DIABETES KNOWLEDGE, PREVENTIVE HEALTH MOTIVATION, PERCEIVED RISK OF TYPE-II DIABETES, AND HEALTH BEHAVIORS AMONG COLLEGE STUDENTS

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Type-II diabetes is typically a preventable and manageable disease but without proper care, it can develop into a severely debilitating and life-threatening illness. This study aimed to examine the level of diabetes knowledge among college students and relationships between knowledge of the disease, perceived risk of Type-II diabetes, and preventive health motivation on health preventive behaviors (i.e., healthy eating habits, fat intake, physical activity, and BMI). This study also explored areas of diabetes knowledge that are low or inaccurate in this population including the causes, complications, and risk factors for Type-II diabetes. A total of 126 participants completed a large survey and had their body weight and height measured. The findings of this study indicate that risk perception may not be as critical as previously considered as a motivational factor for the young adult, college population. Rather, diabetes knowledge might have effects on eating a healthy diet and consuming less fat. Future research should aim to clarify the causal relationships between these variables. Also, the areas of diabetes knowledge that were found to be especially low for this population should be targeted along with preventive health motivation in future education efforts to ensure adequate knowledge of Type-II diabetes and motivation for maintaining a healthy lifestyle.

CHAPTER I

INTRODUCTION

Overview of Type-II Diabetes

According to the American Diabetes Association (2010), type-II diabetes is a chronic disease that causes high levels of sugar to accumulate in the blood. The disease originates from a problem in the way the body makes or uses insulin. Insulin functions to move sugar into cells where it can be stored and later used for energy. In a person who has Type-II diabetes, the body doesn't respond correctly to insulin, which produces a condition called insulin resistance. As a result of this resistance, sugar cannot get into cells. This causes abnormally high levels of sugar to build up in the blood, a condition known as hyperglycemia. High blood sugar levels trigger the pancreas to make more insulin, but it is not enough to keep up with the demand of the body. People who are overweight are more likely to have insulin resistance, because higher amounts of body fat interfere with the body's ability to properly use insulin. Although Type-II diabetes is a disease that usually occurs gradually, it has the potential to cause severe life-threatening and even fatal outcomes for patients suffering from the disease (American Diabetes Association, 2010).

The United State's Centers for Disease Control (CDC) recently reported that diabetes is the sixth-leading cause of death in the United States, with Type-II diabetes accounting for roughly 90-95% of all diagnosed cases (CDC, 2008). This trend indicates that diabetes, and particularly Type-II diabetes, is a significant public health problem reaching epidemic proportions.

Type-II diabetes affects over 18.2 million people in the United States, which is about 6.3% of the U.S. population (Goz, Karaoz, Goz, Ekiz, & Cetin, 2005). This percentage indicates that about 6 out of every 100 people living in the U.S. have been diagnosed with Type-II diabetes, and this does not include those who are living with the disease but have not yet been diagnosed. In addition, researchers have estimated that 1 out of 3 Americans born in the year 2000 will develop Type-II diabetes sometime in their lifetime (Adams & Lammon, 2007). The implication of this prediction is that 1 out of 3 Americans born in 2000 is expected to fail at maintaining a life-long, healthy body-weight regimen and will eventually only be able to produce minimal amounts of insulin. This inadequate production of insulin will begin a series of injurious symptoms and eventual long-term complications related to insulin resistance (Adams & Lammon, 2007).

Although, most patients with Type-II diabetes will suffer from many debilitative symptoms, such as fatigue, nausea, vomiting, weight-loss, lethargy, frequent or slow healing infections, and blurred-vision, those diagnosed can take precautionary steps to control and maintain the disease. Making correct health-related decisions and lifestyle changes can lower patients' risk for developing serious complications, such as heart disease, neuropathy (nervous system disease), diabetic retinopathy (eventual blindness), peripheral vascular disease, kidney disease, surgeries, amputations, stroke, coma, and premature death (American Diabetes Association, 2010).

The disabling complications and poor-quality of life associated with Type-II diabetes create major challenges for both healthcare professionals and patients (ADA, 2009). Diabetes poses a significant burden to both society and individuals suffering with the disease including a rapid escalation of diabetes related medical costs, which increase substantially each year (ADA, 2009).

According to the CDC (2008), the risk factors for developing Type-II diabetes include prolonged obesity, family history of the disease, age greater than 45 years, impaired glucose metabolism, sustained physical inactivity, and race/ethnicity. The ethnic groups at highest risk for Type-II diabetes include: Hispanic-Americans, African-Americans, Pacific-Islanders (i.e. Native Hawaiians), Asian-Americans, and American-Indians (CDC, 2008). Unfortunately, many people seem to be unaware of the objective health risk factors for developing Type-II diabetes (Adriaanse *et al.*, 2008). Some of the risk factors such as having a family history of Type-II diabetes, being of a certain ethnic background or being of an older-age cannot be prevented. However, other established risk factors such as lack of exercise and poor diet, can be effectively managed through knowledge of objective risk factors and sustained lifestyle modification (CDC, 2008).

Perceived Risk, Knowledge, & Health Behavior Change

Perceived risk plays a pivotal role in health behavior change (Robb, Campbell, Evans, Miles, & Wardle, 2008). If people believe that their risk is high for a specific illness, they are more likely to engage in behaviors related to reducing that risk (Kreuter, & Strecher, 1995). However, people tend to consistently underestimate their risk for a variety of health or illness risk situations (Adriaanse *et al.,* 2008; Harwell *et al.*, 2005; O'Brien, Fries & Bowen, 2000).

Psychologists have proposed several theoretical models to explain psychological mechanisms of health behavior change, including the Protection Motivation Theory (Rogers, 1983), the Theory of Reasoned Action (Ajzen & Fishbein, 1980), the Theory of Planned Behavior (Ajzen, 1991), Transtheoretical Model/Stages of Change (Prochaska, 1979), the Health Action Process Approach (HAPA) (Schwarzer, 1992), and the Health Belief Model (Janz & Becker, 1984; Rosenstock, 1974). Despite differences among them, all these models suggest that perceived risk plays a key motivational role in setting the stage for contemplating behavior change.

For example, in the *Health Belief Model* (Janz & Becker, 1984) perceived risk plays a central role in predicting health protective behavior. The Health Belief Model proposes that an individual's decision to engage in health related behaviors is influenced by the desire to avoid becoming ill and the belief that a behavior will prevent or reduce the illness. A high perceived risk or threat of harm increases people's motivation to engage in health-protective behaviors that reduce or eliminate their risk.

However, without adequate knowledge of the risk factors for a certain illness, one cannot accurately assess their risk (Graham, Leath, Payne, Guendelman, Reynolds, & Kim, 2006). Knowledge of the complications or consequences of the illness are also necessary to properly perceive the seriousness of the disease (Janz & Becker, 1984). If one does not perceive themselves to be at risk for a serious health problem, he/she will not have motivation to make appropriate behavior adjustments. For example, researchers showed that in the case of weight loss, the choice to engage in health-related behaviors is higher if people identify themselves to be of poor health as a result of being overweight or obese (Kepka, Ayala, & Cherrington, 2007).

Previous research for a variety of health problems has shown that many people lack adequate knowledge about the risk factors for various illnesses including breast, cervical, and testicular cancers (Daley, 2007); heart disease (Collins, Dantico, Shearer, & Mossman, 2004); stroke (Harwell *et al.*, 2005); and digestive heart failure and diabetes mellitus (Davis, Wheeler, & Willy, 1987). For example, Harwell *et al.* (2005) assessed perceived risk for developing a stroke and history of stroke risk factors in a random-digit-dial telephone survey of primarily Caucasian adults, aged 45 and older. Perceived risk information was collected and recorded on a *Behavioral Risk Factor Surveillance System Survey,* and an additional two questions were asked to estimate perceived risk including: "Do you believe you are at increased risk of having a stroke?" and "Has a doctor or other healthcare professional ever told you that you may be at risk for a stroke"? The results revealed that almost half of the respondents with two or more objective risk factors were inaccurate and did not consider themselves to be at risk of developing a stroke. The authors concluded that if people do not have adequate knowledge of the risk factors for a stroke, they are unable to accurately assess their own risk for developing the condition; if they do not have sufficient knowledge and perceived vulnerability for developing a stroke, they do not have enough motivation to perform appropriate health-protective behaviors (Harwell *et al.*, 2005).

Similarly, a lack of knowledge regarding the risk factors for Type-II diabetes was found to be directly linked to the underestimation of risk for developing the disease (Adriaanse *et al.,* 2008). Adriaanse *et al.* (2008) examined perceptions of Type-II diabetes risks in Dutch adults, aged 50-75, and discovered the majority of participants had inadequate knowledge about the disease and were inaccurate in regards to judging their personal risk for Type-II diabetes. Risk was commonly underestimated; among the high-risk participants, 50% considered themselves as having "zero" risk for developing Type-II diabetes. The authors concluded that a lack of knowledge regarding the risk factors for Type-II diabetes was directly related to the underestimation of the likelihood of developing the disease, among high-risk participants (Adriaanse *et al.,* 2008). This study confirms that as with other medical conditions, knowledge about the risk factors for Type-II diabetes is necessary for accurate perception of one's personal risk for this disease. However, the exclusively older-aged participants of the study might limit the extent to which these outcomes can be generalized to younger populations.

In the U.S. population, a limited number of studies have focused on knowledge and health behaviors in non-diabetic Hispanics, an objectively high-risk minority ethnic group for developing Type-II diabetes (Kepka, Guadalupe, Ayala, & Cherrington, 2007; Chilton, Hu, & Wallace, 2006). Chilton, Hu, and Wallace (2006) have assessed health promoting lifestyles (i.e., health responsibility, physical activity, and nutrition) and Type-II diabetes knowledge among Hispanics from different demographic groups (i.e., age, education, gender, income). The results revealed that participants had lower scores on health promoting behaviors (i.e., responsibility, nutrition, and physical activity) and Type-II diabetes-related knowledge than African American populations in previous studies (Johnson, 2005; Brady & Nies, 1999). The results also showed that diabetes knowledge was predicted by age and education of participants. In addition to acculturation and low socioeconomic status being factors in the outcome of this study, the authors hypothesized that education level may play a role, with lower education leading to less health promoting behaviors and poorer Type-II diabetes knowledge. In support of this notion, the study found that both age and education were positively correlated with the amount of Type-II diabetes knowledge (Chilton, Hu, & Wallace, 2006).

Though the association between level of education and knowledge of diabetes is convergent with previous findings (Arcury *et al.,* 2004; Daniulaityte, 2004; Firestone *et al.,* 2004), the outcomes regarding the relationship between age and diabetes knowledge are inconsistent. In a study by Firestone and colleagues (2004), those of a younger age were found to have greater knowledge of Type-II diabetes, whereas in Chilton *et al.* (2006), diabetes knowledge was found to be greater in older adults. In Firestone *et al.* (2004), the researchers were looking for predictors of diabetes knowledge and treatment satisfaction in Costa Rican adults (age range 24-88) already diagnosed with Type-II diabetes. It must be noted that this sample was primarily older-aged (Mean = 61.4 years) in comparison to Chilton *et al.* (2006; Mean = 32.4 years). This discrepancy in the mean ages of samples could be related to the differences in the relationship found between age and diabetes knowledge. Perhaps in older samples, the older participants do not have the appropriate cognitive capacity to retain diabetes knowledge as well as the younger adults in the sample. On the other hand, a positive correlation may be found between age and diabetes knowledge in younger samples, because the older participants may have more life experience with diabetes. Considering these discrepancies, it is necessary to further examine the relationship between age and Type-II diabetes knowledge.

Chilton, Hu, and Wallace (2006) concluded that the risk factors of Type-II diabetes not only included a lack of knowledge, but also low physical activity levels.

Furthermore, levels of knowledge and physical activity are factors that are considered modifiable, in that changing them can help produce positive changes in health behavior. However, the results of this study are limited by a small sample of only 40 adult subjects; future research should utilize a larger sample size to further examine the relationship between diabetes-related knowledge and health behaviors (Chilton, Hu, & Wallace, 2006).

Baptiste-Roberts *et al.* (2007) examined knowledge of objective risk factors for Type-II diabetes in a similarly high-risk minority population of 2,310 predominantly African-American adults aged 18 and older. The population studied consisted primarily of women. Knowledge of risk factors for Type-II diabetes was directly related to health behaviors. Participants with diabetes risk factor knowledge were more likely to attempt weight loss, engage in physical activity, consume five-or-more servings of fruit and vegetables per day, and had been screened for Type-II diabetes. The limitations of this study include the fact that it focused primarily on women with less than a high school education. Therefore, these findings cannot be generalized to other populations. In addition, though previous studies have examined college students' perceived knowledge of Type-II diabetes (Collins, Dantico, Shearer, & Mossman, 2004), little is actually known about how diabetes knowledge and perceived risk for Type-II diabetes are related in this population since few studies have directly examined this relationship.

