ILLNESS REPRESENTATION AND GLYCEMIC CONTROL
IN WOMEN WITH TYPE 2 DIABETES MELLITUS

DISSERTATION

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the Degree Doctor of Philosophy in the
Graduate School of The Ohio State University

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ABSTRACT

Type 2 diabetes is a growing threat to the health and well-being of Americans. Mid-life women are especially vulnerable to the devastating complications associated with diabetes. Health care professionals must facilitate effective diabetes self-management to minimize the negative consequences of the disease.

Self-regulation theory provided a framework for nursing research, “Illness Representation and Glycemic Control in Women with Type 2 Diabetes” (IRT2DM). Illness representation theory proposes that a health threat is processed on cognitive and emotional levels. Emerging from this is a schema termed “illness representation”. The content of illness representation then shapes the choice of coping procedures to the threat.

Using a descriptive, exploratory, cross-sectional design, the following research questions were posed: 1. What are the illness representations of a group of women with Type 2 diabetes? 2. What psycho-social factors are associated with illness representation? 3. What is the relationship between illness representation and diabetes self-management? 4. What diabetes self-management practices are associated with glycemic control? Illness representation was measured using the Illness Perception Questionnaire-Revised (IPQ-R). Diabetes knowledge was tested using the University of Michigan Diabetes Knowledge Test (DKT).
Demographic and medical history data were gathered. Self-monitoring of blood glucose (SMBG) was chosen to represent effective coping procedures. Level of glycemic control was measured using HgbA1C.

The average age was 57 years. The majority was White (65%) and well educated. Over half of the group had been living with Type 2 diabetes over 5 years. The majority of the women (75%) reported having 2 or more co-morbidities. Only 40% reported performing SMBG daily. The average HgbA1C was 8.2% at baseline.

Diabetes knowledge was high, although there was lack of knowledge about goals for blood glucose testing. Higher scores on two of the constructs in illness representation, cure/control and emotional representation, were found to be predictive of better glycemic control. A higher number of co-morbidities predicted less glycemic control. Daily SMBG was predictive of better glycemic control. In a multiple regression, the daily performance of SMBG explained 7% of the variance in HgbA1C. This research supports the self-regulation model of illness representation and lays a foundation for further nursing intervention research to enhance diabetes self-management.
DEDICATION

To loved ones I miss dearly:

My parents: Bill and Hazel Cheeke

Steve and Patrice Gosse
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I am grateful to many for support and encouragement along my academic path. The College of Nursing and the Graduate School at The Ohio State University gave me the financial wherewithal to pursue this degree.

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I am grateful to my Ph.D. cohort, a constant source of encouragement and strength.

Most of all, I am grateful to my husband, Darrel I. Gosse for his love and support.
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CHAPTER 1

INTRODUCTION

Type 2 diabetes mellitus is a serious and growing threat to the health of Americans. This cardio-metabolic disorder is the sixth leading cause of death in the United States (Centers for Disease Control and Prevention, 2005). Type 2 diabetes is the leading predisposing factor to cardiovascular disorders. Persons with diabetes die of heart disease and stroke at rates two to four times higher than non-diabetic populations with similar demographic characteristics (Engelgau et al., 2004). Microvascular disorders, such as retinopathy and kidney failure are also associated with Type 2 diabetes (Sheetz & King, 2002).

Currently, 7% of the American population, nearly 21 million individuals, lives with Type 2 diabetes. Men outnumber women with the disease. An estimated 10.9 million men compared to 9.7 million women have diabetes (Centers for Disease Control and Prevention, 2005). However, women are especially affected by this disease. More women than men with Type 2 diabetes suffer early mortality from cardiovascular complications (Hayes, 2006).

There are distinct ethnic differences in incidence for women aged 50-59 years. In this age group, 23% of African American, 24% of Hispanic Americans, and 9.7% of
white Americans have Type 2 diabetes (Center for Disease Control and Prevention, February 3, 2006). The increasing prevalence and serious complications from Type 2 diabetes presents a public health and nursing practice challenge.

*Diabetes Self-Management*

The devastating acute and chronic complications of Type 2 diabetes can be postponed and possibly eliminated through effective diabetes self-management with glycemic control. The United Kingdom Prospective Diabetes Study (UKPDS) (Turner, Cull, Frighi, & Holman, 1999) conclusively demonstrated that “tight” glycemic control, as measured by Hemoglobin A1C (HgbA1C), was associated with a significant decrease in diabetes mortality and morbidity. The UKPDS was a 20 year, randomized trial of several treatment modalities for Type 2 diabetes. This multi-center research enrolled over 5,000 participants (Ibid.). Overall, for every 1% decrease in HgbA1C level, reflecting a normalizing of mean blood glucose, an associated 35% decrease in risk for diabetes complications was reported.

Interventions that equip the medically naïve person with Type 2 diabetes to effectively manage the disease are needed. Like some other chronic diseases, diabetes requires the integration of a daily regimen of self-care activities to achieve desired clinical outcomes. The pillars of Type 2 diabetes management: dietary intake, activity level, medication adherence and self-monitoring of blood glucose (SMBG) are all self-initiated behaviors (Loring & Gray, 2006). Programs to enhance diabetes self-management most often focus on dietary modifications, medication and knowledge about the disease (Bell, Patel, & Malasanos, 2006; Chapman-Novakofski & Karduck, 2005; Miller & Fain, 2006; Panja, Starr, & Colleran, 2005). These short term programs aim to
increase disease control “know how” that may translate to long term benefits. However, less than half of persons with Type 2 diabetes report participating in formal diabetes education (Center for Disease Control, 2003). Research to illuminate the attributes associated with effective self-management may extend the rewards of glycemic control to women struggling with the disease.

*Theoretical Framework*

The self-regulation model of illness representation developed by Leventhal, et al. termed the “common sense model” (CSM) guided this study (Leventhal, Nerenz, & Steele, 1994; Leventhal, Brissette, & Leventhal, 2003). A synopsis of the model is presented here, a fuller description of the development, theoretical underpinnings and utility of the CSM follows in Chapter 2.

The CSM proposes that when confronted by a health threat, people construct an “illness representation” or mental schema of perceptions and beliefs about the threat. This representation has cognitive and emotional features which then drive the selection of coping procedures. The CSM of illness representation provides a way of capturing the experience of life with Type 2 diabetes from the perspective of the individual.

The CSM has shown considerable strength as a predictive model in the study of adherence to medical treatment (Leventhal, 2002; Leventhal & Friedman, 2004; Leventhal & Mora, 2005). This makes it particularly useful in nursing research with women with Type 2 diabetes. The CSM proposes that people are active problem solvers who seek to engage in activities that will maintain or enhance health. The CSM framework acknowledges the contextual features of the socio-cultural environment as influential in illness representation.
Although widely applied in other disease groups, (Hagger & Orbell, 2003; Leventhal, Diefenbach, & Leventhal, 1992) little research using the CSM in persons with Type 2 diabetes has been reported. The research presented here, “Illness Representation and Glycemic Control in Women with Type 2 Diabetes Mellitus” (IRT2DM) tested the applicability of the CSM to the disease experience of mid-life women. This self-regulatory model is a dynamic one which fits well with the demands of a chronic disease such as diabetes.

Problem Statement

The benefits of effective diabetes self-management are well known (Fisher et al., 2007; van der Jacobs, et al., 2007) yet, little research has been conducted to explore the determinants of glycemic control in mid-life women.

Purpose

The purpose of this study was to explore the relationship(s) between sociodemographic attributes, disease knowledge, illness representations, diabetes self-management practices and glycemic control in a group of women with Type 2 diabetes.

Research Questions, Hypotheses

Q1: What are the illness representations of a group of post-menopausal women with Type 2 diabetes?

Q2: What demographic, diabetes knowledge and medical history factors are associated with illness representation in a group of post-menopausal women with Type 2 diabetes?

H2.1: Women with low SES status will have a different illness representation than women with middle or above SES.
H2.2: Women who are White will have a different illness representation than women who are non-White.

H2.3: Women with low diabetes knowledge will have a different illness representation than women with high knowledge.

H2.4: Women who report several co-morbidities will have a different illness representation than those women who report none or one co-morbidity.

H2.5: Women who report use of psychotropic medications will have a different illness representation than those who do not.

Q3: What is the relationship between illness representation and diabetes self-management practices in a group of women with Type 2 diabetes?

Q4: What diabetes self-management practices are associated with levels of glycemic control in a group of women with Type 2 diabetes?

Significance of the Study

The serious toll of Type 2 diabetes is reflected in the early mortality and disabling complications associated with the disease. Women at mid-life living with Type 2 diabetes represent a unique population at high risk for negative clinical outcomes. Effective diabetes self-management with glycemic control can decrease these consequences (Skyler, 2004), yet little research has focused on the barriers and facilitators of glycemic control in mid life women.

Despite wide acceptance of standards of care for persons with Type 2 diabetes, little progress has been made in key indicators of effective diabetes management (American Diabetes Association, 2006b). Women with Type 2 diabetes lack knowledge about needed routine screenings to detect and prevent diabetes related complications.
Most critical of these is surveillance of glycemic state through daily self testing combined with periodic laboratory monitoring. A national survey reported by the American Association of Clinical Endocrinologists (AACE) found a disappointing 67% of persons with Type 2 diabetes do not meet the recommended level of glycemic control (2005).

The IRT2DM contributes to the diabetes literature by illuminating the challenges of life with Type 2 diabetes in mid-life women. The predictors of effective diabetes management have been revealed in this group. These findings can be compared to other groups and research. The IRT2DM adds to nursing knowledge by highlighting the utility of a theoretical framework to guide research and contribute to planning for intervention.

In the literature reviewed for this study, no research was found which directly investigated the illness representations, disease knowledge, socio-demographic and diabetes outcome variables within a theoretical framework. The research presented here addresses this gap by taking a comprehensive approach to the multiple influences on glycemic control. The IRT2DM also contributes to the literature regarding self-regulation of health. Support for the CSM of illness representation was gained.

Summary

This chapter has introduced the focus for this study, women living with Type 2 diabetes. By investigating the influences that assist or deter the management of a chronic disease, a foundation for further intervention work has been laid. A theoretical framework to guide research in this population was introduced.

Chapter two will review literature related to the scope of the IRT2DM. First, the etiology and epidemiology of Type 2 diabetes will be discussed. The attributes of the CSM and research in its construction and utility will be reviewed. An adaptation of the
CSM for the IRT2DM will be presented and research supporting the choice of variables in this study will be discussed.

In Chapter three, the design of the study, data collection procedures, measures and analysis plan are presented. Chapter four presents the research findings. In Chapter five, a further discussion of the findings, limitations and implications of the study and recommendations for further research is provided.
CHAPTER 2

REVIEW OF LITERATURE

In this chapter, the context and focus of the IRT2DM are presented in detail. First, the pathogenesis and epidemiology of Type 2 diabetes are reviewed. An overview of the CSM and the adaptation of the model for the IRT2DM are presented. Finally, research literature specific to the variables of interest in this study will be surveyed.

*Diabetes Mellitus*

Glucose, blood sugar, is the essential fuel of the body. Medical scientists and clinicians know that normal range for blood sugar, regardless of food consumption, is fairly narrow, between 70 and 140 mg/dl (American Diabetes Association, 2006a). The amount of glucose circulating in the blood is regulated by several processes and hormones, in particular, insulin. Diabetes mellitus is diagnosed when blood sugar exceeds normal ranges.

The vast majority of people with diabetes mellitus, 90-95%, are living with Type 2 diabetes. Persons with untreated or poorly managed Type 2 diabetes have higher than normal pre and/or post-meal glucose levels due to insulin deficiencies that trap excess glucose in the blood. This metabolic defect blocks the efficient utilization of glucose
within the body. This imbalance, over time, results in damage on the cellular, organ and system levels (Buse et al., 2007). Compared to non-diabetic populations, people with diabetes are more likely to be blind and to develop kidney disease. Persons with Type 2 diabetes are more at risk for lower limb amputation. Most dangerous is the 2 fold greater risk of heart attack or stroke (California Healthcare Foundation & American Geriatrics Society, 2003; Center for Disease Control and Prevention, 2003).

Etiology

It is widely believed that both Type 1 and Type 2 diabetes originate from a milieu of lifestyle and genetic factors (Dean & McEntyre, 2004). The precise etiology of Type 2 diabetes remains unclear. What researchers know is that a transport defect, termed insulin resistance at the cellular level, coupled with falling insulin production from pancreatic β-cells, result in excess blood glucose (Fowler, 2007). The cascading physiological failures leading to higher than normal blood sugar, hyperglycemia, involve the liver and muscle cells as well as the primary focus in diabetes, the pancreas.

Early in the natural progression of the disease, hyperglycemia occurs only after large meals. Eventually, as β-cell production of insulin continues to decline, a perpetual high glycemic state develops. Studies have suggested that there is a 40% - 60% loss of β-cell mass by the time Type 2 diabetes is diagnosed (Butler et al., 2003). The exact cause or causes of β-cell death, apoptosis, is unknown. Treatment strategies that conserve β-cells while lowering net blood sugar are essential to decrease complications from Type 2 diabetes.
Onset

The classic signs of diabetes: excessive thirst, frequent urination and weight loss are rarely reported in persons with Type 2 diabetes. Findings from the National Health Interview indicated about half of persons with diabetes seek medical care because of experiencing symptoms which led to a diabetes diagnosis. The other half was diagnosed through routine screening at medical appointments (Capes & Anand, 2001). The effect this difference in onset symptomology may have on diabetes self-management behavior and disease outcomes has been little studied.

Prevalence of Type 2 Diabetes Mellitus

The United States, indeed the world, are in the midst of an epidemic of Type 2 diabetes. Globally, projections are that half a billion persons will have the disease by mid-century (Fagot-Campagna, Bourdel-Marchasson, & Simon, 2005; King, Aubert, & Herman, 1998). Diagnosed cases of diabetes in the US have nearly doubled since 1990. The Center for Disease Control and Prevention (CDC) predicts that the number of American adults with diabetes will reach 29 million by the year 2050 (2005). Figure 1 summarizes incidence by ethnicity of Type 2 diabetes from recent CDC data. The distinct differences among groups are evident. The prevalence in African American populations is only exceeded by rates within the smaller American Indian groups. The target level of 25 per 1000 persons is the Healthy People 2010 goal is included in the figure. This target will not be achieved. As seen in these data, population groups do not share equal risk to develop Type 2 diabetes.
Prevalence of Diabetes in the United States

Age-adjusted rate per 1,000 population

Figure 1: CDC Reported Prevalence of Diabetes by Ethnic Group 1999-2005
The Role of Obesity

One undeniably negative consequence of abundant, inexpensive, calorie dense food and technological, energy conserving advances is the current global obesity epidemic. Obesity is most often measured and reported by the Body Mass Index (BMI), a crude indicator of body fat percentage. Obese persons have a BMI > 30. This internationally accepted standard is somewhat arbitrary but is based on analysis of the health impact of different BMI levels (Eckel et al., 2004).

