, Staff Nurse
- 1982 B.S. in Nursing, Wagner College, Staten Island, New York
- 1983 Visiting Nurse of Staten Island, Community Health Nurse, New York
- 1984 M.S. in Nursing, Wagner College, Staten Island, New York
- 1985-88 Visiting Nurse of Brooklyn, Assistant Educator Coordinator and Nursing Supervisor, New York
- 1989-91 Staten Island University Hospital, Staff Nurse/Staff Education, New York
- 1992-2001 College of Staten Island, Adjunct Lecturer and Substitute Lecturer, New York
- 2003 Rutgers, The State University of New Jersey, Teaching and Research Assistant
- 2005 College of Staten Island, Assistant Professor, New York
- 2007 D'Alonzo, K., & Fischetti, N (2007) Cultural beliefs and attitudes of Black and Hispanic college-age women toward exercise. *Journal of Transcultural Nursing*
- 2008 Fischetti, N., (2008) Using Standardized Nursing Language: A Case Study Exemplar on Management of Diabetes, *International Journal of Nursing Terminologies and Classifications*
- 2009 Fischetti, N., Development and Evaluation of Two Instruments: Knowledge of Risk Factors T2DM, and Health Beliefs about T2DM. Abstract: Eastern Nursing Research Society, Boston, Massachusetts, March 19, 2009
- 2009 PhD in Nursing, Rutgers, The State University of New Jersey