One study that indirectly studied the relationship between diabetes knowledge and risk perception among young adults was conducted by Collins, Dantico, Shearer, and Mossman (2004). The researchers' primary goal was to assess knowledge of heart disease risk factors, risk perception, and risk management strategies in 1,481 mainly

Caucasian college students. In addition, participants were asked to select a health issue they believed they knew most about (subjective or perceived knowledge). These health issues included sexually transmitted diseases (STD's), cancer, psychological disorders, heart disease, and diabetes. The results of subjective/perceived knowledge were: STD's (37%), psychological disorders (32%), cancer (15%), heart disease (8%), and Type-II diabetes (7%). It is important to note that of these various health issues, only knowledge pertaining to heart disease was objectively assessed, meaning that participants' actual knowledge about the risk factors for heart disease was actually tested. Subjective knowledge, on the other hand, refers to perceived knowledge or what the person believes they know about the issue, and the amount of actual knowledge is not assessed. The results of the objective heart disease knowledge revealed that overall students had relatively low knowledge about heart disease risk factors, and they also had an overall low risk perception for developing heart disease. In addition, the results indicate that students in this study perceived that they had the least knowledge about Type-II diabetes (Collins, Dantico, Shearer, & Mossman, 2004). The researchers suggested that the inadequate knowledge of medical risks in this population may be attributed to the fact that the potential negative consequences of Type-II diabetes or heart disease are too remote for young adults to have any motivational impact, especially compared to other immediate health threats such as sexual diseases, depression, and anxiety (Collins, Dantico, Shearer, & Mossman, 2004). Again, it is important to note that this study did not assess participants' actual knowledge of Type-II diabetes (i.e., risk factors, symptoms, consequences) or their risk perception of Type-II diabetes. Therefore, more insight is needed in regards to whether young adults are lacking in actual knowledge about Type-II diabetes as well as into the relationship between actual knowledge and risk perception of the disease.

Previous studies have shown that appropriate knowledge about a disease or illness is linked to increased compliance with a healthy lifestyle (Baptiste-Roberts *et al.,* 2007; Forsyth & Goetch, 1997); however other researchers report findings inconsistent with this trend. For example, one study found that appropriate osteoporosis knowledge did not lead to appropriate dietary behavior in 911 college students (Ford, Bass, & Keathley, 2007). Similarly, Mahajerin, Fras, Vanhecke, and Ledesma (2008) found that level of diabetes knowledge and health behaviors in high school adolescents were not related. Awareness (knowledge of Type-II diabetes) and self-reported risk factors for Type-II diabetes were explored in 664 high school adolescents. Awareness was evaluated by questions referring to risk factors, complications, and methods to decrease future risk. The results revealed that high school students had an overall good knowledge of the causes, risk factors, complications, and lifetime risks for Type-II diabetes. Specifically, 95% of students correctly identified that diabetes is a problem with moving sugar out of the blood; 49% identified obesity, physical inactivity, junk food, family history and certain ethnicity as risk factors; 35% identified obesity as the most important risk factor; 33% correctly identified complications associated with Type-II diabetes; 51% said cardiovascular disease was the most common complication; and 48% percent correctly said that there is a 1 in 3 lifetime risk for developing the disease (Mahajerin, Fras, Vanhecke, & Ledesma, 2008). Although students had adequate diabetes knowledge about the risk factors and complications, they also exhibited a high level of behavioral risk factors (i.e., high percentages watching more than 10 hrs of TV weekly, eating fast food and not getting more than 2 hrs of exercise per week) demonstrating that level of knowledge was not related to health-preventive behaviors in this population. So although knowledge of the risk factors and consequences of a particular disease are thought to increase one's risk perception about the disease, it may not be enough to lead the individual to perform health-preventive behaviors. This may be particularly true for young adults. General research on risk perceptions of young adults indicate that young adults typically see themselves as less at risk for the probability of negative health outcomes, including developing a disease or illness (Millstein & Halpern-Felsher, 2002). Research specific to assessing accuracy of young adults' risk perceptions of developing Type-II diabetes seem to be very few. As a result, it is difficult to ascertain what may be affecting this population's perceived risk of developing Type-II diabetes, and thereby not performing as many preventive health behaviors.

As previously speculated by Collins and colleagues (2004), the negative consequences of Type-II diabetes might be too remote for young adults compared to other immediate health threats (e.g., sexual diseases, depression, anxiety, etc), and therefore less attention is given to these conditions. In other words, because the consequences of not performing health preventive behaviors for Type II-diabetes are not immediate, a possible explanation for the findings could be that the teenagers in Mahajerin *et al.*'s (2008) study were probably not motivated to perform those health behaviors. Early adulthood is the crucial time period for establishing healthy behaviors to effectively reduce risk of developing the disease later in life. The young adult population is at a considerably higher risk for developing Type-II diabetes than prior generations as a result of the drastic rising rates of obesity and Type-II diabetes among young adults (CDC, 2008; U.S. Department of Health & Human Services, 2005). Increasing college students' knowledge of harmful long-term health consequences of an unhealthy diet may be a necessary step for preventing the Type-II diabetes epidemic from growing.

Indirect and Direct Factors Other than Knowledge Affecting Risk Perception

Research has indicated that adequate knowledge of a medical condition is a necessary prerequisite to accurate risk perceptions (Adriaanse *et al.,* 2008; Kepka, Ayala, & Cherrington, 2007; Graham *et al.,* 2006; Harwell *et al.,* 2005). In addition to knowledge, several other factors were indicated as predictors of risk perception such as an individual's personal health motivation to perform a health behavior, knowledge of family history with the disease (Hiraki *et al.,* 2009), having a friend or acquaintance with the disease (Ey *et al.,* 2000), and being older-aged (Kreuter & Strecher, 1995; Chilton, Hu, & Wallace, 1995). It should be mentioned that having a family history or knowing someone with a disease as well as having a personal health motivation to perform a health behavior will probably have some correlation with risk perception that may be mediated by knowledge, however, there may be other factors that influence the relationship between these variables and risk perception. It could be that part of the correlation between these variables and risk perception may be due to these variables themselves, independent of diabetes knowledge.

Health Motivation

Health motivation can be defined as goal-directed arousal to engage in health-protective behaviors (Moorman & Matulich, 1993). This trait focuses on one's interest in performing certain health preventive behaviors. Individual differences on this trait make one more or less likely to be concerned about health risks and more or less likely to perform health behaviors. Examining the effect of health motivation on the relationship between Type-II diabetes knowledge, risk perception of the disease and health-preventive behaviors may provide insight as to why knowledge of a particular disease and its risk factors may not always translate into performing preventive health behaviors (Mahajerin et al., 2008). Health motivation is thought to have a powerful influence on health choices and health outcomes (Simmons, 1989). Tucker and colleagues (2009) were interested in examining the predictors of engagement in both a health-promoting lifestyle and individual health-promoting behaviors among low-income, African-American mothers and non-Hispanic White mothers, each of whom was a primary caregiver for a chronically ill adolescent. The individual health-promoting behaviors that were investigated were eating a healthy diet, exercising regularly, stress management practices, and health responsibility behaviors. An example item assessing health responsibility is, "Do you choose a diet low in fat, saturated fat, and cholesterol?"

In this study, health motivation was found to be a significant predictor of health responsibility, but it was not found to be a significant individual predictor of an overall healthy lifestyle. The authors speculate that this finding may be due to the fact that health motivation was measured indirectly by assessing participant's value of health rather than by directly assessing health motivation. However, previous research has indicated that health motivation predicts eating behaviors such as restricting unhealthy foods and adding healthy ones and is positively related to a healthy lifestyle (Jayanti & Burns, 1998; Moorman & Matulich, 1993; Carter, 1990). Therefore, it would be valuable to directly assess health motivation to determine whether or not it truly affects the performance of health-preventive behaviors. Again, health motivation is believed to make one more or less likely to be concerned about health risks (Moorman & Matulich, 1993). It therefore stands to reason that health motivation may have its effects on health behaviors through its effect on one's risk perception. For instance, one with high health motivation may perceive their risk for developing a disease as greater than those with a low health motivation; therefore, they are more likely to perform the health-preventive behaviors.

Family History, Perceived Risk, & Knowledge

Having a family history of the disease may also influence one's risk perception. Hiraki *et al.* (2009) found that having a family history of Alzheimer's disease was significantly associated with participants' Alzheimer's risk perception, where having more affected relatives predicted a higher level of perceived risk. Similarly, a study by Montgomery, Erblich, DiLorenzo, and Bovbjerg (2003), demonstrated that individuals with a family history of breast cancer perceive their risk for the illness to be much greater than participants without a family history of breast cancer.

Adriaanse *et al.* (2008) found similar results for family history of Type-II diabetes in the adult population; having a parent or sibling with diabetes significantly increased participants' perceived risk and vulnerability for developing diabetes among non-U.S. adults. Montgomery, Erblich, DiLorenzo, and Bovbjerg (2003) also found that family history of Type-II diabetes was related to a greater perceived risk for developing the disease. Having a parent or sibling with the disease was also found to increase risk perception in Caucasian and African American adolescents aged 11-19; as number of relatives with the disease increased, so did perceived vulnerability to disease (Ey *et al.*, 2000). Likewise, Forsyth and Goetsch (1997) assessed perceived threat of illness in 30 Caucasian adults with parental history of Type-II diabetes and also found that family history significantly increased perceived risk for Type-II diabetes.

Having a friend or acquaintance with a disease may also affect an individual's risk perception. If one has a friend or acquaintance with a particular disease, this introduces and familiarizes them with an illness, thereby increasing the personal association regarding the health issue. In the study by Hiraki and colleagues (2009), perceived risk of breast cancer was increased, not only by having a family history of breast cancer, but also from having a personal association with the disease (Hiraki *et al.*, 2009). Similarly, Ey *et al.* (2000) found that having a non-blood relative with a history of colon cancer, heart disease, or diabetes contributed to participants' perceived risk, in that those with a non-blood relative that had a history of disease perceived themselves as being at higher risk for colon cancer, heart disease, and diabetes. Because these relatives were not related to participants by blood, it was not considered family history of the disease; rather it was classified as friend or acquaintance history.

It was also found that having a family history expands not only risk perception, but also overall knowledge about the disease and implementation of relevant health behaviors (Baptiste-Roberts *et al.*, 2007; Forsyth & Goetsch, 1997). Forsyth and Goetch (1997) found that individuals with a family history of Type-II diabetes reported engaging in significantly more health protective behaviors (i.e., weight control) than did a control group with no family history. Similarly, Baptiste-Roberts *et al.* (2007) found that family history was positively related to knowledge about the risk factors for Type-II diabetes and healthy behaviors; participants with better knowledge of risks associated with Type-

II diabetes were more likely to consume five-or-more servings of fruit and vegetables per day. However, the researchers established that the amount of knowledge was a better predictor of health behaviors than family history. The authors stress the key importance of accurate and comprehensive diabetes-related knowledge for promotion of preventive behavior, independent of the origin of this knowledge (Baptiste-Roberts *et al.,* 2007). However, there is a good case to be made that having a family or friend history of Type-II diabetes can help increase one's knowledge of the risk factors and consequences of the disease and therefore increase one's personal risk perception of Type-II diabetes, which may lead to performing more health-preventive behaviors.

In regards to Type-II diabetes, it seems well evidenced that the knowledge of risk factors is necessary for a person to accurately assess a personal risk and in turn, perform appropriate health behaviors to reduce this personal risk. Individuals need to be especially aware of the modifiable risk factors for Type-II diabetes in order to effectively manage their risk for developing the disease. In addition, being overweight or obese, consuming a poor diet, and little-to-no physical exercise are also factors that can be modified to reduce one's objective risk for developing Type-II diabetes (Castro, Shaibi, & Boehm-Smith, 2009). The CDC (2008) declares that healthy eating and physical activity are the behaviors that maintain good health in Type-II diabetic individuals and prevent Type-II diabetes in at-risk populations. The agency recommends that every adult make efforts to adopt a healthier lifestyle by engaging in physical activity and improving eating habits by consuming less calories, less daily fat, and more fruits and vegetables (CDC, 2008).

Modifiable Risk Factor for Type-II Diabetes: Obesity

Obesity is the most important single modifiable predictor of Type-II diabetes (Gill & Cooper, 2008; CDC, 2008). Obesity is defined by the CDC (2008) as having a very high amount of body fat in relation to lean body mass; a body mass index (BMI) of 30 or more constitutes a diagnosis of “obese”. A person’s body mass index is calculated by multiplying a person’s weight (in pounds) by the number 703, then dividing by the height (in inches) squared (i.e., BMI = weight in pounds*703/height in inches^2). A BMI under 18.5 constitutes a weight status of “underweight”; a BMI of 18.5-24.9 constitutes a weight status of “normal”; and a BMI of 25-29.9 places one in the “overweight” category. Where excess fat is located on the body is another risk for health; women are at a higher disease risk if their waist circumference is larger than 35 inches and men are at a higher risk when their waist measures more than 40 inches because of the fat being collected around the waist (CDC, 2010).