As reported by the Nurses’ Health Study in 1990, early age mortality rate increased in women with recorded BMI >19. This research also found lower mortality among those women whose weight had remained stable since early adulthood (Manson et al., 1990). Type 2 diabetes is strongly associated with obesity across all ethnic groups (Eckel et al., 2004). The relative risk of developing Type 2 diabetes increases with the degree and duration of obesity and with the central distribution of body fat (Ibid).

According to data from the National Diabetes Surveillance System, in the year 2003, 50.1% of every 100 persons with diabetes fell into the obese category. Combining overweight with obese raised that percentage to 80.6% (Centers for Disease Control and Prevention, 2005). The rising obesity rates and increased incidence of Type 2 diabetes demonstrate the interconnectedness of these two conditions at the cellular, system and macro life-style levels.

No convincing hypothesis has emerged that totally explains the pathogenesis of Type 2 diabetes in obese persons yet clearly glycemic control is shown to improve as excess body weight is lost (Cheng, 2005). Effective interventions aimed at control of
Type 2 diabetes must include recognition of the role weight loss, and maintenance play in overall glycemic control. The IRT2DM examined illness representation, diabetes knowledge and clinical outcomes in a group of obese women.

The Role of Age

The aging of the population has forced attention on the health care needs of this group. An estimated 10.3 million or nearly 21% of persons over 60 have diabetes in the United States (Centers for Disease Control and Prevention, 2005). Controversy exists within the medical community regarding the mechanism responsible for this increased prevalence. It is known that pancreatic $\beta$-cells normally renew throughout the lifespan (Janson et al., 2004). Whether to consider the upward incidence of Type 2 diabetes an inevitable consequence of aging biology or a disease process has not been conclusively determined (Ibid).

Researchers were able to track 815 participants with 10 years of oral glucose tolerance test (OGTT) data from the Baltimore Longitudinal Study of Aging, (Meigs, Muller, Nathan, Blake, & Andres, 2003). The sample was mostly Caucasian, middle income, and was included in analysis if there were at least three OGTT results recorded for the participant. Analysis of the data showed the progression of 43% of the participants from normal to impaired fasting and 2 hour glucose post challenge over time. Participants over 65 years had accelerated rates of progression to abnormal compared to younger subjects, suggesting greater insulin resistance. The IRT2DM focused on mid-life women who are especially at risk for the complications of diabetes.
Diabetes and Women

Type 2 diabetes represents a serious threat to women at all stages of life. Gestational diabetes afflicts 8% of pregnant women. Birth defects and labor complications are associated with Type 2 diabetes during pregnancy (Homko & Trout, 2006). Mid-life women are also at risk. By the year 2010, an estimated 41 million American women will be in the age group of 45-64 years. Nearly a third of this number will be living with Type 2 diabetes, (Center for Disease Control and Prevention, February 3, 2006). Also in this age range, women have an increased risk of experiencing complications from diabetes.

Recent research has suggested that women with diabetes have a higher rate of cardiovascular disease compared to men. A 4 year study followed 67 men and 21 women with Type 2 diabetes. This research found that 40% of the women suffered cardiovascular incidents compared to 18% of the men. The researchers controlled for differences in blood pressure and body weight (Zandbergen, Sijbrands, Lamberts, & Bootsma, 2006). Though a small study, these findings suggest that women are especially at risk for serious diabetes complications. The growing prevalence and debilitating consequences of Type 2 diabetes dictate a research approach that acknowledges the self-regulatory nature of this chronic disease.

Self-regulation Theoretical Framework

Self-regulation theory, as proposed by Howard Leventhal, (Cameron & Leventhal, 2003; Leventhal, 1970) has emerged as an empirically sound and useful conceptualization of human behavior in health and illness. Self-regulation is defined as
an “adaptive process in which self-monitoring and reliance on perceptual appraisal or feedback is used as a guide for behavior” (Reynolds & Alonzo, 2000).

Development of the CSM of Illness Representation

Leventhal’s early work tested the effects of fear media messages on the public. Leventhal was interested in the net impact of public health media campaigns and studied how these messages altered behavior. Two health threats, tetanus and cancer were examined. Messages were designed that were termed “high fear” and “low fear”. Leventhal reported little effect on the health behavior of subjects based solely on high versus low fear messages. Leventhal found that both altered behavior when the message was coupled with an “action plan”. The action plan included information with suggestions of a precise way of lowering the threat (Leventhal & Trembly, 1968).

Leventhal (1968) also found that the absence of the fear producing message did not achieve any increase in adherence to health promoting activity, in particular, seeking inoculation or smoking behavior. This research was responsible for the abandonment of the Fear-Drive model of health behavior. Cognition (knowledge) and emotion were the underlying influences for managing a health threat (Leventhal, 1970). The researcher went on to formulate an exploratory parallel processing model of cognition and emotion. Leventhal focused on the experience of the individual as data in the building of the construct of illness representation (Petrie & Weinman, 1997).

Leventhal and colleagues used semi-structured or open-ended interview techniques to obtain data on illness representation. The responses were recorded, transcribed verbatim and categorized. Frequencies of response by group were analyzed. Once Leventhal and colleagues had collected the data of participant experiences, the
responses were subjected to detailed content analysis, the results grouped by categorical variables (Leventhal, 2003).

This exploratory process was employed in the hypertension studies (Meyer, Leventhal, & Gutmann, 1985) often cited as laying the groundwork for the construct of illness representation. Measures used were interviews with self-report ratings of symptoms, beliefs about causes, duration and the consequences of personal illnesses. In this way, the subject of research becomes the instrument to operationalize the construct of illness representation.

Other research further detailed illness representation. Data were collected (N=1,628) from participants who described a recent illness one or more times over a 17-month period. The researcher used guided interview questions to extract the attributes of illness representation. This research (Lau et al., 1989) confirmed that cognitions fall into the five components: identity, time line, consequences, cause, and cure. These five components were found to be reasonably stable over time and across different illness episodes. The consequences or response to illness representations were seen in this research. For instance, it was found that people with strong Identity and Cure components had a greater tendency to visit a doctor when ill and adhere to treatment.

Researchers acknowledge that somatic experiences alone do not guarantee that the individual will assign correct meaning or be motivated toward effective coping behavior. The differences of culture and social environment must also be considered. Data suggest that people construct “personal models” of the impact of a health threat that then guide behavior (Hagger & Orbell, 2003; Leventhal et al., 2003). The next section will examine further the tenets of the CSM.
Four Tenets of the CSM of Illness Representation

Leventhal outlines four prevailing tenets or assumptions that must guide a self-regulatory approach to health promoting theory, practice and research. According to Leventhal, health and risk behavior has a “bidirectional interplay” (2002). In the life-span, behaviors to enhance health change in response to symptoms, beliefs and circumstances. The foundational principles which served as the platform upon which a diabetes self-management model has been built are further explained below.

The first principle is system complexity. Human biobehavioral systems absorb an infinite number of sensory data experiences and life events. Prediction pathways are frequently cluttered with obstacles, blind alleys and dead ends. Throughout the life span, health threats are experienced differently by the same being. The same illness, easily thrown off in youth, can devastate the individual in old age. With the aging process comes a multiplicity of illnesses, physical dysfunction and the consequence of poor health habits. Leventhal calls for a multivariate approach to understanding health and illness behavior. The goal for research is to design support systems that will allow health enhancing change to occur for the long term (2002).

The second assumption is the hierarchical nature of social and individual health belief systems. Researchers and clinicians must recognize that the priorities of the society affect the individual and that representations of threat are often culturally determined. Behaviors that attend to or avoid health threats emerge from personal and cultural norms. Some of these behaviors and activities are protective to health. Where the threat falls on the hierarchy of the individual will often dictate the response or behaviors that follow problem recognition (Leventhal, 2002).
A third pillar of self-regulation theory is the *interactions of social and cognitive hierarchies*. Leventhal (2002) describes an individual within a social context. Picture a board balanced on a rock. On one side, the beliefs about self and the perception of the health threat reside. On the other, the societal beliefs, norms and other important attributes of the social environment are placed. Ideally, there is balance between the two, each contributing to overall system homeostasis. Frequently however, one side holds more weight and can tilt the being toward health or illness.

The often uneasy relationship between the individual and the social environment is acknowledged in the CSM. The term *social influence* emerges as an important antecedent for response to a health threat. Noting differences in knowledge and understanding of health needs is a first step in a comprehensive approach to research within the self-regulatory framework. Providing a means of building new behaviors supportive of health targets is possible after thorough assessment of societal barriers to health (Leventhal, 2002).

A final tenet offered by Leventhal (2002) is the importance of a *life span view* of self-regulation. Leventhal encourages a search for factors that allow for recognition of “optimalization” (p. 306) of health behavior that can occur at any age. Leventhal maintains that health behavior interventions must acknowledge the impact of the “experiential as well as the abstract, conceptual side of the mind” (p.307).

**Illness representation: Two levels**

In the self-regulatory common sense model (CSM) theorized by Leventhal et al (Leventhal et al., 2003; Petrie & Weinman, 1997) an individual will “represent” the threat of an illness or disease on two levels, a perceptual (emotion) level, the somatic
experience itself, and the conceptual (cognitive) level, the more abstract knowledge one carries about illness or disease. These constructs were first validated by research in persons with hypertension (Meyer et al., 1985). The researchers hypothesized that actions taken to reduce health risks or consequences were guided by the persons’ subjective or common-sense constructions of the health threat. Both levels guide the choice of subsequent coping behaviors.

*Illness representation attributes*

The attributes of illness representation have been further defined by Leventhal; et al (Leventhal et al., 1992). *Identity* is the first sub concept of illness representation. This is the diagnosis or symptom recognition, the *name* of the problem given by a health care provider or created by the individual. Also included in representation is *time*. Is the threat acute, chronic, or does it come and go? *Consequences* of the illness are also a part of representation. Are there economic, physical or social detriments from the illness? Assumed *causes* of the illness contribute to representation as does the potential for cure or *controllability*.

These five sub-concepts make up illness representation. This evaluative process paints a picture for the individual of the origins, impact and potential course of the disease (Leventhal & Nerenz, 1985). The evolution of illness representation leads to decisions and subsequent behaviors that can support or deter a medical regimen (Kanfer & Karoly, 1982; Leventhal, 2002).

This *representation* of the illness is essential in guiding response to a health threat (Leventhal & Mora, 2005). Once representation is made, coping procedures follow at the emotional and cognitive level. Coping procedures are then appraised in an evaluative
phase. These processes form a feedback loop that can then change the representation of illness either cognitively or emotionally (Cameron & Leventhal, 2003).

This construct of illness representation is dynamic, it ebbs and flows with the course of the disease or condition. Illness representation is also central in determining adherence and other coping behaviors in diabetes self-management (Lange & Piette, 2006). The current study into the illness representation and diabetes self-management behavior of women with Type 2 diabetes accepted and applied the preceding assumptions in the selection of variables to measure. Demographic, social and medical history characteristics which influence health status are brought forward in the IRT2DM. A comprehensive approach to diabetes self-management must consider and address the social context of the individual.

Research Support for the CSM in Chronic Disease Groups

Research by Hampson and others (1990) attempted to validate all five domains of illness representation. Here the researchers referred to illness representation as the “personal model of diabetes”. The instrument used was a comprehensive interview guide, the Personal Model of Diabetes Interview (PMDI). The researchers developed the guide based on input from Leventhal (Leventhal, Nerenz, & Steele, 1984) All were female participants (N=46), mean age was 57. All were diagnosed with Type 2 diabetes. Interviews lasted about an hour and included a range of open and closed response questions (Hampson, Glasgow, & Toobert, 1990).

Strong support for 4 of the 5 illness representation domains was found. The research (Hampson et al., 1990) found little distinction between time-line and consequences; these domains were combined and termed “seriousness”. In this research,
identity was dropped from analysis as the data was least reflective of any variable of interest to the researchers. Using a process for determining inter-correlations among responses, alpha reliabilities for cause, seriousness and cure (or treatment) were all .70 or better.

Ray et al (1992) obtained data from patients with chronic fatigue syndrome (n=208). All subjects completed a researcher constructed illness perception questionnaire which dealt both with their illness in general and with the extent to which they experienced specific symptoms. Data were subjected to factor analysis. Fatigue, other somatic symptoms and cognitive difficulty were associated with overall sense of illness severity (consequences, timeline). Negative emotions were correlated to symptoms (identity) (Ray, Weir, Cullen, & Phillips, 1992/4).

Skevington (1993) used a standardized scale, The Beliefs about Pain Control Questionnaire (BPCQ), to operationalize some of the attributes of illness representation. Chronic pain patients (N=44) completed this measure as well as instruments to measure self-esteem and depression. Results yielded support for existence of control, causation and consequences in the illness representation of this population. Strong scores indicating high controllability predicted less depression. High scores on items relating to cause and consequences predicted more depression (Skevington, 1993).

Hampson (1994) also conducted research in patients with osteoarthritis. The aim of the research was to uncover the personal models of osteoarthritis (OA). There were 61 patients in the study, all over 60 years of age. The models were elicited using a structured interview. Findings were that there was considerable variance in the illness experiences of this group. The findings were correlated to important outcome measures.
for this population. There was most support in these data for the domains of symptoms (identity) and seriousness (time-line and consequences). These were most consistently related to treatment adherence, self-care behaviors and the utilization of medical services. In addition, persons with high scores in these areas experienced a poorer quality of life. This research yielded information useful in patient-provider interaction and more effective patient educational materials (Hampson, Glasgow, & Zeiss, 1994).

Kleinman et al, (1994) reported on research conducted in China among persons with epilepsy (N=80). Semi-structured interviews were conducted by trained local health professionals. Interviews were tape-recorded and coded for responses. Evidence yielded support for identity, causation and consequences in the illness representation of this group. Medication adherence was linked to a high number of reported symptoms (identity). Subjects readily discussed beliefs about causation and the presumed consequences of the disease. The strong social component of the illness experience is evident in this research. Cross-culture evidence for shared illness representation attributes was found in the research (Kleinman et al., 1994).

End-stage renal patients were the focus of research (Devins, Beanlands, Mandin, & Paul, 1997). Maintenance dialysis patients (N=49) and kidney transplant patients (N=52) completed the Illness Intrusiveness Rating Scale, a 13 item self-report index of symptoms and quality of life. A 7 point Likert scale was used to determine the degree of illness intrusiveness on activities of daily life. Rating ranged from not very much to very much. Structured interviews were also undertaken as well as other measures of self-esteem and emotional distress. According to the researcher, illness intrusiveness variables echo consequences, identity, duration and causation in illness representation.
Depression correlated to degree of illness intrusiveness. This research lends support to interaction between variables of self-concept and illness representation.

A 1998 publication described research by Schiaffino et al examined illness representation in patients with rheumatoid arthritis (RA) (n=63) and multiple sclerosis (MS) (n=66). To measure illness representation, the researchers used the 45 item Implicit Models of Illness Questionnaire (IMIQ). The tool is expected to measure seriousness, controllability, personal responsibility (cause) and changeability. These factors were said to show similarities to the commonsense model of illness representation.

The research also drew data on functional status and depression. Group comparisons were made between these two chronic illness groups. Persons with RA had illness perceptions that their disease was more serious, more curable and more in their own responsibility than those with MS. Depression was associated with symptoms in both groups. The researchers state the findings lend support for the domains of illness representation and that illness experiences shape illness representation (Schiaffino et al., 1998).

**Accuracy in Illness Representation**

The construction of an accurate illness representation can assist in disease self-management and the choice of subsequent behaviors (Karoly & Kanfer, 1982). A flawed illness representation could hinder diabetes self-management. Intervention research has successfully addressed faulty illness representation (Glasgow et al., 1999; Glasgow et al., 2005; Leventhal & Mora, 2005; Reuille, 2002). What influence an accurate versus inaccurate illness representation has on effective diabetes self-management has not received enough research attention.
Summary of the CSM

The preceding sections have reviewed the assumptions and attributes for illness representation. The research support for the CSM was also shown. The utility of this model for guiding research in groups with a chronic disease is seen. No studies were found that explored the cognitive and emotional components of the theory with outcome variables such as level of glycemic control and diabetes self-management in women. The research reported here will address a gap in literature regarding the links between illness representation and glycemic control in women with Type 2 diabetes.

By providing focus on explicating the picture of the illness possessed by the individual, the CSM yields information useful clinically for setting goals and targets of adherence. The multiple instruments and methodologies used to describe the constructs of the CSM make comparisons difficult. Yet, the attributes of the model have been widely validated and used as an explanatory model and to guide interventions in many populations and health conditions. These include preparation for a noxious medical procedure, (Johnson & Leventhal, 1974), cancer treatment, (Easterling & Leventhal, 1989) diabetes self-management (Watkins et al., 2000) and others. The next section will apply the CSM to research in mid-life women with Type 2 diabetes.

The CSM of Illness Representation in Mid-life Women with Type 2 Diabetes

Overview

According to the CSM, from the stimuli of a health threat, processed on emotional and cognitive levels, a representation of the illness emerges which guides subsequent health behaviors (Leventhal et al, 1997; Leventhal, Hudson, & Robitalille, 1997; Watkins
et al., 2000). The IRT2DM used an adaptation of the CSM to explore the illness representations of a group of mid-life women. Corresponding diabetes self-management practices and clinical outcomes were examined based on demographic and medical history characteristics of the group.

Figure 2 is a representation of the model used in this study. The specific variables measured in the IRT2DM are included in the figure in italics. In the model, attributes of self, ethnicity and SES are included with diabetes knowledge and medical history as formative influences on illness representation. The content of the illness representation then can inform the choice of coping behaviors for the individual. These coping procedures can have an effect on overall disease outcomes.

The IRT2DM examined illness representation for the total sample and by socio-demographic and medical history variables. In this way, a more complete picture of important antecedents of illness representation was uncovered. It is the contention of this investigator that the social determinants of health which are active in the development and onset of a chronic disease such as Type 2 diabetes are also influential in ongoing management. This contention is consistent with CSM tenets. The disparities of incidence of Type 2 diabetes among ethnic and socioeconomic groups are well known (Center for Disease Control and Prevention, February 3, 2006; Cowie et al., 2006).
Figure 2: Self Regulatory Model of Illness Representation in Women with Type 2 diabetes (Reynolds, et al., in press)
**Sociocultural, Medical History Variables**

For the IRT2DM, sociocultural variables which have shown influence in the onset of diabetes were chosen. In this way, differences in illness representation by group were illuminated. These variables included ethnicity, educational level (proxy of SES). Medical history impacts illness representation according to the CSM. This research also investigated the effects of co-morbidities on illness representation.

**Ethnicity and SES**

Demographic variables such as ethnicity and socioeconomic status have shown influence over illness representation and subsequent coping procedures. Recently reported research lends evidence to the construction of a “personal” model of diabetes by the individual. In research using the framework of the CSM, a diverse group (N=452) of adults with diabetes were recruited. Three rounds of data collection were done, each several months apart. Measures included detailed demographic and medical history information, a guided interview to uncover the attributes of illness representation and self-reported functional surveys. Outcome measures were obtained from the medical records and included HgbA1C. Nearly half of the sample was low income (annual income $20,000/year or less), 69% were male and 77% had Type 2 diabetes. An HgbA1C of 7.86% at baseline was reported (Lange & Piette, 2006).

When the sample was grouped by ethnic and income level, differences in illness representation were found. White participants reported greater beliefs in treatment control and treatment effectiveness than other groups. Participants with at least some college or a degree rated diabetes treatment as more serious than those who did not attend college. Education level was also the strongest predictor of treatment effectiveness.
beliefs. Persons with more education carried a greater sense of treatment effectiveness for diabetes. Higher income also predicted a greater sense of personal control. The researchers found overall, that sociocultural attributes of the sample explained the largest part of the variance in health outcome variables (21%) (Lange & Piette, 2006).

Family and personal income has been correlated to life expectancy and the presence and severity of disease (Brown et al., 2005; Kanjilal et al., 2006; Kawachi, Kennedy, & Wilkinson, 1999). The National Institute of Diabetes & Digestive & Kidney Diseases (NIDDKD) (2005) reported that persons with Type 2 diabetes were less likely to be employed, had achieved less education and had lower total family income than non-diabetics. This disparity continued even after controlling for age.

Low socio-economic status (SES) has been hypothesized as a causal agent to differences in health among groups (Kington & Smith, 1997). Lower SES can inhibit access to care, may predispose one to a lower quality of care, as well as later diagnoses and treatment of health conditions. In particular, managing a chronic condition such as diabetes can be a considerable financial burden.

Women with Type 2 diabetes were found to be markedly poorer than non-diabetic women in a CDC analysis of year 2000 data from the Behavioral Risk Factor Surveillance System. From the foundational data set of 109,680 women in the survey, 6,835 or 6.3% had been told by a doctor that they were diabetic. The average age at diagnosis was 48. This subset of women was more likely to be unemployed, nonwhite, living alone and less educated than non-diabetic women (2002).

Self reported educational attainment level will proxy as a measure of socio-economic status. The experience of a chronic disease is shaped by the social
circumstance of the individual. The IRT2DM will focus attention on the influence of SES to mediate illness representation and clinical outcomes.

*Diabetes Knowledge*

Diabetes knowledge can influence illness representation and subsequent coping procedures and outcomes. Researchers at the University of New Mexico administered a standardized diabetes knowledge test to 77 patients with Type 2 diabetes and examined medical records for most recent measurement of glycemic control (HgbA1C). Higher levels of diabetes specific knowledge was predictive of better glycemic control (p< .0001) (Panja et al., 2005). This inverse linear relationship, higher knowledge correlating to lower mean blood glucose, supported the researchers’ hypothesis of the empowering nature of diabetes specific knowledge. Recommendations from the research included a strong endorsement of formalized diabetes education as an integral part of treatment.

Interestingly, very specific *pieces* of diabetes knowledge have been associated with better clinical outcomes. A cross-sectional survey and medical records review of 686 adults with Type 2 diabetes was conducted to explore connections between diabetes knowledge, clinical outcomes and self-care behavior. The researchers were most interested in the patients who were able to accurately report the last HgbA1C recorded in their medical record. Only 25% of the sample could report this number. These patients were more likely to have a better understanding of diabetes treatment and goals for improvement (Heisler et al., 2005). This research points out the wide gap that exists in the communication of *essential* information from the health care provider to the individual living with Type 2 diabetes.
Qualitative research has documented the lack of knowledge about diabetes in an Appalachian community. Sixteen focus groups (N=61) were conducted to describe the level of knowledge about diabetes and diabetes self-management. Respondents were all adults with Type 2 diabetes. The research found a lack of knowledge about the seriousness of diabetes, the risk factors and complications associated with the disease and a general sense of helplessness about the disease among this population (Tessaro, Smith, & Rye, 2005). The researchers recommended structured instruction that could capitalize on the strengths of the culture while supplying needed information and support.

Full discussion of complex treatment modalities do not fit in the usual office visit time frame. In particular, over the past decade, pharmaceutical advances offer greater hope for glycemic control. Through formal diabetes self-management education information about medications can enhance adherence (Cramer, 2004; Rhee et al., 2005), correct misconceptions and give support during the practice and acquisition of necessary diabetes self-management skills. Better glycemic control and a decrease in complications of diabetes are realistic outcomes when coupled with enabling knowledge (Kim & Oh, 2003; Ofman et al., 2004).

As pharmaceutical treatments have increased in number and complexity, less attention to diabetes education has occurred. Disease knowledge has been shown to positively influence treatment plan adherence and health status (Gazmararian, Williams, Peel, & Baker, 2003; Panja et al., 2005). Even though curriculum content has been largely standardized and sanctioned by the American Diabetes Association (ADA), consistent distribution and implementation does not occur.
This disease specific, nutrition and medication information may influence illness representation and the subsequent selection of coping procedures. In this way diabetes knowledge may be a predictor of self-management practices and clinical outcomes. What role a lack of knowledge may play in diabetes self-management is not well articulated in research literature. How illness representation and diabetes knowledge together may contribute to a desired clinical outcome in women with Type 2 diabetes has not been studied. Nurses and other health care providers treating individuals with Type 2 diabetes must continually validate the type and quality of disease specific knowledge possessed by the patient. This knowledge is part of the fuel that powers the individual through life.

Once again, the research examining personal models of diabetes collected data reflecting diabetes knowledge (Lange & Piette, 2006). Diabetes knowledge was measured by collected data about attendance in diabetes classes in the last year. Those who had attended recent education exhibited greater optimism about diabetes treatment.

Other nursing research has demonstrated the importance of diabetes knowledge to self-management. In a sample of diabetic patients who used insulin (N=141), individuals with greater disease specific knowledge exhibited more diabetes self-management behaviors. This effect was expanded when coupled with higher social support. Outcome measures were not reported in this research, as the purpose of the research was testing a conceptual model (Sousa, Zauszniewski, Musil, McDonald, & Milligan, 2004).

Co-morbidities

The physical consequences of Type 2 diabetes fall into two main categories, macrovascular and microvascular complications. The inter-relatedness of Type 2 diabetes and vascular health has been acknowledged for over 30 years. This unhealthy
synergy has led to the current classification of diabetes as a *cardio-metabolic* disorder (Buse et al., 2007; Chyun & Young, 2006/12; Deedwania & Fonseca, 2005). What effect(s) compounding medical conditions may have in groups with multiple chronic conditions has been little studied.

The research reviewed above that investigated personal models of diabetes also examined the health history and number of co-morbidities reported in the group (N=452). Self-reported diagnoses, rather than medical record information, was used to evaluate the number of co-morbidities as this better reflects the participant perceptions of health. Higher numbers of co-morbidities predicted a higher sense of seriousness about diabetes. As numbers of co-morbidities went up, sense of control and emotional representation decreased (Lange & Piette, 2006). This research, using the CSM, lends support for the influence of co-morbidities on illness representation.

Other research examined a group of patients with Type 2 diabetes associated with a university primary care clinic, (N=909). The Health Utilities Index (HUI), a 15 item self-report instrument encompassing functional status and quality of life domains was used along with measures for evaluating depression and demographic characteristics. Medical records were examined to confirm numbers of medications, diagnoses and other self-report data. Measures of glycemic control were not reported. Among the findings were that as the number of reported co-morbidities and medications increased, overall health status decreased. Women with Type 2 diabetes had lower health status when compared to men. Those with diagnosed depression had the lowest reported quality of life. Symptomatic co-morbidities had the most negative impact on quality of life (Wexler et al., 2006).
Hypertension, coronary artery and peripheral artery disease are frequently found in persons with Type 2 diabetes. At least 70% of the early mortality in people with diabetes is attributed to cardiovascular insults (Gerstein, Malmberg, Capes, & Yusuf, 2001). Women with Type 2 diabetes are experiencing increased rates of cardiovascular disease compared to male counterparts (Ibid). The exact mechanism(s) whereby a person with Type 2 diabetes may fall victim to a multiplicity of cardiovascular disorders is not known. What is not disputed is that long-term glycemic control, maintaining near normal blood sugars, decreases cardiovascular incidents such as myocardial infarction and stroke (Buse et al., 2007; UKPDS Writing Group, 1998).

No research was found that directly examined co-morbidities in light of diabetes self-management practices and glycemic state. The IRT2DM investigated the impact of co-morbidities on illness representation.

Co-morbidity: Depression

Depression is common in adults with diabetes (Surwit, van Tilburg, Parekh, Lane, & Feinglos, 2005). Researchers have yet to identify the exact etiology for this phenomenon; some speculate depression is associated with poor glycemic control, obesity or both conditions (Ibid). Researchers recruited (n=805) Type 2 diabetes patients from a health maintenance organization in North Carolina to examine the relationship between depression and glycemic control. The Beck’s Depression Inventory (BDI) was administered along with a blood sample to determine level of glycemic control, HgbA1C. Findings revealed Pearson correlations between BDI scores and HgbA1C that were low and insignificant (r= 0.284; p = 0.034) (Ibid).
This finding contrasts with another published meta-analysis. The researcher used MEDLINE and PsycINFO databases to search for articles examining depression and diabetes complications in Type 1 and Type 2 diabetes samples published between 1975 and 1999. A total of 27 studies (total combined N = 5,374) met all the inclusion criteria. A significant association was found between depression and complications of diabetes (p < .00001, z = 5.94). Depression was significantly associated with a variety of diabetes complications (diabetic retinopathy, nephropathy, neuropathy, macrovascular complications, and sexual dysfunction). These findings demonstrate a significant and consistent association of diabetes complications and depressive symptoms (de Groot, et al, 2001).

Recent research indicates that approximately 33% of people with diabetes demonstrate clinical or sub-clinical depression (Hermanns, Kulzer, Krichbaum, Kubiak, & Haak, 2006). The impact of depressive syndrome on diabetes self-care management has not been well examined. The IRT2DM will directly examine the possible effects of taking anti-depressant drugs on diabetes self-management and glycemic control. The role of this prominent co-morbidity is highlighted in the IRT2DM.

The IRT2DM examined illness representation, based on ethnicity, education level, diabetes knowledge and co-morbidities. Differences among groups were highlighted and analyzed in light of an important clinical outcome. The current study adds depth to the understanding of sociocultural influence on the formation of illness representation.
Illness Representation and Coping Procedures

In the CSM, *coping* is defined as the “set of procedures, overt and covert that an individual uses for managing a problem situation” (E. Leventhal, Suls, & Leventhal, 1993). Coping procedures are shaped by situational demands and often change over time. Outcome appraisal following implementation of these procedures can change coping. Once a coping procedure is utilized and appraised, the likelihood of its re-use may influence clinical outcomes. According to Leventhal et al (2005) the antecedent of illness representation is critical and shapes coping procedures. Leventhal prefers the term “procedures” to coping as it more accurately reflects self-management responses to illness representation and it has a more neutral connotation. Thus coping procedures may have multiple functions within a self-regulatory framework, they may be cognitively or emotionally focused and may assist or deter progress overall (Leventhal et al., 1997).