According to the U.S. Department of Health and Human Services (2005), an overweight or obese status places one at-risk for many diseases such as Type-II diabetes, hypertension, heart disease, stroke, osteoarthritis, and various cancers. Obesity is a substantial problem in the United States as rates have risen substantially in past years; in 1987, the obesity rate for U.S. adults in the state of Texas alone was 10%, and by 2009, the percentage of obese adults living in Texas had drastically grown to 29.5% (CDC, 2008). Today, the overall prevalence rate of overweight and obese American adults are 36.1% and 27.1% respectively (CDC, 2009). That means approximately one-third of the population is obese with a BMI of 30 or greater (CDC, 2010). According to the CDC (2008), African Americans have a 51% higher rate of obesity, and Hispanic Americans have a 21% higher rate of obesity when compared to Non-Hispanic White Americans. Statistics from the CDC (2008) also report that rates of obesity in children and young adults are at an all time high, with 16.9% of Americans (ages 2-19) being classified as obese. From 1980 and 2008, rates of obesity in preschool children ages 2-5 rose from 5% to 10.4%, and in adolescents aged 12-19, obesity rates dramatically increased from 5.0% to 18.1% in the same time period (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Also, young boys ages 2-19 are more likely to be obese than girls of the same age, and Hispanic boys had significantly higher odds of being obese compared to Non-Hispanic White boys ages 2-19 (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). These trends are troubling since the growing rates of obesity are predicted to result in an overall increase and earlier onset of health problems such as Type-II diabetes and heart disease.

The prevalence of overweight children and adolescents has risen considerably in previous years with 16% percent of children and adolescents being overweight, which is a rate that has tripled over the last two decades (U.S. Department of Health & Human Services, 2005). This rate is alarming and needs attention, because overweight children and adolescents are likely to continue poor eating habits into adulthood. The U.S. Department of Health and Human Services (2005) emphasizes that maintaining a healthy weight throughout childhood and adolescence can significantly decrease the likelihood of becoming an overweight or obese adult.

Several studies have consistently shown that college-aged, young adults are well known for experiencing weight gain, especially within the first few years of college (Lloyd-Richardson *et al.,* 2009; Racette, Deusinger, Struebe, Highstein, & Deusinger *et al.,* 2005; Guo, Huang, & Maynard *et al.,* 2000; Mokdad *et al.,* 1999). For example, Lloyd-Richardson *et al*. (2009) conducted two separate studies on college students in which the prevalence of weight gain was assessed. Study 1 examined weight change in 904 freshman and sophomore students at Indiana State University from 2002-2004. Study 2 assessed weight gain and BMI change over the freshman year in 382 students at a private university in Rhode Island from 2004-2006. Seventy-seven percent of students in study 1 and 70% of students in study 2 gained weight over their freshman year. In the first study, 16.9% of students were overweight and 7.4% were obese at the start of college, but by the end of their freshman year, 28.5% were overweight and 7.5% were obese. For the students followed into their sophomore year, 16% of students were overweight and 4.3% were obese at the start of college, and by the end of their sophomore year, 25.9% were overweight and 9.2% were obese. In the second study, 70% of students gained weight during their freshman year. At the start of the school year, 11% of students were overweight and 3.7% were obese, and by the end of the year, 13.5% of students were overweight and 4.3% were obese. In study 1, the average increase in body weight was similar for males and females and both genders continued to gain weight into their sophomore year. According to the authors, this trend of gradual body weight gain may persist throughout one's lifetime elevating their risk for various health problems including Type-II diabetes (Lloyd-Richardson *et al.*, 2009). Researchers suggest that young adults are in need of more health-related information to increase the likelihood of establishing a healthy lifestyle and prevent poor health choices in the future (Lloyd-Richardson *et al.*, 2009). The rise in obesity, and its reputation as one of the major risk-factors for the disease, could explain the expected rise of Type-II diabetes' cases in future years (Adams & Lammon, 2007).

Over the last 20 years, obesity rates among all Americans have increased by 23% (Owens, 2008; CDC, 2008). Recent years also witness a considerable increase of Type-II cases for young adults. In fact, for people between the ages of 30-39, rates have increased by 70% within the past 10 years (Owens, 2008). The percentage of adults 20 years and older with diabetes (diagnosed or undiagnosed) is as high as 10.7%, or 23.5 million people in the United States (CDC, 2008). The progressive increase of obesity--one of the major risk factors for the disease--is expected to further elevate overall rates of Type-II diabetes and earlier onset of the disease in future years (Adams & Lammon, 2007).

Not only is obesity a significant risk factor for developing Type-II diabetes, it has been found to be associated with substantially more problems and a reduced quality of life in patients with Type-II diabetes. For example, Hlatky, Chung, Escobedo *et al.* (2010) found that a higher BMI was associated with worse scores on quality of life in patients with Type-II diabetes. The authors concluded that obesity has negative effects on the health and well-being of patients with Type-II diabetes as it is linked with significantly more health problems and a reduced quality of life (Hlatky, Chung, & Escobedo *et al.,* 2010).

There is increasing evidence that being overweight or obese is significantly associated with insulin resistance in non-diabetic individuals (Madden, Loeb, & Smith, 2008; Steinberger & Daniels, 2003). Prolonged obesity leads to insulin resistance which over time leads to a loss of control of blood glucose, resulting in dietary glucose intolerance that ultimately results in the development of Type-II diabetes (Steinberger & Daniels, 2003). Weight loss in obese individuals' improves insulin sensitivity, which helps control glucose intolerance in diabetic individuals and delay, and in some cases, prevent the onset of Type-II diabetes in at-risk populations (Steinberger & Daniels, 2003). Likewise, Sjostrom, Peltonen, Wedel, *et al.* (2000) found that a 16% weight loss resulted in a significant reduction in the incidence of Type-II diabetes. These convergent findings support the notion that obesity is a significant risk factor for Type-II diabetes. However, they also suggest that the risk of developing Type-II diabetes can be effectively lowered by maintaining a healthy body weight.

Modifiable Risk Factor for Type-II Diabetes: Physical Activity

Maintaining an adequate level of physical activity has two-fold benefits; it can reduce one's risk for developing Type-II diabetes by helping to maintain a healthy body weight and by increasing insulin sensitivity (CDC, 2008). Physical activity has positive effects on the body because regular exercise improves the amount of glucose that is absorbed into the body's cells increasing the body's sensitivity to insulin and facilitating the maintenance of healthy glucose levels within the body (Castro, Shaibi, & Boehm-Smith, 2009). Improved blood glucose levels can reduce complications, such as cardiovascular disease, renal failure, and blindness in diabetic patients', as well as prevent Type-II diabetes in high-risk populations (Wangberg, 2008). As shown in previous studies (Castro *et al.,* 2008; Gill & Cooper, 2008; Madden, Loeb, & Smith, 2008; Goris & Westerterp, 2007; Schulze & Hu, 2005), exercise decreases the risk for developing Type-II diabetes by facilitating the maintenance of a healthy body weight, as well as reducing stored body fat, while maintaining healthy glucose levels, which in turn can prevent onset of the disease.

Numerous studies have consistently reported inverse relationships between physical activity and Type-II diabetes risk (e.g., Hu, Lindstrom, Valle *et al.,* 2004; Monterrosa, Haffner, Stern *et al.,* 1995; Helmrich, Ragland, Leung *et al.,* 1991). In a comprehensive review, Gill and Cooper (2008) examined data from 20 longitudinal cohort studies, which evaluated the role of physical activity in the prevention of Type-II diabetes. The outcomes of an age-adjusted analysis revealed that participants who reported the highest levels of physical activity had a 33% to 50% lower risk of developing Type-II diabetes, compared to the less active participants (Gill & Cooper, 2008). The longitudinal Nurse's Health Study conducted on women in the U.S. found that exercising vigorously at least one-time per-week reduced risks for diabetes by 33%, compared to individuals who exercised less (Gill & Cooper, 2008). The participants with the highest amounts of weekly physical activity showed a 46% risk reduction for Type-II diabetes, compared to participants with the lowest levels of physical exercise. The results also confirmed benefits of exercise intensity. A faster walking pace was associated with a 14-41% lower risk for Type-II diabetes. Overall, women who engage more frequently and with more intensity in physical activities developed Type-II diabetes at a substantially lower rate compared to less active participants (Gill & Cooper, 2008).

One of the benefits of physical activity is increased fat oxidation, while inactivity reduces the oxidation of fat in the body (Castro *et al.,* 2008). Regular physical activity is protective against obesity and Type-II diabetes and helps prevent body-fat accumulation and maintain a healthy body composition (Goris & Westerterp, 2007). The American Diabetes Association (2006) recommends at least 150 minutes of moderate-intensity physical activity (or 60-90 minutes of vigorous activity) per week to reduce the risk of

Type-II diabetes. According to CDC (2007), every adult should accrue 30 minutes or more of moderate-intensity physical activity on most, and if possibly, all days of the week.

Modifiable Risk Factor for Type-II Diabetes: Diet

In addition to physical activity, eating a healthy diet is crucial for preventing obesity and Type-II diabetes (Madden, Loeb, & Smith, 2008; Schulze & Hu, 2005). According to the U.S. Department of Agriculture (2005), the dietary guidelines for preventing diabetes emphasize eating fruits, vegetables, whole grains, fat-free milk or low-fat milk, and milk products; consuming lean meats, poultry, fish, beans, eggs, and nuts; eating a diet that is low in saturated fats, trans fats, cholesterol, sodium, and added sugars; and staying within daily calorie needs. Recommendations also include consuming less red meat, butter, refined grains like white rice, bread, and pasta, and potatoes, and consuming more healthy fats and oils like olive oil and soy, and more whole grains like brown rice, wheat pasta, and oats. Daily exercise is also recommended in addition to eating a healthy diet to aid in the prevention of Type-II diabetes (U.S. Department of Agriculture, 2005). These health-protective behaviors aid in the prevention of Type-diabetes by controlling weight and ensuring proper intake of nutrients vital for health. However, if overweight individuals lack knowledge of what constitutes a healthy diet, they are unable to make the best decisions regarding their own diet.

Eating a healthy diet is not only critical for preventing Type-II diabetes, but it is also important for managing Type-II diabetes. According to Medline Plus (2010), a healthy diet for diabetics consists of limiting sweets; eating small meals often; using caution about the timing and amount of carbohydrates being consumed; eating plenty of whole-grain foods, fruits and vegetables; eating less fat; and limiting alcohol intake. It is well established that eating a diabetic diet helps keep blood glucose from becoming too high, which helps to prevent the complications associated with diabetes (Medline Plus, 2010).

Previous research has included physical activity and diet as modifiable risk factors for diabetes (Madden, Loeb, & Smith, 2008; Schulze & Hu, 2005). Both increasing physical activity and improving eating habits, have been shown to be effective in the prevention of Type-II diabetes and obesity. A comprehensive literature review of lifestyle interventions by Madden, Loeb, and Smith (2008), revealed that several studies demonstrated the efficacy of diet and exercise in preventing Type-II diabetes. In this review, five studies evaluated the effects of diet on diabetes prevention and four-out-of-five studies resulted in statistically significant decreases in body weight and blood glucose levels (Madden, Loeb, & Smith, 2008).

A study conducted on the Chinese population provided causal evidence of healthy diet and physical exercise on reducing the risk of developing Type-II diabetes. A Chinese Trial randomly assigned 577 participants with impaired glucose tolerance (pre-onset to Type-II diabetes) to one-of-three intervention conditions: diet alone, exercise alone, diet-plus-exercise, or control condition. The participants were all over the age of 25 with a mean age of 45. Results indicated promising outcomes for participants. The goals of the diet group consisted of increasing vegetable intake, lowering sugar, alcohol, and overall calorie intake. The exercise group's goal was to increase leisure time physical activity. These interventions lasted for 6 years. Participants were also followed 20 years later to determine long term effects of the interventions on Type-II diabetes risk.

Compared to the control group, which received no intervention, the diet alone produced 31% significant reduction in risk of developing Type-II diabetes, exercise alone-46% significant reduction, and diet-plus-exercise-42% significant reductions (Shulze & Hu, 2005). During the active intervention, the cumulative diabetes incidence in the intervention group was 43% and 66% in the control group. At the 20 year follow period, the cumulative diabetes incidence was 80% for the intervention group and 93% for the control group. Also, the participants in the intervention group had an average of 3-6 fewer years with diabetes (Schulze & Hu, 2005). These results demonstrate that diet and/or exercise can significantly reduce one's risk for developing Type-II diabetes. Unfortunately, no study in this review examined the effects of diet or exercise intervention on young adults. However, if these preventative efforts work in older populations with impaired glucose tolerance, it might be that these efforts are also effective in a young-adult population without impaired glucose tolerance.

Dietary fat is a crucial factor that increases the likelihood of developing obesity, and it has an influence on insulin sensitivity both directly and indirectly through obesity; high dietary fat intake has been proven to lead to insulin resistance (Stoeckli & Keller, 2004). In animal experiments, high-fat diets resulted in impaired glucose tolerance (Stoeckli & Keller, 2004). Dietary fat is amongst the most significant predictors for the development of obesity (Goris & Westerterp, 2007). A diet high in fat increases risks for obesity and Type-II diabetes (CDC, 2008); therefore eating a low-fat diet is important in the prevention of these conditions.