*Coping Procedure: Diabetes Self-Management*

The chronic illness trajectory of Type 2 diabetes does not have to be one of disability and early mortality. Once diagnosed, the goal of clinicians must be to assist persons with diabetes to normalize blood glucose levels through medication, medical nutrition and lifestyle changes (American Diabetes Association, 2002; Center for Disease Control and Prevention, February 3, 2006). There is evidence that health care professionals know about and ascribe to the benefits of glycemic control (Benoit, Fleming, Philis-Tsimikas, & Ji, 2005; Heisler, Piette, Spencer, Kieffer, & Vijan, 2005; Spitz & Kanani, 2006). Despite this, indicators of progress toward better glycemic control in persons with Type 2 diabetes are missing (American Association of Clinical Endocrinologists, 2005; Campion, Tully, Barrett, Andre, & Sweeney, 2005).
Through the process of effective diabetes self-management, the consequences of the disease can be lessened or avoided (Funnell, 2004; Miller & Fain, 2006/12). The unmodifiable influences of ethnicity and age can be ameliorated with individual attention to the self care competencies necessary to normalize blood sugar levels. The primacy of self in determining clinical outcomes in Type 2 diabetes must be acknowledged and cultivated in health care partnerships. There is recent impetus for health care professionals to develop more interactive; problem solving approaches to care that enables diabetes self-management (Leeman, 2006; Whittemore, 2006/12).

Measurement of effective diabetes self-management most often centers on adherence to medically prescribed treatment. A recent analysis of 15 research studies found that adherence rates for oral anti-diabetic agents ranged widely from 36-93% in patients remaining on treatment for 6-24 months (Cramer, 2004). Clearly, despite the multiple health and quality of life benefits, long term medication adherence is difficult and elusive for many with Type 2 diabetes (Rhee et al., 2005; Rubin, Peyrot, & Siminerio, 2006).

Coping procedures in diabetes self-management also include diet and exercise. These are touted as the essential 3 parts of diabetes self-management. A fourth area, self-monitoring of blood glucose (SMBG) has joined these as home testing technologies have become more available and usable (Siebolds, Gaedeke, & Schwedes, 2006). The place of SMBG in Type 2 diabetes self-management is not conclusive and requires further investigation. What is not in dispute is that effective diabetes management is essential for long term survival and quality of life with the disease (Chyun & Young, 2006).
Self-monitoring of Blood Glucose

Daily fingerstick glucose testing is an activity of diabetes self-management supported by the American Diabetes Association for persons with Type 2 diabetes (American Diabetes Association, 2006b). SMBG has long been a standard for insulin dependent people with Type 1 diabetes due to the greater risk for dangerous hypoglycemia. However, recent national surveys estimate that only slightly over 50% of persons with Type 2 diabetes perform SMBG daily (Astin & Jones, 2006).

A recently published meta-analysis upholds the worth of self-testing in Type 2 diabetes management by linking this behavior to better glycemic control measured by Hemoglobin A1C. The researcher used published results of 8 randomized controlled trials, total N=1,307 persons for analysis. The researchers contrasted those trials that included SMBG with those that did not. Using a mixed effect model, the researchers concluded that the trials that included SMBG reported significantly better glycemic control pre to post treatment. Using stratified analysis, an overall, HgbA1C reduction of .39 to .42%, a clinically significant reduction, was attributed to the use of SMBG in the trials reviewed. The researchers translated this difference to representing a 15% reduction in risk of complications from Type 2 diabetes (Sarol, Nicodemus, Tan, & Grava, 2005). SMBG serves as a real time measurement of disease state.

Other research does not support SMBG as a means to achieving glycemic control. The Fremantle Diabetes Study followed 1,286 Australian adults with Type 2 diabetes over five years. No differences in HgbA1C were found in those who tested versus those who did not test. Frequency of testing did not predict better control (Davis, Bruce, & Davis, 2006). Further research must explicate the role of SMBG in diabetes self-
management and as an adjunctive agent to achieve glycemic control. No literature was found which directly examines illness representation as predictive of SMBG practice.

Recent research highlights the importance of SMBG and the impact of this activity on diabetes clinical outcomes. Research conducted in Germany and Austria randomized 223 people with Type 2 diabetes into two groups. At baseline, both groups had similar demographic features and HgbA1c. One group was given training in the use of a blood glucose monitor and log. Dietary intake was also recorded. Occasional brief, scripted counseling was also given to the intervention group. Findings of this research included statistically and clinically significant reduction in HgbA1C in the intervention group over 6 months (1% decrease). Also noted was a decrease in depression among the intervention group (Siebolds et al., 2006).

There are differences in diabetes self-management practices by ethnicity and SES. Recent research looked at enrollees of a managed care organization. The investigators used a 40 item survey to evaluate diabetes care practices and the utilization of preventive services all were entitled to receive. There were 6,035 surveys analyzed. African Americans and Hispanic members with diabetes were significantly less likely to monitor their diet and blood sugar and were more likely to smoke. When compared to whites, these groups also had lower rates of utilization of preventative health management services and screening for complications of diabetes (Oster et al., 2006). All had similar access to services. The researchers recommended further investigation into the differences in diabetes self-management by ethnicity. The IRT2DM investigated differences in diabetes self-management based on demographic variables.
Performing SMBG can serve as a coping procedure by delivering needed information to the person. From this information decisions can be made that may enhance health. SMBG is a health promoting procedure that assists in diabetes self-management. There is a gap in the literature that directly examines the illness representation and knowledge of persons who choose to perform self-testing of blood glucose and those who do not test.

The link between the performance of this activity and clinical outcomes of diabetes must be clarified. By focusing on SMBG, an admittedly narrow and incomplete view of effective diabetes self-management is the result. However, this coping procedure is a widely accepted standard of care and was chosen to represent the consequence of illness representation in the IRT2DM (American Diabetes Association, 2002).

Summary: Self-Management of Diabetes

Recently, the American Association of Diabetes Educators (AADE) have highlighted 7 self-care behaviors and have framed these as client “outcomes performance areas” rather than the previously provider focused content driven curricula (2007). Self care behaviors include healthy eating, activity, as well as managing medication and risks, self-monitoring of blood glucose, and healthy coping.

Such performance is in part dependent on the sociocultural attributes and disease knowledge which has shaped illness representation. Then the choice of coping procedures that improve clinical outcomes can occur. The importance of sociocultural attributes, medical history, diabetes knowledge and the performance of SMBG are highlighted in the IRT2DM.
Health Outcome: Glycemic Control

It has been widely acknowledged that the “gold standard” measures of diabetes severity are glycemic control indicators such as fasting blood sugar (FBS) and HgbA1C (American Association of Clinical Endocrinologists, 2005). Achieving ideal, life sparing and sustaining glycemic control is dependent most on the actions of the person with the disease, not the health care professional (The American Association of Clinical Endocrinologists, 2000). The IRT2DM used HgbA1C as the outcome measure of diabetes self-management. Standards of the American Association of Clinical Endocrinologists (2000) call for strategies that enhance glycemic control by “vigorous and persistent efforts” (p. 43).

There is much evidence that effective diabetes self-management results in better glycemic control. Causation and directionality seems clear for this clinical outcome (Davidson, 2007; Grant et al., 2007; Piatt et al., 2006). Longitudinal, observational data was collected from 573 patients of an inner city public health clinic. All had Type 2 diabetes and were low income. Most were Hispanic (53%). The researchers used mixed effects modeling to identify factors influencing glycemic control. Multiple medications, multiple co-morbidities and younger age all were strong predictors of poorer glycemic control (Benoit et al., 2005). Clearly, barriers to diabetes management are many. Pathways to improving diabetes self-management are needed.

The goal of the IRT2DM was to examine selected factors that may predict or explain the level of glycemic control in post-menopausal women with Type 2 diabetes. By exploring the components of illness representation, disease knowledge and other psychosocial variables in women with Type 2 diabetes, insight into adaptation was
generated. A picture of life with a chronic disease emerged that can then be scrutinized for potential areas of intervention to improve diabetes self-management.

**Summary: Review of Literature**

This review has discussed the pathogenesis, epidemiology and consequences of Type 2 diabetes. Also, the development and constructs of the CSM have been discussed. The Leventhal CSM is a reliable framework for research and has guided the choice of variables in the IRT2DM.

This study used a self-regulatory model of illness representation to investigate the multivariate process of diabetes self-management in a group of women. This investigation of concurrent relationships among important determinants of glycemic control will add to the scientific literature and serve as a foundation for intervention research. The health care professionals providing care to persons with Type 2 diabetes must be prepared to improve current health as well as to address the potential for future complications and premature mortality. The IRT2DM will explicate the variables which contribute to glycemic control in a group of women with Type 2 diabetes. Chapter 3 will describe the methodology for this research.
CHAPTER 3

METHODS

The IRT2DM was a sub study of the Women’s Diabetes Study (WDS), (Dr. Martha Belury, Principal Investigator). The WDS tested the efficacy of a nutritional supplement as an adjunctive therapy in diabetes management. The WDS was conducted during the years 2004-07. The WDS was supported with an unrestricted grant from Cognis Corporation, a producer of nutritional supplements. This investigator was involved in many aspects of the WDS including recruitment, screening and consenting of participants, as well as in data collection.

Study Design

The IRT2DM used a cross-sectional, descriptive, predictive correlation design.

Setting

Participants reported to the General Clinical Research Center (GCRC) at The Ohio State University (2nd floor of the Davis Medical Research Center, 480 West 9th Avenue, Columbus, OH) for the collection of all data.
Sample

Inclusion/Exclusion Criteria

The following criteria were followed for inclusion in the IRT2DM. The motivating rationale for these criteria (from the WDS) was to equalize, as much as possible, metabolic processing. Characteristics known to interfere in glucose uptake were eliminated as much as possible (Belury, 2005).

Inclusion Criteria:

1. Female, age less than 70 years.
2. Diagnosis of Type 2 diabetes
3. Obese (BMI ≥ 30 kg/m2)
4. Post-menopausal
5. Hgb A1C ≥ 6.5 and ≤ 14%
6. Plan to stay in the Columbus, OH area for 1 year from enrollment
7. Able to read, write English

Exclusion Criteria:

1. Use of tobacco
2. Use of alcohol to excess or other substance abuse
3. Cognitive impairment
4. Abnormal liver function
5. Use of exogenous insulin
6. Use of hormone replacement therapy
7. Having an implanted pacemaker or defibrillator
Recruitment

Recruitment was accomplished in several ways. Flyers describing the study were widely distributed. Physicians treating women with Type 2 diabetes were solicited to write to clients about the study and invite inquiry. Certified diabetes educators (CDE) were contacted and informed about the research. Radio announcements and newspaper advertisement was also used to recruit for the study.

Sample Size

From these recruitment methods, approximately 363 women were screened for the WDS. Of that number who met inclusion criteria, 55 women consented and gave baseline data for the IRT2DM. Eligible women were paid a total of $150 for completing the research.

Procedures to Protect Human Subjects

Institutional Review Board:

The WDS has been reviewed by and approved by The Ohio State University Institutional Review Board (IRB), protocol number MAB003. The IPQ-R was added to the research protocol after review and approval by the IRB in June 2005. All subject documents will remain confidential, and all samples and data will be coded according to assigned subject numbers. Subject data are stored in locked file cabinets kept by the Department of Human Nutrition and project staff.
Informed Consent:

Participants gave informed consent prior to enrollment. Protection of human subjects is assured through safety monitoring built into the research protocol and oversight by the GCRC safety committee and the IRB.

Measures

Table 1 is a summary list of the research questions, the construct, the operational definition and the unit of analysis for the IRT2DM.
<table>
<thead>
<tr>
<th>Research Question</th>
<th>Variable</th>
<th>Measure</th>
<th>Unit of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 1: What are the illness representations?</td>
<td>Illness Representation</td>
<td>Illness Perception Questionnaire-Revised</td>
<td>Sub-scale total score for cause, consequences, emotional representation, causation, timeline, illness coherence and identity</td>
</tr>
<tr>
<td>RQ 2: What factors are associated with illness representation?</td>
<td>Ethnicity, education</td>
<td>Self-reported on the baseline screening document</td>
<td>Self-selected ethnicity from 6 categories</td>
</tr>
<tr>
<td></td>
<td>Diabetes Knowledge Co-morbidities</td>
<td>University of Michigan Diabetes knowledge test Screening tool, health history self-report from list</td>
<td>Self-selected educational level from 6 categories</td>
</tr>
<tr>
<td></td>
<td>Psychotropic Medications</td>
<td>As indicated in the self-report of all medications and supplements being taken</td>
<td>Number of diagnoses or disorders indicated collapsed to 3 levels, diabetes +1, diabetes +2, diabetes +3 or more</td>
</tr>
<tr>
<td>RQ 3: What diabetes self-management practices are reported?</td>
<td>Coping procedure</td>
<td>Self-reported practice of SMBG</td>
<td>As indicated grouped by response to 2 levels, takes psychotropic drugs or does not take psychotropic drugs</td>
</tr>
<tr>
<td>RQ 4: What levels of glycemic control are associated with diabetes self-management?</td>
<td>Glycemic Control</td>
<td>Hemoglobin A1C</td>
<td>Actual level of HgbA1C translated to 3 level reflecting good control, needs improvement or poor control</td>
</tr>
</tbody>
</table>

Table 1: Research Questions, Variables, Measures and Unit of Analysis for the IRT2DM
**Demographic Variables**

Categorical variables central to the IRT2DM were collected upon enrollment. Self-reported were age, years of education completed (proxy for SES), and ethnicity. See Appendix A for this document.

**Medical History Variables:**

Health status data were collected by asking the participant to identify other diagnoses from a comprehensive list and to reveal all medications and nutritional supplements being taken. The health history questions are part of demographic document in Appendix A.

**Illness Perception Questionnaire-Revised (IPQ-R):**

This self-report, survey instrument was developed by several health psychologists to measure the constructs of illness representation as purported by Leventhal, et al (Leventhal et al., 2003). Several of the developers of the IPQ-R have conducted research and published with Leventhal. Some details of self-regulation theory and illness representation have already been presented. The instrument was specifically designed to measure the 5 domains of illness representation as well as emotional representation. See Appendix B for a copy of this document.

**Reliability and validity of the IPQ**

Content validity was determined by the developers through the comparison of results on the IPQ with the results of research conducted by Leventhal and colleagues in semi structured interviews. The tool developers established content validity, in part, with a group with diabetes (N=52) (Nerenz, Repasky, Whitehouse, & Kahkonen, 1992). The developers of the IPQ claim “strong” evidence for all the themes of illness representation.
drawn from interviews when compared to the answers on the IPQ (Weinman, Petrie, Moss-Morris, & Horne, 1996).

Data from 7 diverse illness groups were drawn to examine the psychometric properties of the IPQ. Samples were from inpatient populations as well as non-hospitalized persons in the UK and New Zealand. Internal consistency of the measure, Cronbach Alpha for all subscales in four of the patient populations (N=370) was reported at .72 to .82 depending on the subscale. The intercorrelations between the IPQ scales were found to follow logical relationships. Patients with a strong identity (acute vs. chronic) were found to be more likely to perceive the illness as lasting a long time (Weinman et al., 1996).

Concurrent validity was determined using other measures such as the Sickness Impact Profile, Locus of Control Scale, Health Distress Scale and others. Numbers of doctor visits and self-rated health was also calculated. The IPQ showed significant “positive correlation” with scores on those items to the parallel subscale. For Locus of control r= 0.44; p < 0.001 (Weinman et al., 1996).

Discriminate validity was also assessed in the IPQ. Patients in different illness groups were compared. A series of one-way analyses of variance were conducted. The results support the known attributes of the illness. For instance, strong identity was associated with illness with many presenting symptoms but not in an illness such as Type 2 diabetes. Weak cure belief was found in groups where the illness has no cure such as rheumatoid arthritis. Predictive validity was also assessed by looking at scores from inpatient to outpatient status at 3 and 6 month intervals. Correlation with baseline scores
showed negative correlation to identity (-.24; p < .05) as expected, other subscales were comparable in the predicted direction (Weinman et al., 1996).

Reliability and validity of the IPQ-R

The IPQ-R was a revision of the original instrument. The same developers, health psychologists, are responsible newer version. The IPQ-R benefits from the use of the IPQ in multiple patient groups in the years since its introduction. One strong motivation for the revision was the desire to include items specifically designed to reflect the emotional representation of the respondent. The IPQ focused solely on the cognitive illness representation of the person (Moss-Morris et al., 2002).

Eight illness groups in the UK and New Zealand were used to determine the psychometric properties of the IPQ-R. In the revision, the causal dimension was grouped as a separate section and items were added. Cronbach’s Alpha, a reflection of validity was found to range from .79-.89 for the subscales. Test-retest reliability was reported for two groups, renal patients and rheumatoid arthritis patients. For the subscales, correlations with baseline ranged from .46-.80 for the renal population and from .35-.71 in the rheumatoid patient population. This showed good stability with the exception of personal control. Principal component analysis also lent support for linking this instrument to the theoretical underpinnings of the CSM (Moss-Morris et al., 2002).

Overall, the IPQ-R has strong psychometric properties. It has been used in many patient groups as well as a part of nursing intervention research. The instrument is easy to administer and takes less than 15 minutes to complete. No information on readability statistics was found. The data from the IPQ-R will allow the researcher to more fully
describe the illness representations of the sample and to correlate the findings with other variables of importance to diabetes self-management.

*Diabetes Knowledge Test*

This instrument is a 10 item tool to gauge general diabetes knowledge (DKT). The test version used in the WDS was specific to Type 2 diabetes. Items are multiple choice or true/false. The test was developed by researchers at the University of Michigan, Diabetes Research and Training Center. Only the 10 items directly taken from the original University of Michigan DKT were used for analysis in the IRT2DM. See Appendix C for this document with the items used for analysis highlighted.

A 1998 publication details the development and testing of the DKT (Fitzgerald et al., 1998). The authors began diabetes knowledge tests development in the 1980’s. The motivation for developing the test was to find an instrument that could be completed quickly and that would supply information useful in the patient education process. The test takes 15 minutes or less to complete.

Two large samples were drawn to test the psychometric properties of the diabetes knowledge test (DKT). A community sample consisted of 312 persons and a public health clinic sample (N=499). No significant differences were found for diabetes type and treatment, years since diabetes diagnosis and education in the two samples. Cronbach’s Alpha for the general test indicate it is reliable (> .70) for the total. For validity, the developers report correlation with persons having completed a diabetes education course scored higher than those who did not. Insulin dependent persons scored higher than persons with Type 2 diabetes. The developers concluded strong support for the instrument in both samples (Fitzgerald et al., 1998).
The instrument can be downloaded and used free from the University of Michigan web site (University of Michigan, 2006). The IRT2DM will test the diabetes knowledge of subjects in a research study at three points during the 52 week project. Data about possible correlations between knowledge and illness representation will be examined.

Data Collection Procedures

Data for the IRT2DM were collected at baseline (week 0) and at weeks 36 and 52.

Demographic, Medical History:

Once a participant was successfully screened and gave informed consent to participate, a detailed demographic and medical history form was completed, see Appendix A. These forms were reviewed with the participant by the research staff for completeness and legibility. Data elements in the demographic and medical history form include age, ethnic background, years of education, and detailed questions relating to past and current medical history and medications, vitamins and nutritional supplements.

Illness Representation/Diabetes Knowledge

These questionnaires were completed during a scheduled 4 hour visit at the GCRC. Written instructions for survey completion are with the two self-report measures, IPQ-R and the Diabetes Knowledge Test. The WDS project staff was available to answer questions about filling out the instrument, but did not give additional guidance. Survey instruments were completed before the scheduled educational/motivational counseling by GCRC dietitians. This dietary counseling was part of the WDS protocol.
**Glycemic Control:**

The outcome variable of interest is glycemic control as measured by the biochemical measure Hemoglobin A1C (HgbA1C). Erythrocyte, red blood cell, exposure to circulating blood glucose precipitates a reaction between the sugar and the A1C protein on the cell membrane. The rate and degree of this bondage is in direct proportion to the mean glucose level of the individual in the previous 120 days (Sacks, Bruns, Goldstein, Maclaren, & McDonald, Parrott, 2002). The American Diabetes Association promotes the use of this measure twice a year for persons who are in “good” control (<7%). Persons not in good control should have this indicator measured quarterly and treatment adjusted until control is achieved (2006b).

Hemoglobin A1C was measured by adequate fingerstick sample and subjected to analysis by the Bayer DCA 2000™. The research nurses in the GCRC obtained the specimen from the fasting subject at weeks 0, 36 and 52 in accordance to standard protocol. The sample was run at the point of care though the Bayer DCA 2000™ in accordance with the guidelines of the manufacturer.

The instrument used to measure HbgA1C has established reliability. Specificity and sensitivity have been established. Correlation with other methods of measurement was found to be high with a coefficient of 0.98 with the more expensive “gold standard” method of high performance liquid chromatography. Coefficients of variation are reported at less than 5% which upholds the instrument’s precision (Bayer Corporation, n.d.).
Daily controls are performed on this machine. A back up identical model is available if the primary instrument is out of calibration. Agreement with known samples is performed as part of the annual certification of this equipment for point of care testing. Fasting blood sugar will also be measured using a calibrated ACCUCHEK devise. Participants are given the following instructions to prepare for testing:

1. Fast, nothing to eat for 12 hours prior to blood collection.
2. Hold any medications; bring them with you, the morning of testing.
3. Drink plenty of water, even when fasting.

A Priori Significance

Cohen’s (1988) techniques were consulted to determine a priori significance level. The significance level to detect differences between groups was set at .05 (alpha). Alpha level refers to the chance of making a Type 1 error. To falsely reject a “true” hypothesis is Type 1 error. With this significance level there is only a 5% chance of rejecting a true hypothesis. In this exploratory research, Type 1 error would occur by concluding a relationship between the independent and dependent variable(s) existed when in fact it did not exist.

A medium effect size is also being set for the IRT2DM. Effect size will indicate the strength of the relationship between variables. No previous study has been found that directly examines these variables in mid-life women. The IRT2DM will use the accepted r=.30 for correlation as a guide to determine influential variables for further analysis. The IRT2DM includes 6 independent or predictor variables and 2 dependent or outcome variables, SMBG and glycemic control.
Statistical Analysis

Descriptive statistics will reveal the characteristics of the sample by age, ethnicity, education, numbers of co-morbidities and medication use at baseline. The statistical program, Statistical Packages for the Social Sciences™ (SPSS Inc., Chicago, IL version 15) was used for all descriptive and inferential analyses.

Research Question 1: What are the illness representations of a group of post-menopausal women with Type 2 diabetes?

As required by the scoring guidelines for the IPQ-R, responses to the questionnaire will be summed by item and then grouped to create subscales when indicated. Identity, the numbers of symptoms attributed to diabetes by the individual will be totaled. Cause, the frequency of each listed item selected by the individual will be reported. Timeline, consequences, control, emotional representations mean scores will be computed and reported. Frequencies and sub-total scores will be reported to answer this question.

Research Question 2: What psycho-social factors are related to illness representation?

For hypothesis testing, multivariate techniques were employed to discover relationships among the variables of interest. A two step approach was used. First, multiple correlation matrices will identify what influential variables are contributing to illness representation. Assumptions will be checked before Pearson’s correlation is run. These include: a representative sample of the population, variables correlated should be normally distributed; scores must have homoscedastic properties (equal variability) and linear relationships between the dependent and independent variables.
Multiple regression techniques explored how those variables contribute to the dependent variable of coping behavior and level of glycemic control. Actual HgbA1C level was used as this represents a continuous variable.

Research Question 3: What diabetes self-management practices are associated with illness representation?

Based on screening data, the sample was categorized into three groups based on the practice of SMBG. An examination (ANOVA) for differences in the sub-constructs of illness representation was carried out.

Research Question 4: What diabetes self-management practices are associated with levels of glycemic control?

Grouping by actual HgbA1C was done. Associations between SMBG and glycemic control were evaluated with Pearson’s correlation matrix and multiple regression techniques.

Summary

This chapter described the methodology used to conduct the research study. The study design, sample, setting and procedures used in data collection were presented. The data analysis collection, human subject protection procedures and analyses plan were discussed. The next chapter presents the findings of this research.
The results of this descriptive, correlational, cross-sectional study of illness representation, diabetes self-management and clinical outcomes are presented in this chapter. A description of the pre-analysis data screening procedures and sample demographics is presented. Findings from the questionnaires and hypothesis testing will be reported.

*Pre-Analysis Data Screening*

Before statistical analysis, data screening was conducted to evaluate the data for statistical assumptions. Preliminary analysis included descriptive statistics for the group as well as assumption testing to determine the shape of the distribution and centrality of these data. Data were examined for outliers and influential data points. On most variables of interest to this research, distributions of data were normal. As this is exploratory research, the decision was made not to transform data when assumptions of normality were violated. Where distributions were not normal is noted in these results.
Reliability analyses were conducted to examine the psychometric properties of the IPQ-R and DKT within the IRT2DM. Cronbach's alpha (Cronbach, 1972) is a measure of reliability. Mathematically, reliability is calculated by determining the variability in the responses to a survey that is the result of differences in the respondents.

Recall that the IPQ-R is a three part questionnaire. The identity scale reflects the number of symptoms the participant has experienced and connects to the condition of Type 2 diabetes. There are 14 items on this list of common and disparate somatic complaints ranging from pain to weight loss. The total number of items the participant reports having (yes responses) is summed for the total score.

To measure other constructs of illness representation, the 38 five level Likert scaled items of the IPQ make up the IPQ items (strongly disagree to strongly agree responses). The 18 items of the Cause section of the questionnaire are also five level Likert scaled items. Cronbach’s Alpha analysis for the IRT2DM is reported in Table 2. Psychometric performance was strong for all three parts of the IPQ-R, ranging from .75-.85. Cronbach’s Alpha for the 10 items of the DKT was also determined. See Table 3.

A standard of alpha for most behavioral health research settings is set at .70 (Kerlinger & Lee, 2000). The IPQ-R exhibited strong reliability in the IRT2DM. For the DKT, a .60 alpha was obtained. This reflects more the differences of content among the 10 items.
### Reliability Statistics of the IPQ-R

<table>
<thead>
<tr>
<th>Reliability Statistics for Identity Sub-Scale of the IPQ-R</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Statistics for Illness Perception Items of the IPQ-R</td>
<td>.75</td>
<td>.79</td>
</tr>
<tr>
<td>Reliability Statistics for Cause Sub-Scale of the IPQ-R</td>
<td>.85</td>
<td>.85</td>
</tr>
</tbody>
</table>

Table 2: Reliability Statistics of the IPQ-R

<table>
<thead>
<tr>
<th>Reliability Statistics for the Diabetes Knowledge Test</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Statistics for the Diabetes Knowledge Test</td>
<td>.60</td>
<td>.59</td>
</tr>
</tbody>
</table>

Table 3: Reliability Statistics for the Diabetes Knowledge Test
Sample Demographics

From the initial screening pool of 363 women, a total of 55 participants met all criteria for inclusion in the WDS and the IRT2DM and gave informed consent. Participants were included in the sample for analysis in this research, if they had a completed demographic form, had recorded baseline measures of glycemic control and had at least one diabetes knowledge questionnaire. Not all 55 women had a completed IPQ-R. This questionnaire was added to the protocol of the WDS a year after recruitment and enrollment in the larger study began.

Table 4 summarizes the frequency distributions for age, ethnic background and education level in this group. Over half of the women were between the ages of 50 and 59 (56%) (M=57 years, SD=6.8). Participants ranged in age from 40-70 years. The majority of the women were White (65%), approximately 35% non-White. In the group, 27% of the sample was African American. The sample was a fairly well educated one with 52% reported some college education or a 2 year degree. Another 29% of the sample had a 4 year college degree or further education.
<table>
<thead>
<tr>
<th>Age Decade</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49 years</td>
<td>5</td>
<td>9.1</td>
</tr>
<tr>
<td>50-59 years</td>
<td>31</td>
<td>56.4</td>
</tr>
<tr>
<td>60-69 years</td>
<td>16</td>
<td>29.1</td>
</tr>
<tr>
<td>70</td>
<td>3</td>
<td>5.5</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>70</td>
<td>57.05</td>
<td>6.894</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black or African American</td>
<td>15</td>
<td>27.3</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td>White</td>
<td>36</td>
<td>65.5</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3.6</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS Diploma or GED</td>
<td>10</td>
<td>18.2</td>
</tr>
<tr>
<td>Some College</td>
<td>22</td>
<td>40.0</td>
</tr>
<tr>
<td>2 year degree</td>
<td>7</td>
<td>12.7</td>
</tr>
<tr>
<td>4 year college degree</td>
<td>8</td>
<td>14.5</td>
</tr>
<tr>
<td>Some Graduate School</td>
<td>5</td>
<td>9.1</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>3</td>
<td>5.5</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4: Sample Demographics
Medical History Descriptive Statistics

Table 5 is a compilation of medical history information for this group of women. In the sample, 51% reported having been diagnosed with diabetes over 5 years. At the other extreme, 14% had been diagnosed for 1 year or less. Numbers of concurrent diagnoses to Type 2 diabetes was reported via the screening medical history form. Hyperlipidemia and hypertension were the most frequently reported concurrent diagnoses. Fully 75% of the sample reported having 2 or more medical conditions in addition to Type 2 diabetes.