A study conducted by O'Brien, Fries, and Bowen (2000), examined how ability to report accurate self-perceptions of fat-intake, may influence perceived health-risk, and intentions to change diet-related behaviors in a sample of 188 undergraduate students. Participants were divided into 3 groups; *overestimate*, *underestimate*, and *accurate* based on their self-reported fat intake responses and objective measures of fat intake. The results of this study revealed that the participants who underestimated their fat intake were less knowledgeable about the fat-content in foods, and perceived less risk of health problems, than participants who overestimated their fat intake. Also, the participants who underestimated fat intake were less likely to have an innate desire to change their diet-related behaviors, than those who overestimated fat intake (O'Brien, Fries, & Bowen, 2000). According to the authors, a future study that compares perceptions of risks and attention to people's subjective assessments of their own diet may be a useful aid in understanding people's cognitions and behaviors regarding dietary fat (O'Brien, Fries, & Bowen, 2000). It may be important to examine people's estimates of dietary fat intake, because these findings suggest a positive relationship between dietary knowledge about fat content in foods, accuracy of health risk perception, and motivation for health and health behavior change. If future research indicates a relationship between these factors, this could be beneficial in regards to tailoring prevention efforts to more effectively motivate an individual to perform preventive health behaviors.

Significance for Health Psychology

A more comprehensive assessment of diabetes knowledge (including the causes, risk factors, and complications), accuracy of risk perception (including assessment of both subjective and objective risks for Type-II diabetes), health behaviors linked to risk of this disease (i.e., fat intake, eating habits, and physical activity), BMI, and health motivation is highly warranted among young adults considering the forecasted prevalence of Type-II diabetes in this population (CDC, 2008). The present study aims to add knowledge to an understudied area of research by exploring college students' Type-II diabetes knowledge levels (i.e., causes, risk factors, and consequences) and the relationships between objective and perceived risks of the disease, modifiable personal risk factors/ health behaviors (i.e. diet, fat-intake, and physical activity levels), and health motivation. Further understanding about what aspects of Type-II diabetes knowledge are lacking is needed so that risk communication and education efforts can target these areas in the young-adult population before disease onset occurs. According to Hiraki *et al.*, (2009), gaining knowledge into perceived risk for diseases, such as diabetes, can be utilized clinically by improving risk communication and inspiring the adoption of preventive health behaviors, especially for those who have an underestimated perceived risk for diseases. The prevention of Type-II diabetes starts with targeting the younger generation, therefore this research can add valuable knowledge for future education efforts targeted at younger, potentially at-risk adults.

Significance for Targeting Young Adults

The young adult population is significantly more at-risk for developing Type-II diabetes than previous generations in view of the rising rates in obesity and Type-II diabetes for young adults (CDC, 2008; U.S. Department of Health & Human Services, 2005). Increasing college students' awareness of negative long-term health consequences of an unhealthy diet could be an important step in preventing the Type-II diabetes epidemic from growing, and help reduce the prevalence of the disease. As mentioned previously, high-risk for onset of Type-II diabetes is an understudied subject of research with regards to young adults, which is troubling, considering there is currently a rapid increase of young adults, 20 years and older, diagnosed with Type-II diabetes (CDC, 2008).

This study attempts to provide empirical data to help raise society's awareness and correct inaccurate perceptions about personal risks to Type-II diabetes (i.e. BMI, activity level, ethnicity etc.), especially at younger ages. As previous research has demonstrated, perceived risk has been shown to increase with age (Kreuter & Strecher, 1995); therefore, the college-aged population needs to learn that they too are at risk, and even if that risk is remote, prevention starts right now. The current study's goal was to examine perceived risks of Type-II diabetes and knowledge of the causes, consequences, and risk factors for diabetes in college students. Differences in the accuracy of one's risk perception will be examined in relation to the presence or absence of a family history of Type-II diabetes. This study will also explore relationships between health motivation, diabetes knowledge and perceived risks for Type-II diabetes. Further understanding of how these three factors interact in predicting healthy behaviors, is needed, especially at younger ages, before disease onset begins to occur.

Research Hypotheses

I. It is predicted that individuals high in diabetes knowledge will perform more health preventive behaviors (have a healthier diet, do more exercise, and take in less fat) and have a healthier weight status, compared to low diabetes knowledge individuals.

II. It is predicted that individuals high in preventive health motivation will perform more health preventive behaviors (have a healthier diet, do more exercise, and take in less fat) and have a healthier weight status, compared to low preventive health motivation individuals.

III. It is predicted that individuals higher in perceived risk will perform more health preventive behaviors (have a healthier diet, do more exercise, and take in less fat) and have a healthier weight status than individuals with lower perceived risk of the disease.

IV. The accuracy of assessing perceived risk to diabetes will be higher among individuals who have a family history of Type-II diabetes compared to those with no family history of this disease.

In addition, the reported knowledge about diabetes will be examined with the goal of identifying areas where knowledge is missing or inaccurate, especially among the participants with an objective high risk of diabetes. This information could be useful for future education and prevention programs targeting college students.

CHAPTER II

METHOD

Participants

One hundred and twenty six Texas State University-San Marcos students (mean age $M = 21.54$), 96 females (76.2%) and 30 males (23.8%) were recruited from psychology classes in which extra credit for participation was offered pending professor's approvals. Of the students that participated in the study, 25.4% (32) were classified by the university as freshman, 26.2 % (33) as sophomores, 26.2% (33) as juniors, 21.4% (27) as seniors, and 0.8% (1) was classified as a graduate student. The ethnic breakdown of participants was as follows: 56.3% Caucasians (71), 29.4% Hispanics (37), 10.3% African Americans (13), and 4% "other" (5). Participants selected an income category based on their household income. The income composition for participants was as follows: 15.9% selected less than 15,000 (20), 15.1% selected 15,000-30,000 (19), 11.9% selected 30,000-45,000 (15), 12.7% selected 45,000-60,000 (16), and 43.7% selected above 60,000 (55). All students were invited and encouraged to participate in the study, however participation was voluntary. Those with a current diagnosis of diabetes were excluded from the data analysis.

Materials & Apparatus

Two questionnaires were administered to participants. The first survey was constructed by the researcher and was comprised of 79 questions. The first four items were demographic questions (i.e., gender, ethnicity, current year in college, and income level). The demographic items were followed by 6 subscales administered in the following order: *Healthy Eating Scale, Health Motivation Scale, Lab A8-2 Fat Intake Scale, Diabetes Knowledge Questions, Objective Diabetes Risk Questions, and the Perceived Risk Question.* The second survey administered was the *International Physical Activity Questionnaire* (Craig *et al.,* 2003). Please see Appendices A-H for all survey items.

The Healthy Eating Scale (Adams & Mowen, 2005), a 6 item scale, was used to measure ***healthy eating habits***. This measure provided information about fruit and vegetable consumption, fiber intake, number of meals a day, consumption of a balanced diet, and monitoring of fat and sugar intake. Participants answered the questions on a 5-point Likert scale ranging from never to always, the degree to which they believe each statement describes their eating habits (refer to Appendix B). The scale reliability is relatively high with an alpha reliability coefficient of .86 (Adams & Mowen, 2005). The score for this subscale is calculated by summing the responses for the items. A higher score constitutes healthier eating habits.

Next, the *Health Motivation Scale* (Adams & Mowen, 2005; Moorman & Matulich, 1993; Cronbach's $\alpha = .72$) was administered. This 8 item scale was employed to obtain ***motivation levels to be healthy and avoid health hazards***. Responses corresponded to a five-point-scale, ranging from never to always. Participants were asked to indicate how often they feel or act in a specific way addressed by 8 statements. Since this study is examining motivation to prevent health problems, only the first three items were used in analysis. According to Moorman (1990), the first 3 items correspond to a preventative orientation, and the proceeding 5 items correspond to a curative orientation. A curative orientation refers to one becoming motivated to take health action after a health problem arises. A preventative orientation refers to one taking action to prevent or avoid a health problem; therefore this orientation alone was further examined in this study. A reliability analysis was computed on the three preventative items and was shown to have good reliability with a Cronbach's $\alpha = .80$. The health motivation index is computed by summation of numerical ratings for the scale items.

The *Lab A8-2 Fat Intake Quiz* (Fahey, Insel, & Roth, 2005) was used to obtain ***levels of fat intake*** (refer to Appendix D). This measure expanded on fat intake information collected from the healthy eating scale. Fat intake is an important predictor of obesity; therefore it was examined more closely in this study. This scale consisted of 21 items. Questions asked participants to think about their eating and cooking habits over the past month and choose the answer that best describes how often they performed the specified behavior. Answer choices corresponded to a 5-point Likert scale ranging from never to always. The fat intake score is an average computed on responses to all items. The scores can range from 2.0 or lower to a 4.6 or higher and authors provide norms for their interpretation. A score of 2.0 or lower constitutes a "very poor rating" (high intake of fat); a score of 2.1 to 3.0 equals "poor"; 3.1 to 3.5 equals a "fair" score; a score of 3.6 to 4.5 means a "good" rating of fat intake; and a score of a 4.6 or higher is an "excellent" score (low fat intake**).**

The survey continued with *the **Diabetes Knowledge** assessment* which included diabetes related questions derived from multiple sources including the American Diabetes Association (2009; 2007), and the Diabetes Knowledge Questionnaire (DKQ-24; Garcia, Villagomez, Brown, Kouzekanani, & Hanis, 2001). Some questions on the DKQ pertain to "my diabetes" and were not included in the survey; 15 questions total were taken from this survey.

Diabetes knowledge statements created about risk factors were based on the following factors: an age greater than 45 years, having diabetes during a previous pregnancy, excess body weight (especially around the waist), having a family history of diabetes, having given birth to a baby weighing more than 9 pounds, having an HDL cholesterol under 35mg/dL, having high blood levels of triglycerides, a type of fat molecule (250 mg/dL or more), having high blood pressure (greater than or equal to 140/90 mmHg), having impaired glucose tolerance, low activity levels (exercising less than 3 times a week), having a condition called acanthosis nigricans, which causes dark, thickened skin around the neck or armpits, and being a person from certain ethnic background, including African American, Hispanic American, Asian American, and Native American, all of which have a higher risk for diabetes. Statements about the complications were based on the following complications: heart disease, stroke, kidney disease, eye complications, neuropathy, nerve damage, skin complications, and foot complications. Participants were asked to answer "yes", "no", or "I don't know" to the statements associated with the listed complications and "true" or "false" to the risk factor questions. Diabetes knowledge scores were based on the number of questions that were answered correctly. Scores could range from -28 to 28 points. If participants chose the correct answer, they received 1 point. If they selected the incorrect answer, they received -1 point. If they chose “I don’t know”, they received 0 points. A higher score indicates a greater level of diabetes knowledge.

The only known scale that assesses amount of diabetes knowledge is the *Diabetes Knowledge Questionnaire* (Garcia, Villagomez, Brown, Kouzekanani, & Hanis, 2001). The 24-item version of the DKQ has previously demonstrated acceptable reliability of 0.78, and construct validity has also been established (Garcia, Villagomez, Brown, Kouzekanani, & Hanis, 2001. Questions acquired from the ADA pertain to the complications (2007) and risk factors (2009) associated with Type-II diabetes. A total of 28 questions addressed diabetes knowledge (see Appendix E).

The *American Diabetes Association (ADA) Diabetes Risk Inventory* (Owens, 2008) followed. This scale was used to assess ***objective risks to diabetes*** and to compute the accuracy of participant’s perceived risk (refer to Appendix F). The Diabetes Risk Inventory consists of 7 items that assess individual risk characteristics and calculate individual diabetes risk scores. The items were derived from the electronic form called the Risk Calculator by the American Diabetes Association (2008). The inventory items reflect the leading Type-II diabetes risk factors: gestational diabetes, familial or genetic pre-disposition for diabetes, overweight or obesity, and older age. Please see appendix F for scoring information. If the responses total 10 or more points, diabetes risk level indicates *highest risk*; sums of 3 to 9 indicate *lower risk*.

The ADA screener relies heavily on age in order to produce a higher diabetes risk score. Participants receive 5 points for being between 45-64 years of age and 9 points for being over 65 years of age. In an effort to counter the age disadvantage of young adults, 5 points was added to all scores to create a projective score of what participant's Type-II diabetes risks would become in middle age if they continue with the same lifestyle habits. Although the ADA's diabetes risk screening instrument has been used widely in community screenings mainly to heighten awareness of diabetes risks (ADA, 2008), it has limited validity, reliability, and use as a scale (Owens, 2008). However, this is the only known paper and pencil Type-II diabetes screener/objective risk scale.