Of special interest in the IRT2DM was the number of women who reported taking anti-depressant drugs. The medical history form requested the names and dosages of all medications and nutritional supplements. Over one fourth, 27%, of the sample reported taking anti-depressant medications. Of the sample, only 2 women reported taking no medications.
<table>
<thead>
<tr>
<th>Time since Diabetes Diagnosis</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year or less</td>
<td>8</td>
<td>14.5</td>
</tr>
<tr>
<td>Over 1 year, less than 3 years</td>
<td>12</td>
<td>21.8</td>
</tr>
<tr>
<td>Over 3 years, less than 5 years</td>
<td>7</td>
<td>12.7</td>
</tr>
<tr>
<td>Over 5 Years</td>
<td>28</td>
<td>50.9</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Number of Concurrent Diagnoses Reported

| Only Diabetes                        | 2         | 3.6     |
| Diabetes + 1                          | 11        | 20.0    |
| Diabetes +2                           | 29        | 52.7    |
| Diabetes + 3 or >                     | 13        | 23.6    |
| Total                                 | 55        | 100.0   |

Anti-Depressants Reported at Baseline

| Anti-depressant Medications          | 15        | 27.3    |

Table 5: Medical History Responses
Descriptive Statistics for Self-monitoring of Blood Glucose

In this sample of women with Type 2 diabetes, 40% reported performing self-testing of blood glucose at least daily (i.e., 7 or more times in a week). Standards of the American Diabetes Association and the American Association of Clinical Endocrinologist both endorse daily self-testing. Almost 13% of the women did not self-test. These data are reported in Table 6.

<table>
<thead>
<tr>
<th>Self-monitoring of Blood Glucose</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does NOT test</td>
<td>7</td>
<td>12.7</td>
</tr>
<tr>
<td>Tests less than Daily</td>
<td>26</td>
<td>47.3</td>
</tr>
<tr>
<td>Tests Daily</td>
<td>22</td>
<td>40.0</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 6: Self Measurement of Blood Glucose

Descriptive Statistics for Diabetes Knowledge

The diabetes knowledge test comprised 10 items pulled from the 19 item nutritional quiz which was administered to each participant at enrollment (week 0) and also at weeks 36 and 52. The 10 items selected for analysis are directly from the University of Michigan Diabetes Knowledge Test (DKT) which has established reliability and validity. For analysis, 103 valid tests were submitted. Reasons for not completing the test included difficulty with establishing intravenous access that hindered ability to complete the survey. Table 7 presents the results by week and the aggregate score.
This group of women did fairly well on the test of diabetes knowledge. For the total 103 tests that were scored Mean=7.32 or slightly over 7 of 10 questions were answered correctly. No ideal score has been established by the authors of the DKT, however, research has demonstrated increased glycemic control with higher scores (Colleran, Starr, & Burge, 2003).

<table>
<thead>
<tr>
<th>Week</th>
<th>N</th>
<th>Lowest Score</th>
<th>Highest Score</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>55</td>
<td>3</td>
<td>10</td>
<td>6.91</td>
<td>1.93</td>
</tr>
<tr>
<td>36</td>
<td>26</td>
<td>4</td>
<td>10</td>
<td>7.77</td>
<td>1.79</td>
</tr>
<tr>
<td>52</td>
<td>22</td>
<td>3</td>
<td>10</td>
<td>7.82</td>
<td>1.62</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>3</td>
<td>10</td>
<td>7.32</td>
<td>1.87</td>
</tr>
</tbody>
</table>

Table 7: Descriptive Statistics of Diabetes Knowledge Scores

In Table 8 the items of the DKT are summarized, the percent of respondents getting that question correct is presented. The 10 test items are presented in descending order by percent. The most often missed item was a multiple choice question asking what the goal pre-meal glucose reading should be for a person with diabetes. The least missed item was a question asking if a diabetic diet is a healthy diet for most Americans. These data suggest that although there is a fair grasp of dietary information in this sample, there is a lack of knowledge regarding goals for blood sugar testing.
<table>
<thead>
<tr>
<th>Item Summary</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The diabetic diet is a healthy way for most Americans to eat</td>
<td>93</td>
</tr>
<tr>
<td>2. Lung problems are NOT associated with diabetes</td>
<td>89</td>
</tr>
<tr>
<td>3. For most people with diabetes, exercise will lower blood sugar</td>
<td>87</td>
</tr>
<tr>
<td>4. Eating low fat foods can lower your risk of heart disease</td>
<td>85</td>
</tr>
<tr>
<td>5. Having an infection can raise your blood sugar</td>
<td>84</td>
</tr>
<tr>
<td>6. A baked potato is a carbohydrate</td>
<td>77</td>
</tr>
<tr>
<td>7. Hemoglobin A1C reflects the average blood sugar over 6-10 weeks</td>
<td>74</td>
</tr>
<tr>
<td>8. Fruit juice will raise blood sugar</td>
<td>70</td>
</tr>
<tr>
<td>9. Among several foods, low fat milk contains the most fat</td>
<td>40</td>
</tr>
<tr>
<td>10. Someone with diabetes should have a blood sugar reading of 90-130 mg/dL pre meal</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 8: Items in the Diabetes Knowledge Test, Percent Correct (N=103)
Descriptive Statistics for Glycemic Control

In Table 9 the descriptive statistics for the measure of glycemic control, HgbA1C is presented. This table reflects all recorded readings for the group of women (N=110). Actual HgbA1C ranged from 5.8 to 13.1 with an average of 7.96%. For each result the actual HgbA1C was grouped by level of control as standardized by the American Diabetes Association. Those results at 7% or below met the goal criteria and were recoded “1” for good control. Level 2 is the cautionary zone at 7.1% to 9% Hgb A1C. Level 3 was assigned to those women with HgbA1C levels of 9.1% and above. These participants showed a wide range in HgbA1C, 5.8-13.1% and the average level was above the recommended standard, 7.96%. The group shows higher than recommended HgbA1C.

As most of the women in this research project were taking diabetes control medications, grouping the women by class of diabetes medication prescribed was done. Most (N=36) were on more than one diabetes medication. Table 10 displays baseline data by class and the HgbA1C at baseline.
<table>
<thead>
<tr>
<th>Actual A1C</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110</td>
<td>5.8</td>
<td>13.1</td>
<td>7.96</td>
<td>1.65</td>
</tr>
<tr>
<td>Translated A1C to</td>
<td>110</td>
<td>1</td>
<td>3</td>
<td>1.85</td>
<td>.780</td>
</tr>
<tr>
<td>ADA standards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Descriptive Statistics for HgbA1C, Actual Values and Standardized

<table>
<thead>
<tr>
<th>Primary Diabetes Medication</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biguanides</td>
<td>N=14</td>
<td>6.6</td>
<td>12.1</td>
<td>8.13</td>
<td>1.75</td>
</tr>
<tr>
<td>Sulfonylureas</td>
<td>N=28</td>
<td>6.4</td>
<td>12.1</td>
<td>8.63</td>
<td>1.80</td>
</tr>
<tr>
<td>Thiazolidinediones/TZD</td>
<td>N=4</td>
<td>6.2</td>
<td>10.0</td>
<td>7.77</td>
<td>1.74</td>
</tr>
<tr>
<td>Incretin Mimetics</td>
<td>N=3</td>
<td>6.6</td>
<td>9.5</td>
<td>8.10</td>
<td>1.45</td>
</tr>
<tr>
<td>Taking 2 Diabetes Medicines</td>
<td>N=36</td>
<td>6.2</td>
<td>12.1</td>
<td>8.33</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Table 10: Diabetic Medications and HgbA1C at Baseline
Summary: Descriptive Statistics

This section has presented the results of overall frequencies and averages of the group by demographic characteristics, medical history, diabetes knowledge, SMBG and glycemic control. The picture revealed is of a woman in the 6<sup>th</sup> decade of life, with some college education, with fairly high diabetes knowledge, managing 2 or more medical conditions in addition to Type 2 diabetes. The average woman in this research also does perform SMBG, but not everyday. The average participant has less than ideal glycemic control while taking one or more diabetes control medications. The next section will address the illness representation of this group of women.

Research Question 1: Illness Representation, Total Sample

The IPQ-R measured the cognitive and emotional representations of diabetes in this group of mid-life women. Once the results of the individual item scores were totaled according to the directions for scoring the questionnaire, the scales were computed (Moss-Morris et al., 2002). Lower scores indicate a belief of short illness duration with a predictable course. Lower scores also indicate fewer consequences, a low sense of control over the disease and an overall confusion and puzzlement about diabetes. Lower scores also reflect low emotional distress. Conversely, higher scores indicate a belief in longer diabetes duration, higher sense of consequences, stronger control and cure or treatment beliefs as well as greater understanding of diabetes. High scores also reflect higher emotional distress. Table 11 is a summary of IPQ-R attributes and the meanings of the scores.

The means and standard deviations of the IPQ subscales for the total sample (N=42) are presented in Table 12. The first section of the IPQ is the Identity subscale.
The identity list measured symptoms reported as being related to Type 2 diabetes. Higher scores on this scale reflect more somatic symptoms linked to diabetes. In this group of women, the most frequently reported symptom was fatigue. 67% of the women linked this symptom to Type 2 diabetes. Only 8% of women associated dizziness and weight loss with diabetes. As Type 2 diabetes is a relatively symptom less condition, this result is congruent with accurate identity in the group.

The second section of the IPQ-R contains 38 items designed to measure other constructs that make up illness representation (Moss-Morris et al., 2002). The subscales are timeline-acute and chronic, timeline-cyclical, consequences, personal control, treatment control, illness coherence, and emotional representation. The timeline-acute and chronic subscale measured the beliefs about the duration of diabetes whereas timeline-cyclical reflects beliefs about the variability and unpredictability of the disease.

The consequences subscale measured beliefs about the short and long term consequences of diabetes. The perceived ability to control diabetes or manage symptoms of diabetes is measured by the personal control subscale. The treatment control subscale measured the beliefs of the individual about the efficacy of medical treatment in controlling diabetes. The illness coherence subscale measured the understanding or confusion regarding diabetes illness representation. Emotional distress of the individual about diabetes was measured by the emotional representation subscale.

The last section of the IPQ-R is the causation list consisting of 18 items scored 1-5 Likert scale (strongly disagree to strongly agree). Respondents were asked to rate their level of agreement with a variety of potential causes for Type 2 diabetes. Some missed this page of the survey so missing items are apparent in these findings. The cause items
are not summed but will be presented by causal belief. *Higher scores* reflect stronger beliefs in that item as important in the development of Type 2 diabetes. Table 13 presents the summary statistics for the total group (N=38). These data reveal a strong belief in the sample that “diet or eating habits” are to blame for Type 2 diabetes (Mean=4.03), followed by “heredity” (Mean=3.97) and “my own behavior” (Mean=3.58). Low scores were found in items such as “chance or bad luck”, “smoking” and “germ or virus” as causative factors in Type 2 diabetes.
<table>
<thead>
<tr>
<th>Illness Representation: Theoretical Construct</th>
<th>Illness Perception Questionnaire-Revised Items</th>
<th>What the scores mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identity:</strong></td>
<td>Number of symptoms the respondent associates with the diagnosis of Type 2 diabetes. 14 items such as pain, nausea, dizziness, fatigue. Numbers of complaints are totaled.</td>
<td>HIGH scores mean more somatic complaints due to diabetes. MORE interference in life and functioning because of the disease. LOW score, less symptomology associated with diabetes</td>
</tr>
<tr>
<td><strong>Timeline:</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My diabetes will last a long time.”</td>
<td>HIGH scores mean more belief in the chronicity, long term effects of diabetes. LOW scores more belief in diabetes as a short term problem</td>
</tr>
<tr>
<td><strong>Timeline:</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My symptoms of diabetes come and go”</td>
<td>HIGH scores mean belief in a disease that comes and goes, a periodic disruption. LOW scores mean belief in the predictability of diabetes</td>
</tr>
<tr>
<td><strong>Consequences:</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My diabetes has major consequences on my life” and “Other people look at me differently because of diabetes”</td>
<td>HIGH scores mean considerable personal or social impact on life due to diabetes. LOW scores, few consequences</td>
</tr>
<tr>
<td><strong>Control: Treatment</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My treatment will be effective in controlling my diabetes.”</td>
<td>HIGH scores mean high belief in the ability of a prescribed plan to control diabetes (medical treatment). LOW scores, low belief in medical treatment</td>
</tr>
<tr>
<td><strong>Control: Personal</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “I have the power to influence my diabetes.”</td>
<td>HIGH scores mean high belief in my actions being able to control diabetes. LOW scores, less belief in personal ability to control diabetes</td>
</tr>
<tr>
<td><strong>Illness Coherence</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My diabetes is a mystery to me”</td>
<td>HIGH scores mean an overall understanding about diabetes. LOW scores, confusion about diabetes</td>
</tr>
<tr>
<td><strong>Emotional Representation</strong></td>
<td>Likert Scale: Strongly disagree to strongly agree with statements such as “My diabetes makes me feel angry”</td>
<td>HIGH scores mean higher distress about having diabetes. LOW scores, few consequences</td>
</tr>
<tr>
<td><strong>Cause</strong></td>
<td>Likert Scale: Strongly disagree to agree with 18 causative agents of diabetes: Heredity, germ or virus</td>
<td>Each item is analyzed separately</td>
</tr>
</tbody>
</table>

Table 11: Illness Representation Construct, Item Description and Meaning of Scores
<table>
<thead>
<tr>
<th>Subscale</th>
<th>Possible Range of Scores</th>
<th>Observed Range of Scores</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Control 6 Items</td>
<td>6-30</td>
<td>20-30</td>
<td>26.17</td>
<td>2.66</td>
</tr>
<tr>
<td>Treatment Control 5 Items</td>
<td>5-25</td>
<td>7-25</td>
<td>19.63</td>
<td>2.94</td>
</tr>
<tr>
<td>Timeline Acute/Chronic 6 items</td>
<td>6-30</td>
<td>12-28</td>
<td>22.71</td>
<td>3.66</td>
</tr>
<tr>
<td>Timeline Cyclical 4 Items</td>
<td>4-20</td>
<td>4-20</td>
<td>11.85</td>
<td>3.53</td>
</tr>
<tr>
<td>Consequences 6 items</td>
<td>6-30</td>
<td>14-30</td>
<td>22.55</td>
<td>3.26</td>
</tr>
<tr>
<td>Emotional Representation 6 Items</td>
<td>6-30</td>
<td>7-28</td>
<td>18.57</td>
<td>4.66</td>
</tr>
<tr>
<td>Illness Coherence 5 Items</td>
<td>5-25</td>
<td>9-25</td>
<td>16.87</td>
<td>4.26</td>
</tr>
<tr>
<td>Identity Scale 14 items Total</td>
<td>14-28</td>
<td>14-27</td>
<td>17.66</td>
<td>3.10</td>
</tr>
</tbody>
</table>