The final item on the first survey assessed ***perceived risk*** using the following single question**,** "In 25 years, how would you estimate your risk of having diabetes?" Answer choices included zero risk, low risk, moderate risk, high risk, and extremely high risk. This score combined with the objective diabetes risk index (see ADA's diabetes risk test, Appendix F) was used to establish the accuracy of participant's risk perception.

Based on methods used by O'Brien, Fries, and Bowen (2000), the ***accuracy of risk perception*** was computed by coding participant's risk perception into high and low categories. If participants chose zero risk or low risk, they were coded as low risk perception (=1). If they chose moderate, high, or extremely high risk, they were coded as high risk perception (=2). These categories correspond with the ADA's diabetes risk test (2008), which places participants into high and low risk categories which were also coded as "1" for "low risk" and "2" for "high risk". Three new variables were created: accurate, underestimate, and overestimate, based on the comparison of their objective risk score to their perceived risk score. Participants were classified as "accurate" if they had the same category (e.g., 1-"low" for objective risk and 1-"low" for their perceived risk) for both their objective risk score and their perceived risk score. They were classified as "underestimated" if their perceived risk score was lower than their objective risk score.

Lastly, they were classified as "overestimated" if their perceived risk was higher than their objective risk.

The second survey, the *International Physical Activity Short Form Questionnaire (IPAQ)* (Craig *et al.,* 2003) was used to obtain ***levels of physical activity***. The short form has 4 items (refer to Appendix G). The formula for computing scores for the IPAQ is: MET level*minutes of activity/day*days per week. MET levels differ by activity level. Walking = 3.3 MET's, moderate intensity = 4.0 MET's, and vigorous intensity = 8.0 MET's. To obtain the total MET, the formula is Total MET = Walk (MET's * min * days) + Moderate (MET's * min * days) + Vigorous (MET's * min * days). These formulas produce a continuous score. For example, to compute the walking score for someone that walks 30 minutes a day for 7 days a week, the formula would be: 3.3 * 30 * 7. A score should be calculated for each MET level: walking, moderate intensity, and vigorous intensity. To obtain the Total MET, each calculated MET level should be added. For example, Walking total + Moderate total + Vigorous total = Total MET.

The IPAQ instruments have acceptable measurement properties with a reliability of 0.8, with comparable data from short and long forms. Criterion validity has a median of about 0.30, which is comparable to most other self-report validation studies. IPAQ has reasonable measurement properties for monitoring population levels of physical activity among 18- to 65-yr-old adults in diverse settings.

Professional Medical Scale Apparatus was used to collect participant's ***body height and weight***. These measurements were used to compute a body mass index (BMI) according to the formula: weight (lb) / [height (in)]^2 x 703.(i.e., dividing weight in pounds (lbs) by height in inches (in) squared and multiplying by a conversion factor of

703). The following BMI categories based on the Center for Disease Control's (2010) recommendations were used to establish an individual BMI status: *underweight* - BMI below 18.5, *normal/healthy weight* - BMI of 18.5-24.9, *overweight* - BMI of 25-29.9, and *obese* - BMI score of 30 or above.

Procedure

In the process of recruiting participants, a sign-up sheet was passed around psychology classes, and participants signed up for a 30 minute testing session. Participants completed a consent form and a large survey consisting of several scales corresponding to selected variables (see Materials & Apparatus). They identified their responses on scantrons using a number 2 pencil for the first survey. The second survey, the International Physical Activity Questionnaire, followed and participants provided their responses directly onto the paper form. The completion of this process concluded the self-report survey portion of the study.

Next, the body weight and height of each participant, for the BMI computation, was taken privately in a research room to ensure confidentiality and comfort during this portion of the study. A professional medical scale (see Materials & Apparatus) was utilized to obtain body height and weight. The data collection was conducted in small groups of approximately 8 individuals to increase participants' motivation to provide complete and reliable responses to self-report assessment, and allow individual measurement of body height and weight. The study took approximately 20 minutes to complete for most participants. The participants were required to complete both the two surveys and the measurement session in order to receive extra credit for participation.

CHAPTER III

RESULTS

Diabetes Knowledge, Preventive Health Motivation, Perceived Risk, and Health Behaviors

The purposes of this study include examining the main effects that diabetes knowledge, preventive health motivation, and perceived risk have on health preventive behaviors (i.e., healthy eating, fat intake, and physical activity) and body mass index/weight status. In order to examine these effects, a 2 (perceived risk) x 2 (preventive health motivation) x 2 (diabetes knowledge) between-subjects ANOVA was computed for each dependent variable (healthy eating, fat intake, physical activity, and body mass index).

Dependent Variable of Healthy Eating

The results of the ANOVA for healthy eating showed a significant main effect for diabetes knowledge ($F(1, 107) = 6.39$, $p < .01$, $r = .24$) with those with higher diabetes knowledge levels ($M = 19.59$; $SD = 4.084$) having significantly healthier eating habits than those with lower levels of diabetes knowledge ($M = 18.63$; $SD = 4.81$). A significant main effect was also found for preventive health motivation ($F(1, 107) = 7.73$, $p < .01$, $r = .26$) with those with higher levels of preventive health motivation ($M = 20.34$; $SD = 4.30$) having significantly healthier eating habits than those with lower levels of preventive health motivation (*M* = 17.68; *SD* = 4.13). Furthermore, a significant main effect was also found for perceived risk ($F(1, 107) = 14.33$, p <.001*,* r = .34) with those with a lower perceived risk (*M* = 20.18; *SD* = 4.16) having significantly healthier eating habits than those with a higher perceived risk for diabetes (*M* = 17.08; *SD* = 4.25). A significant interaction of diabetes knowledge and perceived risk was also found ($F(1, 107) = 3.68$, p <.05*,* r =.18) with the group with high diabetes knowledge and a low perceived risk (*M* = 20.31; *SD* = 3.87) having the healthiest eating habits. The group with low diabetes knowledge and a high perceived risk to the disease (*M* = 14.77; *SD* = 3.30) reported significantly lower healthy eating habits compared to the other three groups (p <.01), which did not differ significantly in their eating habits. This interaction effect is displayed in Figure 1. The two other interaction effects for healthy eating habits were not significant.

Dependent Variable of Fat Intake

The results of the 2 (perceived risk) x 2 (preventive health motivation) x 2 (diabetes knowledge) between-subjects ANOVA for fat intake showed a significant main effect for diabetes knowledge ($F(1, 108) = 7.26$, p <.001,. r = .25), with those possessing higher levels of diabetes knowledge (*M* = 3.00; *SD* = .69) having significantly lower fat intake than those with low levels of diabetes knowledge (*M* = 2.70; *SD* = .71). There were no other significant effects found for fat intake.

Dependent Variable of Physical Activity

The results of the 2 (perceived risk) x 2 (preventive health motivation) x 2 (diabetes knowledge) between-subjects ANOVA for physical activity revealed a significant main effect for perceived risk, ($F(1, 108) = 6.90$, p <.01*,* r = .24) with those with a lower perceived risk to diabetes (*M* = 5697.22; *SD* = 7299.86) having significantly higher levels of physical activity compared to those with a higher perceived risk (*M* = 2096.90; *SD* = 1661.32). No other significant effects were found for physical activity.

Dependent Variable of Body Mass Index

The results of the 2 (perceived risk) x 2 (preventive health motivation) x 2 (diabetes knowledge) between-subjects ANOVA for body weight status (BMI) revealed several significant findings. First, a significant main effect was found for diabetes knowledge ($F(1, 107) = 3.94$, $p < .05$, $r = .19$) with those with lower levels of diabetes knowledge (*M* = 24.13; *SD* = 4.64) having significantly lower body mass index/weight status compared to those with higher levels of diabetes knowledge (*M* = 26.27; *SD* = 6.68). A significant main effect was also found for perceived risk ($F(1, 107) = 10.50$, $p < .001$, $r = .30$) with those with a lower perceived risk for diabetes (*M* = 23.97; *SD* = 4.64) having a significantly lower BMI/weight status than those with a higher perceived risk (*M* = 28.29; *SD* = 7.32).

In addition, results showed a significant interaction of diabetes knowledge and perceived risk ($F(1, 107) = 3.80$, $p < .05$, $r = .18$) with those high in diabetes knowledge and high in perceived risk having significantly higher BMI (*M* = 29.84; *SD* = 7.69) compared to all other three groups ($p < .01$), which did not differ significantly among themselves in average body weight status. This interaction effect is displayed in Figure 2. A significant interaction was also found for preventive health motivation and perceived risk ($F(1, 107) = 4.49$, $p < .05$, $r = .20$) with those with low preventive health motivation paired with high perceived risk having significantly ($p < .01$) higher BMI statuses (*M* = 29.56; *SD* = 8.27) compared to groups with low perceived risk and either high or low preventive health motivation (*M* = 24.60, *SD* = 4.01 and *M* = 22.91, *SD* = 5.47 respectively). The body weight status of the group with high perceived risk and high preventive health motivation was marginally lower ($p < .08$) than the high perceived risk and low preventive motivation group (*M* = 26.62; *SD* = 5.67), but this group did not differ significantly from either low perceived risk groups (see Figure 3). A trend was also found for the interaction effect of preventive health motivation and diabetes knowledge ($F(1, 107) = 3.32$, $p < .07$, $r = .17$) with those with high preventive health motivation and high diabetes knowledge (*M* = 26.59; *SD* = 4.62) having the highest body weight status and those with high preventive health motivation but low diabetes knowledge (*M* = 23.24; *SD* = 3.65) having the lowest body weight status. The three way interaction of diabetes knowledge, perceived risk and preventive health motivation was not significant.

Family History on Accuracy of Risk Perception

In addressing hypothesis IV regarding differences in the accuracy of assessing risk for Type-II diabetes depending on family history of this medical condition, it was found that in our sample only 13 participants reported having a family history of diabetes. Eleven participants reported having parents with diabetes, and only 2 participants had siblings with the disease. Due to the small number of participants reporting a family history of diabetes and resulting unequal groups (i.e., 13 participants with family history of diabetes vs. 113 without), no meaningful statistical analyses could be performed to verify hypothesis IV about group differences in accuracy of risk perception.

Objective Risk and Accuracy of Perceived Risk

Overall, our sample had a high percentage of participants objectively at high-risk to diabetes (60.6%) compared to those with a lower objective risk to diabetes (39.4%). In evaluating the accuracy of participants' perceived risk, it was found that 57.9% of the sample was accurate in their assessment of risk for Type-II diabetes. However, 28.6% underestimated their risk for Type-II diabetes. Only 5.6% of participants overestimated their risk. The missing data accounted for 7.9% of the sample.

Diabetes Knowledge among College Students

In exploring the areas of diabetes knowledge that are lacking among college students, we found that participants had relatively low knowledge and inaccurate perceptions about causes, consequences and risk factors of diabetes. Table 1 shows the distribution of answers for all diabetes knowledge questions which were answered correctly by only 50% or less of the participants (see Table 1).

The question, *"Eating too much sugar and other sweet foods is a cause of diabetes?"* was answered incorrectly by 81% of participants, 9.5% did not know the answer, and only 9.5% of participants answered this question correctly. They also had low knowledge regarding the question, *"Diabetes is caused by failure of the kidneys to keep sugar out of the urine."* In response to this question, 43.7% selected "I don't know", 24.6% answered incorrectly, and only 31.7% answered this question correctly. The question, *"Kidneys produce insulin"* also proved to be a weak area of knowledge for participants as it was answered incorrectly by 25.4% of participants, 43.7% of the sample did not know the answer to this question, and only 30.2% answered it correctly. The other questions regarding causes of diabetes were answered accurately by over 50% of our sample. The question, *"The usual cause of diabetes is lack of effective insulin in the body"* was answered correctly by 66.7% of participants. The question, "*In untreated diabetes, the amount of sugar in the blood usually increases"* was answered correctly by 56.3% of participants, and an additional 69% of participants knew that *diabetes cannot be cured.* Also, 82.5% of participants knew that *"There are two types of diabetes: Type I (insulin dependent) and Type-II (non insulin dependent)".*

Participants exhibited low knowledge in some areas regarding complications associated with Type-II diabetes. The majority of students (61.9%) did not know the answer to the question, *"Skin complications can be caused from diabetes".* Another 3.2% answered incorrectly, while only 34.9% answered it correctly. In response to the question, "*Eye problems that can lead to blindness are less likely in diabetics*", 39.7% did not know the answer, 25.4% answered incorrectly, and only 34.9% answered this question correctly. Nerve damage, also a complication of diabetes is an area that students seem to know little about as 46.8% did not know and 4.8% answered the question, "*Nerve damage is unlikely in diabetics*" incorrectly.

However, several of the questions regarding complications associated with Type-II diabetes were answered correctly by over 50% of the sample. Sixty-nine percent of participants knew that *diabetes often causes poor circulation*. *"Cuts and abrasions on diabetics heal more slowly"* was answered correctly by 64.3% of participants. Sixty-one percent of participants knew that *diabetes can damage the kidneys*. The following question, "*Diabetes can cause loss of feeling in the hands, fingers, and feet*" was answered correctly by 71.4% of participants. More than half (58.7%) of the sample correctly identified that *heart disease and stroke are common complications of diabetes*.

The question regarding *foot problems due to nerve damage* was also answered correctly by 57.1% of participants.

Participants also had low or inaccurate knowledge regarding certain risk factors for diabetes as 54.8% did not know that one is at higher risk for developing diabetes *if they had diabetes while they were pregnant* (gestational diabetes). The question, "*Giving birth to a baby weighing more than 9 lbs puts one at lower risk for developing diabetes*" was also an area that participants were not aware of as 62.7% selected "I don't know", 4% answered incorrectly, and only 33.3% knew the correct answer. *Impaired glucose tolerance* is another risk factor for diabetes, and this sample seemed to know very little about this factor as 52.4% selected "I don't know", 11.1% answered incorrectly, and only 35.7% answered it correctly. Another 47.6% did not know that h*igh triglycerides (a type of fat molecule) in the blood elevate one's risk for type-II diabetes*, and an additional 3.2% answered this question incorrectly. A high percentage of the sample (63.5%) did not know that *Acanthosis Nigricans is a skin condition causing dark and thick skin around the neck or armpits* and is a risk factor for diabetes. The last question pertaining to *certain ethnic backgrounds* (African American, Hispanic American, Asian American, and Native American) being at higher risk for diabetes also revealed that participants had low knowledge as 39.7% did not know and 11.1% answered incorrectly.

However, some of the questions regarding risk factors for diabetes were answered correctly by 50% or more of our sample. Participants seemed to have high knowledge that heredity is a risk factor for diabetes as 84.1% answered the following question correctly, "I*f I am diabetic, my children have a chance of being diabetic?"* The question regarding *being over the age of 45 places one at a higher risk to diabetes* was answered correctly by 57.1% of the sample. A high number of participants (77%) also knew that, "*Having excess body weight especially around the waist puts one at a higher risk for developing diabetes*". Almost all participants (94.4%) are aware that, "*You are at a higher risk for developing diabetes when you have a family history of diabetes*". Another 55.6% of participants correctly identified that *high blood pressure is a risk factor for Type-II diabetes*. A large portion of the sample (81.7%) also correctly identified that *a low physical activity level places one at a higher risk to diabetes.*

Diabetes Knowledge among High-Risk for Diabetes Participants

We were particularly interested in the participants that are at objectively high-risk for Type-II diabetes in respect to their knowledge of diabetes, therefore we further examined the areas of diabetes knowledge that are lacking or inaccurate in the subsample of only the objectively high-risk participants (n=69). Our exploratory analyses revealed that diabetes knowledge among the high risk participants closely resembles that of the entire sample. The high-risk participants had relatively low knowledge and inaccurate perceptions about the same questions regarding causes, consequences, and risk factors except for 2 questions. Table 2 shows the distribution of answers for all diabetes knowledge questions which were answered correctly by only 50% or less of the participants (see Table 2).

The objectively high-risk group seemed to have slightly more knowledge than the collective sample on two of the questions including the question, "*Nerve damage is unlikely in diabetics*" (53.6% correct in high risk group vs. 48.4% in entire sample) and "*Being of a certain ethnicity including African American, Hispanic American, Asian American, and Native American puts one at a higher risk of diabetes*" (59.5% correct in high risk group vs. 49.2% in entire sample) Other than these differences, the two groups were rather similar in their levels of diabetes knowledge (see Table 1 & Table 2).

CHAPTER IV

DISCUSSION

Diabetes Knowledge, Preventive Health Motivation, Perceived Risk, and Health Behaviors

Dependent Variable of Healthy Eating

The results of our study provided partial support of hypotheses. The data provided support for Hypothesis I and II for healthy eating behaviors. Significantly healthier eating habits were reported by the high vs. low diabetes knowledge group and by the high vs. low preventive health motivation group. However, the finding for perceived risk was inconsistent with our predictions (i.e., hypothesis III) for healthy eating. We found that the group with a lower perceived risk of diabetes reported significantly healthier eating habits compared to the participants who perceived their risk as high. A possible explanation for this finding is that the participants' health behaviors (i.e., eating habits) influenced their perceived risk of diabetes (i.e., because they do eat healthy, they perceived themselves to be at a lower risk for developing Type-II diabetes). Another possible explanation for this finding may be cognitive dissonance, meaning that the group with the higher perceived risk may avoid thinking and learning about eating a healthy diet, even though they are aware of their heightened risk for Type-II diabetes. Previous research has suggested that a high perceived risk of a health threat (i.e., disease) motivates people to perform health behaviors to lower their risk for the illness (e.g., Kreuter, & Strecher, 1995; Janz & Becker, 1984). In this study, we found group differences in the opposite direction. Those with a higher perceived risk had poorer eating habits than those with a lower perceived risk, suggesting that in this population, perhaps perceived risk is not always a good predictor of health preventive behaviors in relation to Type-II diabetes. Perhaps, the direction of causal relation between these two variables reverses during the course of behavioral change; the recognition of being at risk for Type II-diabetes might serve as a motivator, for some individuals, to adopt a healthier diet, but once the behavior is changed (i.e., a person establishes healthy eating habits), the reduced threat of developing the disease (i.e., lower perception of risk) serves as a motivator to maintain healthier eating behavior. The results found for diabetes knowledge and healthy eating suggests that this may be an important area to target to increase healthy eating behaviors among young adults.

Dependent Variable of Fat Intake

The level of diabetes knowledge (i.e., low vs. high) was the only variable which revealed significant group differences in fat intake. Participants with higher levels of diabetes knowledge reported consuming significantly less fats in their diet; this outcome is consistent with hypothesis I, which predicted that those with higher levels of diabetes knowledge will perform more health preventive behaviors (i.e., consume less fat in their diets). These results further emphasize the importance of diabetes knowledge in promoting healthy behavior among young adults. Moreover, these results are consistent with those of Davis, *et al.* (1987). Hypothesis II, which predicted that those with a higher preventive health motivation will have a lower intake of fat, was not supported.

Hypothesis III, which predicted that those with a higher perceived risk for diabetes will take in less fat, was also not supported.

Dependent Variable of Physical Activity

The only significant finding for physical activity was related to perceived risk with those with a lower perceived risk reporting significantly more physical activity than those with a higher perceived risk. This finding is inconsistent with our predictions (i.e., hypothesis III) but is consistent with patterns found for healthy eating habits. The hypothesis states that those with a higher compared to a lower perceived risk, will perform more health preventive behaviors (i.e., perform more physical activity). Again, this finding may be due to participants who are already exercising regularly perceiving themselves to be at a lower risk for Type-II diabetes. Those who are less active may realize that as a result of their current behaviors, they are at higher risk for diseases like Type-II diabetes. Hypothesis I, which predicted that a higher level of diabetes knowledge would be predictive of a higher level of physical activity, was not supported. Hypothesis II predicting that a higher preventive health motivation will be predictive of a higher level of physical activity was also not supported.

Dependent Variable of Body Mass Index

Several significant main effects and interaction effects were found for body mass index (BMI). Contrary to our predictions (i.e., hypothesis I), we found that those with lower levels of diabetes knowledge had significantly lower body weight status than those with higher levels of diabetes knowledge. Perhaps the heavier participants with higher levels of diabetes knowledge have been informed by medical professionals that their overweight or obesity status is placing them at risk for Type-II diabetes; therefore they have more knowledge than participants of a lower weight status. These findings are consistent with Davis, *et al.* (1987) that found a significant difference between normal weight and obese individuals on general health related knowledge. Normal weight individuals reported significantly more knowledge. Similarly, our results revealed a significant difference opposite to the expected direction for perceived risk and BMI (i.e., hypothesis III). We predicted that participants with a higher perceived risk to diabetes, compared to low perceived risk individuals, will have a healthier body weight status. Again, maybe it is the participant's current weight status that is influencing their perceived risk and not their perceived risk that is influencing them to perform health behaviors or achieve a healthier weight status. The non-experimental design of this study (i.e., comparison of pre-existing groups) does not allow for the clarification of causal relationships between these variables.

Hypothesis II, which predicted that a higher preventive health motivation would be predictive of a healthier weight status, was not supported. However, our results revealed a significant interaction of preventive health motivation and perceived risk. Participants with low preventive health motivation and high perceived risk have significantly higher BMI statuses compared to groups with low perceived risk and either high or low preventive health motivation. According to these results for BMI, we can only speculate that a low preventive health motivation may result in participants not performing preventive behaviors, therefore facilitating weight gain (i.e., higher BMI). The same individuals may also realize that because of their heavier weight status, they are at higher risk to Type-II diabetes. Again, it seems that our data suggest that perceived risk in this population is influenced by reported engagement in preventive lifestyle (i.e., diet, physical activity, healthy body weight) and not the perception of risk that motivates the preventive behavior.

Family History on Accuracy of Risk Perception

Due to the small number of participants reporting a family history of diabetes and resulting unequal groups (i.e., 13 participants with family history of diabetes and 113 without family history), we were unable to perform any meaningful statistical analyses to verify hypothesis IV regarding group differences in accuracy of risk perception. Family history may be an area of interest in regards to accuracy of risk perception; therefore it should be examined further in future research with a larger representation of young adults from at risk populations (e.g., Latino or African-Americans) to ensure adequate recruitment of participants with a family history of Type-II diabetes.

Objective Risk and Accuracy of Perceived Risk

Our sample consisted of a large number of participants at objectively high-risk for diabetes (60.6%), which is a concerning percentage. If these participants continue with the same lifestyle, they are likely to be diabetic adults by the time they are 45 years of age. The computation of objective risk included 5 points added to each participant's risk score to project them to over the age of 45. In assessing accuracy of risk perception in this sample, we found that more than half (57.9%) of the sample was accurate in their assessment of risk for Type-II diabetes. Although, a high number were accurate in identifying their objective risk, 28.6% underestimated their risk for Type-II diabetes. Only 5.6% of the participants in this sample overestimated their risk.

Despite the fact that a large percentage (57.9%) of participants were accurate in assessing their risk, the 60.6% are still considered at objectively high-risk. These results suggest that participants may be able to identify that they are at high risk as a result of their behaviors and weight status, but they still lack the motivation to perform the necessary preventive behaviors vital for preventing future disease. The findings in this study suggest that risk perception may not be as important of a motivational factor as previously predicted for this population. Instead, diabetes knowledge seems to be more predictive of health preventive behaviors such as eating a healthy diet and consuming less fat. More research is needed to clarify the causal relationships between these variables.

Diabetes Knowledge among College Students

In examining the areas of diabetes knowledge that are lacking and inaccurate, we found several areas of Type-II diabetes knowledge including the causes, complications, and risk factors associated with Type-II diabetes, in which 50% or less of the sample answered the question correctly (see Table 1 and 2). These areas of low or inaccurate knowledge are important to target for efforts that aim to increase diabetes knowledge in young adults. Especially important is the fact that 90.5% of the entire sample and 88.4% of the participants at objectively high-risk for the disease either did not know or were incorrect in identifying that eating too much sugar and sweets is not a cause of diabetes. Perhaps these participants believe that if they avoid sugar and sweet treats, they will not get diabetes, when in fact, that is not the case. A person who never ate much sugar in their life can still develop diabetes if they are overweight and not very physically active. Such misconceptions need to be targeted by health education and prevention programs, so individuals become more aware of the true causes of Type-II diabetes and the lifestyle that should be adopted to avoid future disease.

Other areas of diabetes knowledge that seem to be lacking and inaccurate in this population are complications associated with the disease. For example, very few participants were able to identify that skin problems and eye problems that can lead to blindness are common complications for diabetic individuals. Because so many of these participants are unaware of these serious complications, they may not perceive adequately the seriousness of the disease which may negatively affect their desire to perform behaviors for prevention. Increasing awareness of various health complications associated with diabetes and decreases in quality of life seem important in order to promote appreciation of the disease's seriousness.

Our results also show unsatisfactory knowledge regarding certain risk factors for Type-II diabetes in the population of young adults. Very few participants, including participants in the objective high risk category, knew that gestational diabetes (temporary diabetes while pregnant) and having a baby weighing more than 9lbs puts one at a higher risk for developing Type-II diabetes. Considering that the majority of this sample was female (76.2%), it seems highly warranted that women especially, be educated on these risk factors. Very few students also knew that high triglycerides (fat levels in blood) are a risk factor for Type-II diabetes. Perhaps many students consume sources of food high in fat not realizing that it could be increasing their objective risk for diabetes. Impaired glucose tolerance is also a risk factor that this population seems to know little about. Perhaps medical professionals are not screening for this condition at young ages, and therefore young adults do not know what the condition entails. However, it might be beneficial to educate young people about impaired glucose tolerance and ways to prevent it. An early adoption of preventive behaviors is crucial for effective disease prevention.