Table 12: Descriptive Statistics for Scores of the IPQ-R subscales (N=42)
<table>
<thead>
<tr>
<th></th>
<th>Possible Range of Scores</th>
<th>Observed Range of Scores</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Diet or eating habits</td>
<td>1-5</td>
<td>1-5</td>
<td>4.03</td>
<td>1.09</td>
</tr>
<tr>
<td>2. Heredity</td>
<td>1-5</td>
<td>1-5</td>
<td>3.97</td>
<td>1.22</td>
</tr>
<tr>
<td>3. My own behavior</td>
<td>1-5</td>
<td>1-5</td>
<td>3.58</td>
<td>1.17</td>
</tr>
<tr>
<td>4. Aging</td>
<td>1-5</td>
<td>1-5</td>
<td>3.24</td>
<td>1.28</td>
</tr>
<tr>
<td>5. Stress or worry</td>
<td>1-5</td>
<td>1-5</td>
<td>3.09</td>
<td>1.29</td>
</tr>
<tr>
<td>6. Family problems or worries</td>
<td>1-5</td>
<td>1-5</td>
<td>2.79</td>
<td>1.43</td>
</tr>
<tr>
<td>7. My emotional state, feeling down, lonely, anxious, empty</td>
<td>1-5</td>
<td>1-5</td>
<td>2.79</td>
<td>1.30</td>
</tr>
<tr>
<td>8. Overwork</td>
<td>1-5</td>
<td>1-5</td>
<td>2.74</td>
<td>1.35</td>
</tr>
<tr>
<td>9. Altered immunity</td>
<td>1-5</td>
<td>1-5</td>
<td>2.50</td>
<td>1.16</td>
</tr>
<tr>
<td>10. My personality</td>
<td>1-5</td>
<td>1-5</td>
<td>2.38</td>
<td>1.07</td>
</tr>
<tr>
<td>11. Poor medical care in past</td>
<td>1-5</td>
<td>1-4</td>
<td>2.24</td>
<td>1.13</td>
</tr>
<tr>
<td>12. My mental attitude</td>
<td>1-5</td>
<td>1-5</td>
<td>2.21</td>
<td>1.21</td>
</tr>
<tr>
<td>13. Alcohol</td>
<td>1-5</td>
<td>1-5</td>
<td>2.15</td>
<td>1.06</td>
</tr>
<tr>
<td>14. Accident or injury</td>
<td>1-5</td>
<td>1-5</td>
<td>2.06</td>
<td>1.15</td>
</tr>
<tr>
<td>15. Pollution</td>
<td>1-5</td>
<td>1-5</td>
<td>1.94</td>
<td>.88</td>
</tr>
<tr>
<td>16. Smoking</td>
<td>1-5</td>
<td>1-5</td>
<td>1.91</td>
<td>1.01</td>
</tr>
<tr>
<td>17. Germ or virus</td>
<td>1-5</td>
<td>1-4</td>
<td>1.85</td>
<td>.79</td>
</tr>
<tr>
<td>18. Chance or bad luck</td>
<td>1-5</td>
<td>1-3</td>
<td>1.79</td>
<td>.80</td>
</tr>
</tbody>
</table>

Table 13: Descriptive Statistics for Scores of the IPQ-R Cause Scale (N=38)
Relationships among the sub-scales of the IPQ-R

To investigate relationships between and among the IPQ-R scores in the total sample, a correlation matrix was produced (see Table 14). Significant correlation was found between general and personal control ($r = .341, p < .05$). Personal control was positively correlated to cure/control ($r = .435, p < .01$). Also, timeline cyclical was negatively correlated to illness coherence ($r = -.372, p < .05$). In this sample, participants who viewed their diabetes with high consequences also had a higher sense of ability to control the disease. In addition, those who viewed the disease as cyclical (as opposed to chronic) had a lower sense of illness coherence, indicating confusion about diabetes.
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Timeline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute/Chronic</td>
<td>1</td>
<td>-.210</td>
<td>.074</td>
<td>.243</td>
<td>-.094</td>
<td>.231</td>
<td>-.101</td>
<td>-.032</td>
</tr>
<tr>
<td>2. Timeline Cyclical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-.005</td>
<td>-.178</td>
<td>.054</td>
<td>-.372(*)</td>
<td>.305</td>
<td>.260</td>
<td></td>
</tr>
<tr>
<td>3. General</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>consequences</td>
<td>1</td>
<td>.341(*)</td>
<td>.011</td>
<td>.119</td>
<td>.283</td>
<td>.193</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Personal Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>.435(**)</td>
<td>.169</td>
<td>.044</td>
<td>-.079</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Cure Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>.018</td>
<td>-.119</td>
<td>-.126</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Illness Coherence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>.081</td>
<td>.035</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Emotional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Representation</td>
<td>1</td>
<td></td>
<td>.318</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Identity Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 14: Correlation Matrix of IPQ-R Subscales N=42
Summary: Research Question 1

This section has examined the illness representation of this group of women with Type 2 diabetes. Most of the subscales showed a lot of variation in the scores with Standard Deviation > 3 for 6 of the 9 domains. The most variation in these data was seen in the construct of emotional representation (Mean=18, Standard Deviation, 4.6). On average, the typical woman in this group possesses a strong belief in the chronic nature and consequences of Type 2 diabetes and had a fairly high sense of control of the disease.

Research Question 2: Factors influencing illness representation, diabetes self-management practices

Hypothesis 2.1 and 2.2: Illness Representation by Education and Ethnicity

To examine for differences based on SES, the proxy of educational level was recoded to reflect 2 levels instead of the original 6. The two categories were created by splitting at the median value. Low education included participants who reported some college or less. High education was a 2 year college degree or more. Table 15 shows the only subscales with differences in group based on education. Acute/chronic beliefs and identity showed significant differences. The women with more formal education were more likely to have high beliefs in the chronicity of diabetes; this is a more accurate view. Emotional representation subscale approached significance and is included here. Higher emotional distress was found in the lower educated group.

Group means were also examined based on ethnicity. Categories were recoded into non-White or White. Only the sub-scale of Cure/Control showed significant
differences between groups, shown on Table 16. The smaller group of non-White participants had a higher sense of cure/control.

_H2.3:_ *Women with low diabetes knowledge will have a different illness representation than women with high knowledge.*

This group of women presented with fairly high and consistent diabetes knowledge as measured by the DKT (M=7.32) or slightly over 7 of 10 questions were answered correctly. No significant differences were seen when analyzing illness representation by DKT score. There were 5 participants who scored less than 50% on this test. Those participants were examined for differences in IPQ-R scores, no significant differences were found in the low knowledge group when compared to the high knowledge group.

_H2.4:_ *Women who report several co-morbidities will have a different illness representation than those women who report none or one.*

Once again, a one way ANOVA analysis was conducted with all sub-scales of the IPQ-R based on number of co-morbidities reported. There were three groups in this analysis, diabetes plus one co-morbidity, diabetes plus two co-morbidities and diabetes plus three or more co-morbidities. As before, the sub-scale: cure/control showed significant differences, see Table 17. Those women who reported having other disorders in addition to Type 2 diabetes were more likely to also have a lower sense of cure/control. Those women reporting Type 2 diabetes plus 3 or more co-morbidities had the lowest sense of cure/control. Figure 3 represents these data.
### Table 15: IPQ-R subscales by Low/High EDUC ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeline</strong>&lt;br&gt;Acute/Chronic *&lt;br&gt;Low/High EDUC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>181.68</td>
<td>1</td>
<td>181.68</td>
<td>19.79</td>
<td>.005</td>
</tr>
<tr>
<td>Within Groups</td>
<td>367.21</td>
<td>41</td>
<td>9.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>548.89</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Emotional Representation</strong>&lt;br&gt;Low/High EDUC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>76.65</td>
<td>1</td>
<td>76.65</td>
<td>3.76</td>
<td>.059</td>
</tr>
<tr>
<td>Within Groups</td>
<td>793.25</td>
<td>41</td>
<td>20.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>869.91</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Identity Scale Total</strong>&lt;br&gt;Low/High EDUC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>52.67</td>
<td>1</td>
<td>52.67</td>
<td>6.24</td>
<td>.017</td>
</tr>
<tr>
<td>Within Groups</td>
<td>303.87</td>
<td>41</td>
<td>8.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>356.55</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 16: IPQ-R subscales by non-White/ White ETHNICITY ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cure Control</strong>&lt;br&gt;non-White/White ETHNICITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>64.03</td>
<td>1</td>
<td>64.03</td>
<td>8.78</td>
<td>.005</td>
</tr>
<tr>
<td>Within Groups</td>
<td>291.49</td>
<td>41</td>
<td>7.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>355.53</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15: IPQ-R subscales by Low/High EDUC ANOVA

Table 16: IPQ-R subscales by non-White/ White ETHNICITY ANOVA
Figure 3: Means plot of CURE/CONTROL by Number of Co-Morbidities

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>71.52</td>
<td>2</td>
<td>35.76</td>
<td>4.91</td>
<td>.013</td>
</tr>
<tr>
<td>Within Groups</td>
<td>284.01</td>
<td>39</td>
<td>7.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>355.53</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 17: CURE/CONTROL BY Number of Co-Morbidities ANOVA
H2.5: Those women who report anti-depressant medication will have a different illness representation than those who do not.

This hypothesis was not supported. Of the 42 women with valid IPQ-R data, 19 reported use of anti-depressant medication. Differences between the groups were small and non-significant.

Research Question 3: What diabetes self-management practices are associated with illness representation?

To look for relationships among the variables of illness representation and SMBG as well as the outcome variable of interest, HgbA1C a correlation matrix was constructed (see Table 18). A significant positive relationship between SMBG and emotional representation was found (r = .482, p < .001). This reflects that as scores on items reflecting emotional representation rose, (higher distress) there was a greater chance that the woman will test daily. Also, a significant negative relationship was found between HgbA1C level and SMBG (r = -.387, p < .001). This finding reflects that women who test are more likely to be in the lower (more desirable) HgbA1C group. Also from this table, general consequence and personal control are correlated as noted before.
### Table 18: Correlation Matrix of Self-monitoring of Blood Glucose, Illness Representation Sub-scales and A1C levels

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Self Measurement of Blood Glucose</td>
<td></td>
<td>1</td>
<td>.185</td>
<td>.188</td>
<td>.209</td>
<td>.084</td>
<td>.178</td>
<td>.482**</td>
<td>.038</td>
</tr>
<tr>
<td>2. Timeline Cyclical</td>
<td></td>
<td>1</td>
<td>-.005</td>
<td>-.178</td>
<td>.054</td>
<td>-.372(*)</td>
<td>.305</td>
<td>.260</td>
<td>.257</td>
</tr>
<tr>
<td>3. General consequences</td>
<td></td>
<td>1</td>
<td>.341(*)</td>
<td>.011</td>
<td>.119</td>
<td>.283</td>
<td>.193</td>
<td>.208</td>
<td></td>
</tr>
<tr>
<td>4. Personal Control</td>
<td></td>
<td>1</td>
<td>.435(**)</td>
<td>.169</td>
<td>.044</td>
<td>-.079</td>
<td>-.168</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Cure Control</td>
<td></td>
<td>1</td>
<td>.018</td>
<td>-.119</td>
<td>-.126</td>
<td>-.292</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Illness Coherence</td>
<td></td>
<td>1</td>
<td>.081</td>
<td>.035</td>
<td>.056</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Emotional Representation</td>
<td></td>
<td>1</td>
<td>.318</td>
<td>-.036</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Identity Scale Total</td>
<td></td>
<td>1</td>
<td>.125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Translated A1C to ADA standards</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
Research Question 4: What levels of glycemic control are associated with diabetes self-management?

One way ANOVA analysis was conducted with all sub-scales of the IPQ-R based on level of glycemic control. Only one sub-scale cure/control showed significant differences. Those women with a higher sense of cure/control were more likely to be in the better glycemic control group, that is, HgbA1C < 7%. Figure 4 represents these data.

To look specifically at the practice of SMBG and the effect this practice may have had on glycemic control an ANOVA analysis was carried out (Table 19). Only baseline data were used for this analysis as this was the most conservative approach. The results approached significant differences between groups (p=.055). Figure 5 is the means plot depicting these data. The difference between the smaller (N=7) does not perform SMBG group, and the test daily group HgbA1C is 1.57%. The larger, performs daily group (N=22) exhibited better control at baseline. A reduction of 1.57% HgbA1C is very clinically important and translates to fewer life threatening diabetes complications.

Table 20 is the regression model summary. As revealed by $R^2 = .07$ or around 7% of the variance in HgbA1C is explained by the model. This suggests other variables are also contributing to the variance. In Table 21 however the coefficients reveal that for every level increase in SMBG behavior there is a corresponding .67% decrease in HgbA1C. So as the coping procedure of SMBG is adopted on a daily basis, better glycemic control is reported in the group.
<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.786</td>
<td>1</td>
<td>10.786</td>
<td>3.838</td>
<td>.055(a)</td>
</tr>
<tr>
<td>Residual</td>
<td>148.955</td>
<td>53</td>
<td>2.810</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>159.741</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Predictors: (Constant), Self Measurement of Blood Glucose  
b Dependent Variable: Actual A1C  

Table 19: ANOVA of Actual HgbA1C by SMBG (N=55)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.260(a)</td>
<td>.068</td>
<td>.050</td>
<td>1.6764</td>
</tr>
</tbody>
</table>

a Predictors: (Constant), Self Measurement of Blood Glucose  

Table 20: Regression Model Summary (N=55)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>9.708</td>
</tr>
<tr>
<td>Self Measurement of Blood Glucose</td>
<td>-.658</td>
</tr>
</tbody>
</table>

Table 21: Multiple Regression Coefficients for HgbA1C with SMBG (N=55)
Figure 4: Means plot of CURE/CONTROL by HgbA1C Level

Figure 5: Means Plot of SMBG by Mean of Actual HgbA1C
Summary: Results

This chapter has begun to fill in the picture of life with Type 2 diabetes for this group of women. Multifaceted relationships have been revealed in these data. Two of the constructs in illness representation, cure/control and emotional representation, were found to be predictive of better glycemic control. Higher number of co-morbidities predicted less glycemic control. Daily SMBG practice is predictive of better glycemic control. The next chapter will expand on the findings of the IRT2DM.
CHAPTER 5

DISCUSSION

The purpose of this study was to explore the relationship(s) between sociodemographic attributes, illness representations, disease knowledge, diabetes self-management practices and glycemic control in a group of women with Type 2 diabetes. This purpose was realized. This chapter begins with an overview of the characteristics of the participants, and then addresses the research questions and the relationship of these findings to the current literature. The utility of the Leventhal model of illness representation (2003) in this nursing research will be discussed. Implications and recommendations for practice, limitations of the IRT2DM and future directions for research will also be presented.

Sociocultural Characteristics, Medical History and Diabetes Knowledge

The demographic attributes and medical history of a group of mid-life women with Type 2 diabetes revealed challenges to diabetes self-management. The participants in the IRT2DM had long lived with Type 2 diabetes, most over 5 years, and also contend with other serious health conditions. An overwhelming number of the women (75%) reported managing diabetes and at least 2 other conditions. A quarter of the group
reported taking anti-depressant drugs. Interestingly, none of the participants reported depression as a diagnosis, although this was not directly asked. This perhaps reflects the persistent stigma associated with the diagnosis. This finding is in keeping with other research regarding the prominence of depression in people with diabetes. From a sample of 376 patients with diabetes, nearly 32% screened positive for clinical or sub-clinical depression (Hermanns, Kulzer, Krichbaum, Kubiak, & Haak, 2006). Consistently, depression is linked with co-morbidities and the worsening of diabetes outcomes (Astle, 2007; Sacco et al., 2005; Surwit, van Tilburg, Parekh, Lane, & Feinglos, 2005). No statistically significant difference in glycemic control based on anti-depressant medication use was found in this research. However, when grouped on the outcome variable of HgbA1C, the women taking these medications had the highest average, 8.5%. What effect the diagnosis and treatment for depression has on illness representation and diabetes self-management is not answered in this study but will require further research. A physiological interaction effect may be occurring in women taking this class of medication.