Another area that few participants identified correctly is the risk factor Acanthosis Nigricans, which causes dark and thick skin around the neck and armpits. This factor, which places one at a higher risk for Type-II diabetes, should be targeted in education efforts so that individuals with the condition realize their heightened potential for developing Type-II diabetes. Knowledge of ethnicity as a risk factor was also low. Less than half of the participants (49.2%) were accurate in identifying that certain ethnicities including African American, Hispanic American, Asian American, and Native American are at a higher risk for developing diabetes due to their ethnicity. Unfortunately, ethnicity is a risk factor that cannot be modified, but it can be managed through appropriate health preventive behaviors like healthy eating and increased physical activity. Individuals of increased risk ethnic backgrounds need to be made aware of their risk status and appropriate health preventive behaviors to delay the onset of the disease or hopefully prevent it from ever developing.

This study provided needed empirical data related to Type-II diabetes in an understudied population of young adults and found several significant patterns involving diabetes knowledge, perception of risk of developing the disease, preventive health motivation, and health behaviors. This study was a preliminary attempt to identify health-factors, perceptions, and attitudes, prior to onset of Type-II diabetes, that need to be addressed in education and prevention efforts, targeting the young adult population (i.e. tailored health messages). Multiple studies have provided significant evidence that tailored health messages are perceived as being more personally relevant, when compared to non-tailored health messages and therefore are more effective (e.g., Wangberg, 2008).

Researchers suggested that risk management strategies introduced at a young age have a positive effect on disease progression (e,g., Collins *et al*., 2004).

CDC (2008) demonstrated that eating a healthy diet and remaining physically active are behaviors that maintain good health in Type-II diabetic individuals and help prevent Type-II diabetes in at-risk populations. Young adults, even in high-risk groups, should not feel destined for Type-II diabetes and can be taught to maintain a pro-active attitude for their health by maintaining preventive health motivation and a healthy lifestyle. They need to be aware that as long as they eat healthy and exercise regularly, it is highly unlikely they will develop the disease (CDC, 2008). However, preventive communication targeting low-risk groups of young adults should emphasize that anyone from a low-risk group can become high-risk, due to sustaining unhealthy behaviors (i.e. high BMI, low activity levels, and a high-fat diet). Young adults can learn early in life that their current health behaviors, perceptions, and attitudes may begin to affect their health in the future, and that it is important to change now, rather than later.

The CDC (2010) recently released a publication emphasizing the significance of the Type-II diabetes epidemic as rates are projected to double or triple by the year 2050, if Americans continue to gain weight and avoid exercise. Currently, rates of Type-II diabetes are 1 in 10 Americans, but they are projected to jump to as high as 1 in 3 adults by the year 2050. Considering the predicted rise in Type-II diabetes in the coming years, there is an urgent need to target young adults in prevention efforts.

Strengths

This study incorporated a comprehensive assessment of diabetes knowledge (including the causes, risk factors, and complications), accuracy of risk perception (including assessment of both subjective and objective risks for Type-II diabetes), health behaviors linked to risk of this disease (i.e., fat intake, eating habits, and physical activity), BMI, and preventive health motivation. This is the first study, to our knowledge, to include all of these variables in the understudied population of young adults.

Limitations

This study was limited by not having a larger representation of ethnic groups. Young adults from ethnic groups at risk for Type-II diabetes (i.e., Hispanic American, African American, Asian American, and Native Americans) are especially important to assess considering their heightened risk for developing the disease. Also, the effects of family history could not be analyzed due to the fact that the majority of participants were Caucasians with very little family history of Type-II diabetes, a disease that is more prevalent in Hispanic and African American populations. Because there were not enough participants with a family history, it was not possible to fully test our hypothesis.

Another limitation is the validity of the objective diabetes risk assessment. By changing the age factor in our assessment of objective risk for diabetes, we may have introduced some error in our data analysis. Moreover, our study utilized self-report measures of health behaviors to collect fat intake, physical activity, and healthy eating information. Although commonly used in research, the assessment of behavior based on self-description is open to biases that can lower its validity. For example, some participants may not have given honest answers in an attempt to appear healthier than they really are.

Implications and Future Research

The findings of the present study indicate that risk perception may not be as critical as previously considered of a motivational factor for the college population. Our results also suggest that adequate diabetes knowledge is an important factor for eating a healthy diet and consuming less fat. It is unclear what factors are predictive of physical activity and BMI, but these factors are important for disease risk and should be explored further in future research. Future research should also aim to clarify the causal relationships between these variables. Also, the areas of diabetes knowledge that we found to be especially low for this population should be targeted along with preventive health motivation in future education efforts to ensure adequate knowledge of Type-II diabetes and effective motivation for health preventive behaviors.

There is also a great need to develop and validate a tool that is effective for forecasting personal objective diabetes risks in young adults. Also, it would be interesting to explore group differences in those who are accurate versus inaccurate in assessing their perceived risk, especially among the objective high risk participants. A future study comparing rises in overweight and obesity in college students versus non-college students of the same age may provide further insight into college weight gain. In addition, using the Transtheoretical Model/Stages of Change may be useful in assessing what stage of behavior change young adults are at in terms of performing preventive health behaviors (Prochaska, 1979). Efforts should also be made to train medical professionals about ways to educate and advise their younger patients about their current behaviors and weight status as well as ways to reduce risks for health problems like Type-II diabetes.

There is a great need to target young adults early in life to perform health preventive behaviors in order to become healthy older adults. Health psychologists can play a fundamental role in Type-II diabetes prevention by designing and implementing educational programs in universities and schools. Also, mass media campaigns aimed at increasing knowledge about Type-II diabetes can be utilized to reach the general public, including those that do not attend school. Such educational programs and campaigns could help in prevention efforts of Type-II diabetes. The CDC (2010) expects rates of Type-II diabetes to double or even triple in the next forty years. This forecasted growth of a potentially preventable, yet possibly fatal disease warrants urgent attention.

Table 1: Distribution of Participants' Responses to Diabetes Knowledge Questions Answered with Less Than 50% Accuracy

Diabetes Knowledge Question	Answered Incorrectly	Did Not Know	Answered Correctly
"Eating too much sugar and other sweet foods is a cause of diabetes?"	81%	9.5%	9.5%
"Diabetes is caused by failure of the kidneys to keep sugar out of the urine"	24.6%	43.7%	31.7%
"Kidneys produce insulin"	25.4%	43.7%	30.2%
"Skin complications can be caused from diabetes"	3.2%	61.9%	34.9%
"Eye problems that can lead to blindness are less likely in diabetics"	25.4%	39.7%	34.9%
"Nerve damage is unlikely in diabetics"	4.8%	46.8%	48.4%
"If one had diabetes while they were pregnant (gestational diabetes), they are at a lower risk of developing diabetes in their lifetime"	1.6%	54.8%	43.7%
"Giving birth to a baby weighing more than 9 lbs puts one at lower risk for developing diabetes"	4%	62.7%	33.3%
"Impaired glucose tolerance is not a risk factor for diabetes"	11.1%	52.4%	35.7%
"Having high blood levels of triglycerides (a type of fat molecule) is a risk factor for type 2 diabetes"	3.2%	47.6%	49.2%
"Acanthosis Nigricans is a skin condition causing dark and thick skin around the neck or armpits and it is a risk factor for diabetes"	5.6%	63.5%	31%
"Being of a certain ethnicity including African American, Hispanic American, Asian American, and Native American puts one at a higher risk of diabetes"	11.1%	39.7%	49.2%

Table 2: Distribution of High-Risk Participants' Responses to Diabetes Knowledge Questions Answered with Less Than 50% Accuracy

Diabetes Knowledge Question	**Answered Incorrectly**	**Did Not Know**	**Answered Correctly**
"Eating too much sugar and other sweet foods is a cause of diabetes?"	78.3%	10.1%	11.6%
"Diabetes is caused by failure of the kidneys to keep sugar out of the urine"	18.8%	46.4%	34.8%
"Kidneys produce insulin"	27.5%	39.1%	33.3%
"Skin complications can be caused from diabetes"	2.9%	53.6%	43.5%
"Eye problems that can lead to blindness are less likely in diabetics"	27.5%	37.7%	34.8%
"If one had diabetes while they were pregnant (gestational diabetes), they are at a lower risk of developing diabetes in their lifetime"	1.4%	52.2%	46.4%
"Giving birth to a baby weighing more than 9 lbs puts one at lower risk for developing diabetes"	1.4%	65.2%	33.3%
"Impaired glucose tolerance is not a risk factor for diabetes"	14.5%	44.9%	39.1%
"Having high blood levels of triglycerides (a type of fat molecule) is a risk factor for type 2 diabetes"	2.9%	49.3%	47.8%
"Acanthosis Nigricans is a skin condition causing dark and thick skin around the neck or armpits and it is a risk factor for diabetes"	5.8%	58%	36.2%

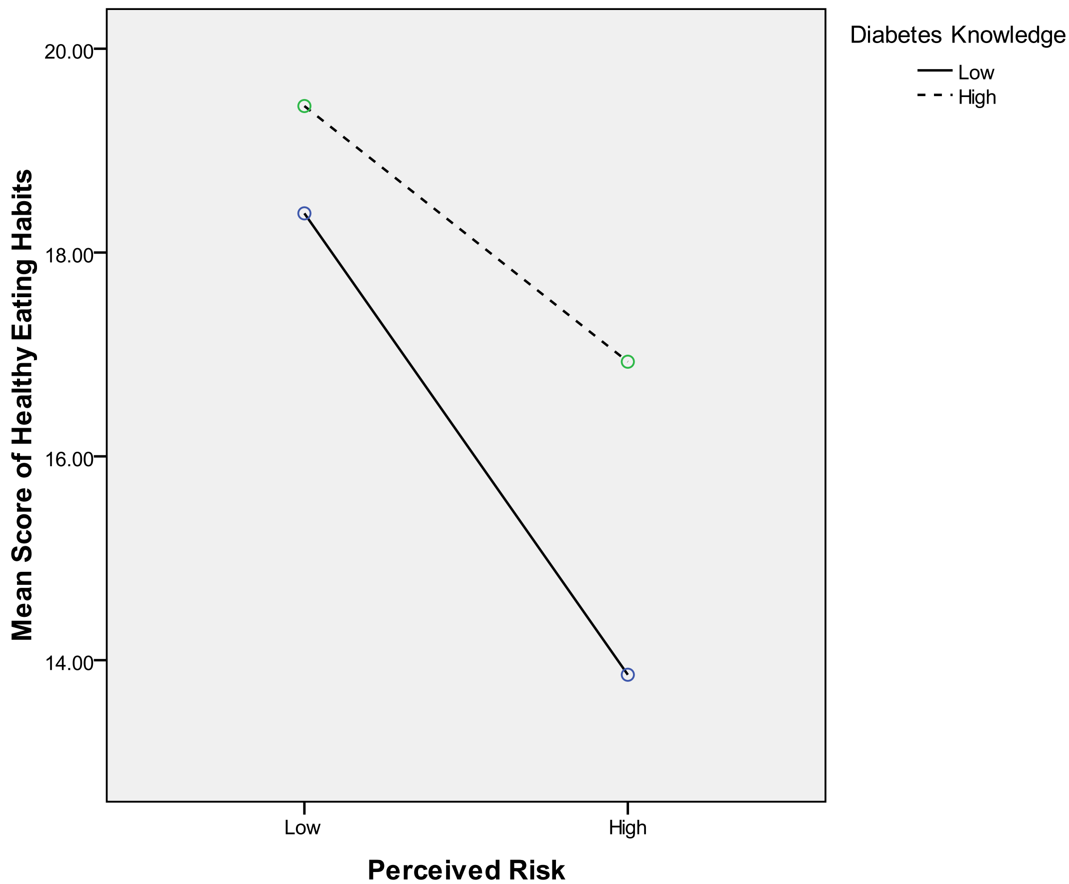

Figure 1: Average Healthy Eating Habits by Diabetes Knowledge and Perceived Diabetes Risk

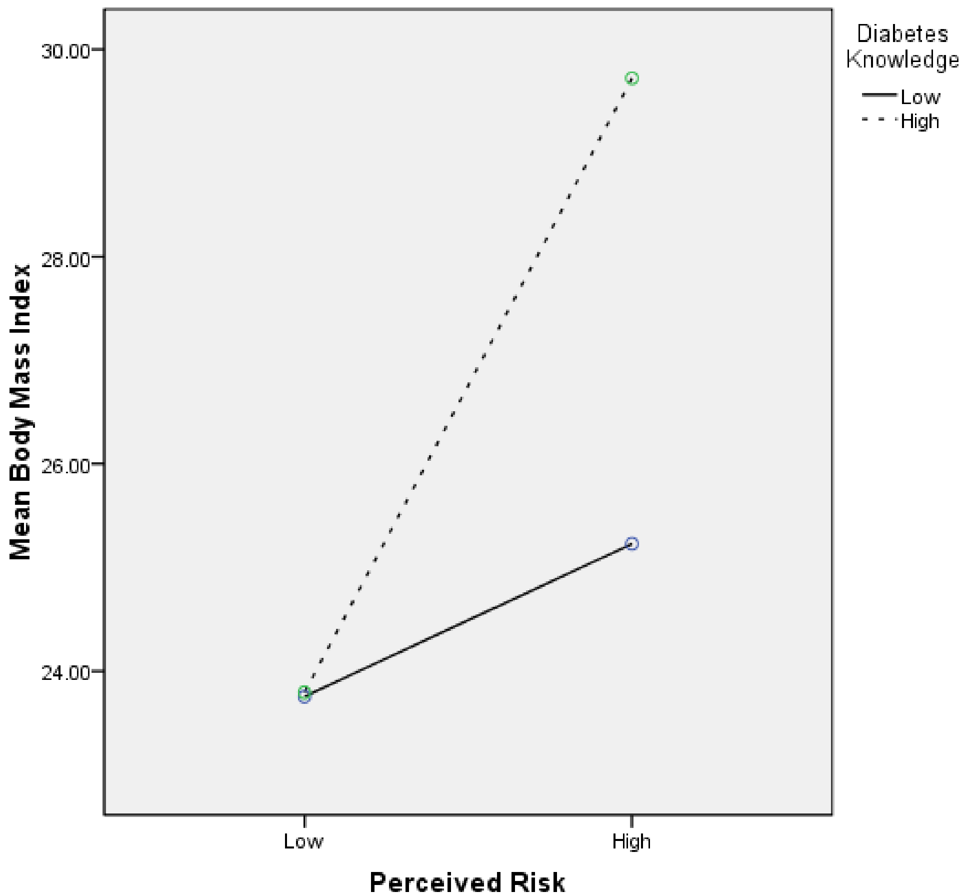

Figure 2: Average Body Mass Index by Diabetes Knowledge and Perceived Diabetes Risk

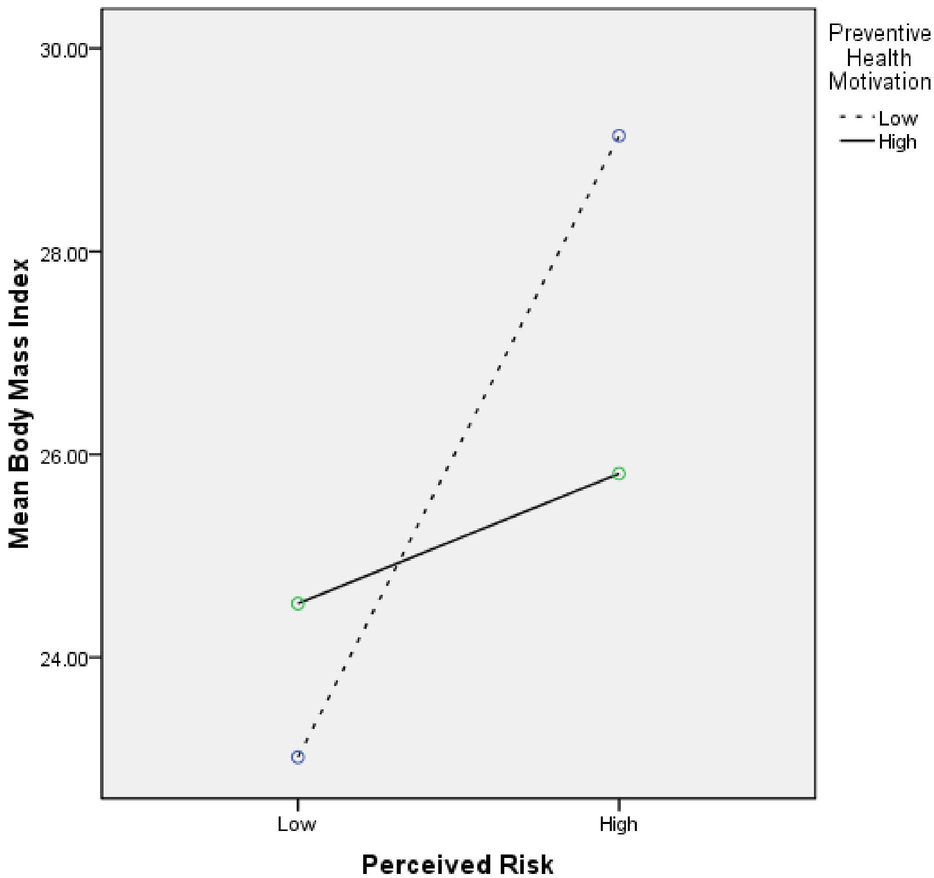

Figure 3: Average Body Mass Index by Preventive Health Motivation and Perceived Diabetes Risk

APPENDIX

Appendix A

Demographic Questions: (Questions 1-4 on survey)

1. What is your gender?

    A. Male

    B. Female

2. How do you describe yourself?

    A. Caucasian/Non-Hispanic White

    B. African American

    C. Hispanic/Latino

    D. Other ______________________

3. What year of college are you currently completing?

    A. Freshman (1st year)

    B. Sophomore (2nd year)

    C. Junior (3rd year)

    D. Senior (4th year)

    E. Graduate Student

4. What is the annual income level in your household?

    A. Less than $15,000

    B. $15,000-$30,000

    C. $30,000-$45,000

D. $45,000-$60,000

E. Above $60,000

Appendix B

Healthy Eating. Alpha = .86
5. Have 5+ servings of fruits and vegetables day
6. Include roughage/fiber (whole grains) in my diet
7. Eat three meals a day
8. Take active steps to eat a well balanced diet of foods
9. Watch the amount of fat I consume
10. Watch the amount of sugar I consume

Appendix C

Health Motivation. Alpha = .72

Preventative Orientation:
11. I try to prevent health problems before I feel any symptoms.
12. I am concerned about health hazards and try to take action to prevent them.
13. I try to protect myself against health hazards I hear about.

Curative Orientation:
14. I don't worry about health hazards until they become a problem for me or someone close to me.
15. There are so many things that can hurt you these days, I'm not going to worry about them.
16. I am aware of the health hazards that are talked about, but don't do anything about them.
17. I don't take any action against health hazards I hear about until I know I have a problem.
18. I'd rather enjoy life than try to make sure I'm not exposing myself to a health hazard.

Appendix D

Lab A8-2 Fat Intake Quiz

19. I ate pizza
20. I cooked vegetables by steaming, boiling, or baking.
21. I ate fast food.
22. I seasoned cooked vegetables with herbs and spices rather than with sauces, butter, or margarine.
23. I used lemon juice or low-fat salad dressing on salads.
24. I drank soda or other sweetened drinks.
25. I used vegetable oil and tub margarine more often than butter or margarine.
26. I drank nonfat or 1% milk instead of 2% or whole milk.
27. I ate bread, rolls, muffins, bagels, and other baked goods without margarine, butter, or regular cream cheese.
28. I drank beer or other alcoholic drinks.
29. I used a nonstick pan or a cooking spray for frying.
30. I ate pasta plain or with a low-fat marinara or vegetable sauce.
31. I ate reduced-fat cheese and/or limited my servings of cheese to less than 2 oz.
32. I ate potatoes and rice plain or with low-fat or nonfat seasonings (herbs, spices, vegetable-based sauces, nonfat cottage cheese, yogurt, etc.)
33. I used nonfat or low-fat mayonnaise instead of regular mayonnaise.
34. I ate deep fried foods like french fries, onion rings, fried chicken, etc.
35. I chose lean cuts of meat.
36. I trimmed visible fat from meats before cooking.
37. I ate out at restaurants.
38. I limited the size of my servings of meat and poultry to no more than 2–3 oz.
39. I removed the skin from poultry.
40. I cooked meat, poultry, and fish by baking, broiling, or poaching.
41. I ate a low-fat vegetarian main dish.
42. I ate no more than three servings per day of meat, poultry, fish, eggs, and nuts.
43. For desserts, I ate cake, ice cream, or anything high in sugar.
44. For desserts, I had nonfat or low-fat varieties (e.g., nonfat ice cream or frozen yogurt) or fresh fruit.
45. I ate fruit or raw vegetables as snacks.
46. When shopping, I used food labels to compare different foods and choose lower fat items.

***Note: Items in bold correspond to the Lab A8-2 fat intake quiz. Other items (not bolded) were used as filler questions and not scored in data analysis.**

Appendix E

Diabetes Knowledge

47. Eating too much sugar and other sweet foods is a cause of diabetes?

48. The usual cause of diabetes is lack of effective insulin in the body.

49. Diabetes is caused by failure of the kidneys to keep sugar out of the urine.

50. Kidneys produce insulin.

51. In untreated diabetes, the amount of sugar in the blood usually increases.

52. If I am diabetic, my children have a chance of being diabetic?

53. Diabetes can be cured.

54. There are two types of diabetes: Type I (insulin dependent) and Type-II (non insulin dependent).

55. Diabetes often causes poor circulation.

56. Skin complications can be caused from diabetes.

57. Cuts and abrasions on diabetics heal more slowly.

58. Diabetes can damage the kidneys.

59. Diabetes can cause loss of feeling in the hands, fingers, and feet.

60. A common complication of diabetes is heart disease and stroke.

61. Eye problems that can lead to blindness are less likely in diabetics.

62. Foot problems due to nerve damage can happen to diabetics.

63. Nerve damage is unlikely in diabetics.

64. Being older than 45 years of age puts one at a higher risk for developing type 2 diabetes.

65. If one had diabetes while they were pregnant (gestational diabetes), they are at a lower risk of developing diabetes in their lifetime.

66. Having excess body weight especially around the waist puts one at a higher risk for developing diabetes?

67. You are at a higher risk for developing diabetes when you have a family history of diabetes.

68. Giving birth to a baby weighing more than 9 lbs puts one at lower risk for developing diabetes.

69. High blood pressure (above or equal to 140/90) elevates ones risk for diabetes.

70. Impaired glucose tolerance is not a risk factor for diabetes.

71. A low activity level (exercising less than 3 days a week) puts one at a higher risk of developing diabetes.

72. Having high blood levels of triglycerides (a type of fat molecule) is a risk factor for type 2 diabetes.

73. Acanthosis Nigricans is a skin condition causing dark and thick skin around the neck or armpits and it is a risk factor for diabetes.

74. Being of a certain ethnicity including African American, Hispanic American, Asian American, and Native American puts one at a higher risk of diabetes.

Appendix F

Objective Diabetes Risk Questions

75. I am a woman who has had a baby weighing more than 9lbs at birth.
76. I have a sister or brother who has diabetes.
77. I have a parent with diabetes.
78. I am UNDER 65 years of age AND I get little or no exercise.

American Diabetes Association Diabetes Risk Inventory Items
Item Responses

1. I am a woman who has had a baby weighing more than 9 pounds at birth **(Yes** (1) **No** (0)**)**
2. I have a sister or brother who has diabetes **(Yes** (1) **N o** (0)**)**
3. I have a parent with diabetes **(Yes** (1) **No** (0)**)**
4. My weight is equal to or above what is listed on the BMI chart **(Yes** (5) **N o** (0)**)**
5. I am UNDER 65 years of age AND I get little or no exercise* **(Yes** (5) **N o** (0)**)**
6. I am between 45 and 64 years of age **(Yes** (5) **No** (0)**)**
7. I am 65 years old or older **(Yes** (9) **No** (0)**)**

***Note to survey respondents:** Little or no exercise is defined in this study as exercising or participating in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities for about *0 to 2 days in 7 days*.

****Note on Objective Risk Calculation:** Question 4 was not administered to survey participants directly; rather it was calculated by the researcher based on the obtained BMI measurement. Also, question 6 was not administered, but 5 points was added to all participants' scores to control for the conflict with age. (see: *Materials and Apparatus* section).

Appendix G

Perceived Risk Question

79. In **25 years from now**, how would you estimate your risk of having diabetes?

A. I will be at **zero risk** of having diabetes.

B. I will be at **low risk** of having diabetes.

C. I will be at **moderate risk** of having diabetes.

D. I will be at **high risk** of having diabetes.

E. I will be at **extremely high risk** of having diabetes.

Appendix H

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. This is part of a large study being conducted in many countries around the world. Your answers will help us to understand how active we are compared with people in other countries.

The questions are about the time you spent being physically active in the last 7 days. They include questions about activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. Your answers are important.

Please answer each question even if you do not consider yourself to be an active person.

THANK YOU FOR PARTICIPATING.

In answering the following questions, **vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder that normal, **moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder that normal.

1a. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?
Think about *only* those physical activities that you did for at least 10 minutes at a time.

________ days per week <u>or</u> ☐ none

1b. How much time in total did you usually spend on one of those days doing vigorous physical activities?

_____ hours ______ minutes

2a. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

________ days per week <u>or</u> ☐ none

2b. How much time in total did you usually spend on one of those days doing moderate physical activities?

_____ hours ______ minutes

3a. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

________ days per week <u>or</u> ☐ none

3b. How much time in total did you usually spend walking on one of those days?

_____ hours ______ minutes

The last question is about the time you spent sitting on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend *sitting* on a **week day?**
____ hours ______ minutes

This is the end of questionnaire, thank you for participating.

This is the final SHORT LAST 7 DAYS SELF-ADMINISTERED version of IPAQ from the 2000/01 Reliability and Validity Study. Completed May 2001.

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