**Illness Representation**

A self-regulatory approach to diabetes self-management would suggest that a more accurate and developed illness representation will predict greater self-care competence. The findings of this research regarding the constructs of illness representation are detailed further with discussion.

**Identity**

The construct of identity revealed the number of somatic complaints attributable to diabetes by the group. Most often cited was fatigue. A distant second to fatigue was
upset stomach. Many oral anti-diabetic agents have gastrointestinal effects which may explain this finding. These data reveal a group of women who on average experience only 3 or 4 symptoms that are perceived to be connected with diabetes. This is an accurate identity as Type 2 diabetes is a disease that produces few symptoms. Unlike Type 1 diabetes, rarely do symptomatic episodes of hypoglycemia occur in Type 2 diabetes. This lack of symptomology presents a challenge as symptom relief is a strong motivator for treatment adherence and disease self-management behavior.

Chronic pain has been associated with poor diabetes self-management (Khoo & Perera, 2005). Present pain relief takes priority over other self-management behavior that may benefit health in the future. Research in persons with asthma, which can display occasional dramatic symptoms, has shown that treatment adherence is linked to the number and severity of symptoms (Halm, Mora, & Leventhal, 2006). In other words, a lack of symptoms meant no asthma and adherence to treatment went down. Many persons with Type 2 diabetes are diagnosed after a significant cardiovascular event which draws focus away from the disease that contributed to the cardiac problem (Wexler et al., 2006). Nursing professionals must assist persons with diabetes to make connections between diagnoses. Nurses must recognize diabetes as a cardio-metabolic disorder and educate clients with the disease of this reality.

**Timeline / Consequences**

Most IRT2DM participants understood that Type 2 diabetes is a chronic disease, not cyclical and that diabetes carries serious consequences. In this group, scores on personal control and general consequences of Type 2 diabetes were correlated. Those who felt a high sense of consequences from diabetes also exhibited a sense of control.
over the disease. Here again the importance of educating persons with Type 2 diabetes is seen. Realization of consequences may motivate more personal control. Higher beliefs in chronicity of diabetes were found in the higher educated group. These findings are on target with the reality of Type 2 diabetes. These women are well aware that diabetes can harm them. A straightforward question, “My diabetes is a serious condition” resulted in a Mean=4.38, indicating strong agreement.

*Cure/Control*

The data for this construct proved to be most interesting in the IRT2DM. On the item, “There is little I can do to control my diabetes” there was strong disagreement Mean=4.17 (reverse scored). Here is a belief in individual action (doing) that will translate to control of Type 2 diabetes. Yet, evidence of *effective* diabetes self-management is lacking in this group of women. In this construct were seen differences by ethnicity, with the smaller non-White group indicating more sense of control than the White group. This may portend a greater sense of empowerment in the non-White group.

It is vital that clinicians assess beliefs in treatment control in persons with Type 2 diabetes. In research with a managed care population, ethnicity does not predict differences in care outcomes (Brown, et al, 2005). As persons are removed from access to care, research demonstrates greater differences between groups based on ethnicity (Fitzgerald, et al., 2000). This finding may only reveal differences in persons who are willing to participate in research and are not representative of the general population of people with Type 2 diabetes.
Emotional Representation

The measurement of this construct resulted in the most variability in scores within the group. For the item, “I get depressed when I think about my diabetes” scores were definitely neutral (Mean=3.07), neither agree nor disagree. The group did not report strong negative feelings related to Type 2 diabetes. Yet, higher scores on emotional distress predicted SMBG, an important diabetes self-management procedure. This lends support to the motivating power of worry or concern about a diagnosis. Other research has found that higher distress predicted greater adherence to medical treatment (Jopson & Moss-Morris, 2003).

Illness Coherence

The items relating to this construct, attempted to sum up an overall sense of understanding about having diabetes. An item such as, “I have a clear understanding about my diabetes” yielded another neutral average (M=3.5). Another paradox is revealed in that these women report being in “control” of their diabetes, yet, there is room for improved understanding of the disease despite the diabetes knowledge test scores.

Diabetes Knowledge

The diabetes knowledge exhibited here was surprisingly high. Yet cognition did not translate to effective diabetes management overall. Lack of knowledge of goals for glucose testing was seen in the group. This emphasizes the importance of communicating specific goals with detailed parameters negotiated between the patient and the health care provider. Specificity in goals may enhance diabetes self-management.
The women who met inclusion criteria may not be representative of the general population of women with Type 2 diabetes. Many of the participants had been living with the disease for over 5 years. Research among newly diagnosed persons with Type 2 diabetes could be quite different. The need for diabetes specific education is not diminished by the findings of this research. Organized instruction and support as life skills are adopted can translate to better control and longer life for people with Type 2 diabetes.

*Diabetes Self-Management*

The proxy used to measure effective self-management was daily self-monitoring of blood glucose. These data revealed that women who self-tested daily carried a higher sense of cure/control as measured by the items of the IPQ-R. Most importantly, those women who tested daily were more likely to be in better glycemic control as measured by HgbA1C. This finding agrees with a recent meta-analysis (Sarol, Nicodemus, Tan, & Grava, 2005). The demographic profile of women who tested versus those who did not was not different. Education, ethnicity was not predictive of self-testing versus those who did not test daily. This daily activity: turning on the meter, inserting the test strip, a slightly painful prick with a needle, then a ritual of applying a drop of blood all in order to get a number reflecting glucose level status, perhaps influences subsequent dietary intake and activity of the individual. The subsequent life-style, dietary, and adherence choices made by the individual may in part be set by the number that is revealed when self-testing is performed.

Most of the women had a home glucose meter, yet, in line with much larger national surveys, only 40% of the women in this research performed daily SMBG
(Saaddine et al., 2006). These data reveal a gap between cognitive “know how” and the consistent performance of diabetes self-management. The concept of illness representation was investigated in the IRT2DM to explain this gap. Further research to identify and remove the barriers to self-testing must be done. The process of SMBG could act as a “symptom” for the woman with Type 2 diabetes, thus raising the level of identity in those who test daily. By acknowledging the presence of a largely symptom less disorder, women with the disease can transfer knowledge into action that will protect and lengthen life.

*Utility of the Leventhal Model*

This research adds to the body of knowledge regarding a self-regulatory approach to understanding health behavior. This multivariate approach revealed the complexities of life with Type 2 diabetes and also focused on areas for intervention. As medical treatment and compounding diagnoses increased, beliefs in cure/control went down. It is essential that the person with diabetes understand the importance of treatment and the interconnectedness of these diagnoses. By reinforcing the importance of a foundation of diabetes care practices, other diseases become easier to control and less burdensome. The important influence of medical history variables was shown by the IRT2DM.

Components of illness representation that predicted coping procedures (SMBG) were logical and again point to the need for intervention. Greater emotional distress about diabetes was predictive of SMBG. This finding points to the need to emphasize the seriousness of the diagnosis and importance of daily blood testing. This coping procedure also was predictive of better glycemic control.
The CSM is a useful framework for organizing a complex health condition and
the needs of a vulnerable population, mid-life women. By guiding the selection of
variables the model has explicated some of the daily struggles and needs of this group.
The CSM can now be used to design intervention research that will assist women toward
better glycemic control.

Implications and Recommendations for Practice

The conundrum for clinicians is how to assist the person with Type 2 diabetes to
transfer “know how” into the daily routines of diabetes self-management. Several
suggestions based on findings of the IRT2DM include:

1. Use a tool, such as the IPQ-R or the even shorter version now available as part of
   the intake assessment for all persons with diabetes. Score and use the tool in the
   first interview. Consider a short diabetes knowledge quiz. Correct wrong
   information.

2. Inquire about formal diabetes education. Strongly recommend and have the
   referral information available to a certified diabetes education in the community.
   Medicare and other insurers will reimburse for diabetes education. If the person
   has no insurance, the ADA often has very low or no cost educational services
   available. Diabetes self-management programs are underutilized for reasons
   relating to access as well as reimbursement issues (Fisher et al., 2007). The
   efficacy and cost effectiveness of diabetes education has been demonstrated yet
   this empowering treatment is still often withheld or overlooked.

3. Create or adapt an “all inclusive” check list for use with all subsequent visits.
   Tell the patient to bring their meter or a log of their readings to each visit.
Review these readings with the patient. Such a review should not be punitive but as a way of emphasizing the importance of a daily routine of self-testing. Tell the patient to rotate times of testing so that in a week there is a representation of fasting, pre and post meal, and bedtime.

4. Implement all clinical standards for screening and preventive care. Inform the patient as to the reasons for the need for testing.

5. Nurses involved in the care of persons with diabetes should inquire about blood glucose monitoring and assist in goal setting. Nurses can be instrumental in teaching individuals and in providing the support for acquiring competence in diabetes self-management.

Limitations of the Study

The IRT2DM was a sub-study of the Woman’s Diabetes Study; a 52 week randomized clinical trial. Small sample size and attrition within the larger study and limits the generalizability of these findings. Women who agree to participate in such a prolonged research project may not be representative of the general population of women with Type 2 diabetes.

Although the directionality of effects in this study is in keeping with self-regulation theory, the cross-sectional design does not allow for causal inference to be made. This study only presented a static snapshot of possible relationships between variables. Larger studies are necessary to firmly establish relationships between variables.

The use of only one measure for diabetes self-management is a limitation of the research. Diabetes is a complex, multi-faceted disease and the management of it is also
complex. However, the importance of self-testing for blood glucose was supported in this research.

Future Directions for Research

Research interest and funding has followed the upward trend of diabetes, yet little is known about the usefulness of technology to assist in control of this chronic disease. The integration of available glucose meters into diabetes self-management offers hope for arresting the complications associated with the disease. Technological advances in glucometer features present a wide variety of information storage and display capabilities. Standard glucometers offer memory of results and a few offer advanced features such as data trending, sorting results to specific times and the ability for data entry of food, exercise, medication and other self care activities. How this recent technology may assist the person with Type 2 diabetic will require further investigation.

The IRT2DM lays groundwork for further more translational research to enhance the health of people with Type 2 diabetes. Larger, more diverse populations will be sought for study. Combining enabling knowledge and disease control through technology assisted channels will allow more women to reap the benefits of glycemic control.

Summary

A diagnosis of diabetes carries with it a considerable health threat. Effective diabetes self-management with glycemic control can buffer the impact and lessen the chance of acute and chronic complications. Encouraging individuals with Type 2 diabetes to become informed and to use tools for daily glucose monitoring is imperative. Leventhal’s self-regulation theory provided a framework to further understanding of the
factors which influence decisions relating to diabetes self-management. Determinants of glycemic control in mid-life women have been explicated. An understanding of how psychosocial influences mitigate illness representation and the self-regulatory practice of diabetes self-management has been gained from this research. Support for comprehensive assessment and a holistic approach to diabetes care has been gained. In a recent editorial, Leventhal calls for an alliance between health behavior theory and evidence based practice. By focusing on the predictors of effective self-management, practitioners can assist clients with burdensome disease and improve clinical outcomes (Leventhal, Musumeci, & Contrada, 2007).
APPENDIX A

SCREENING DOCUMENT
Screening Questionnaire, PART I

This form contains information that will be used to determine your eligibility to participate in the Women’s Diabetes Study. Please PRINT all information. Shaded areas will be filled in by members of the study staff.

Demographic Data

GENDER:  
☐ Male  ☐ Female

HIGHEST LEVEL OF EDUCATION COMPLETED:  
☐ Did not complete high school  ☐ 4-year college degree  
☐ High school diploma or GED  ☐ Some graduate school  
☐ Some college  ☐ Master’s degree  
☐ 2-year college degree  ☐ Doctoral degree

ETHNICITY:  
☐ Hispanic or Latino  
☐ Not Hispanic or Latino

RACE:  
☐ Black or African American  
☐ White  
☐ Native Hawaiian/Pacific Islander  
☐ Asian  
☐ American Indian or Alaskan Native  
☐ Other: _______________

DATE OF BIRTH:  
Subjects will not be excluded from study participation due to race

HOW DID YOU HEAR ABOUT THIS STUDY?

________________________________________________________________

Study Participation Information

1. Did you voluntarily sign an informed consent form prior to participation in this study?  
☐ NO  ☐ YES

DATE SIGNED

2. Do you plan to remain in this area for at least 1 year?  
☐ NO  ☐ YES

3. Are you willing to fast for at least 12 hours before and refrain from taking your diabetes medications on the morning of your study visits? (During fasting you may consume only water.)  
☐ NO  ☐ YES
### Study Participation Information, continued

4. Are you willing to have your body composition assessed using a scale (weight), stadiometer (height), flexible measuring tape (waist and hip circumferences), and abdominal caliper (sagittal diameter) at five study visits throughout the study?  

   - [ ] NO  
   - [ ] YES

5. Are you willing to have your body composition measured by bioelectric impedance analysis (BIA) at five study visits?  

   - [ ] NO  
   - [ ] YES

6. Are you willing to have your body composition assessed using a whole-body DEXA scan at five visits throughout the study? *(This part of the study is optional.)*  

   - [ ] NO  
   - [ ] YES

7. For each of five oral glucose tolerance tests, are you willing to consume a glucose (sugar)-containing beverage prior to giving several blood samples?  

   - [ ] NO  
   - [ ] YES

8. Are you willing to have blood samples drawn from your vein at study visits?  

   - [ ] NO  
   - [ ] YES

9. Are you willing to record your food intake and activities for three days prior to each of seven study visits (a total of 21 days throughout the study)?  

   - [ ] NO  
   - [ ] YES

10. Are you willing to complete a 15-minute telephone interview concerning your food intake and activities over the previous day up to 12 times during the study?  

    - [ ] NO  
    - [ ] YES

11. Are you willing to take 8 capsules per day of a  

    - [ ] NO  
    - [ ] YES
supplement containing either conjugated linoleic acid (CLA) oil or safflower oil for one year?

12. Are you willing to keep a daily log of supplement capsules you consume?  
☐ NO  ☐ YES

13. Are you willing to keep the study staff updated of any changes in your health and medications/supplements during the study?  
☐ NO  ☐ YES

14. Are you willing to inform your usual doctor that treats you for diabetes of your study participation?  
☐ NO  ☐ YES

15. Are you willing to have your nutrition knowledge and beliefs about diabetes assessed three times during the study?  
☐ NO  ☐ YES

Health Information

1. Are you post-menopausal?  
☐ NO  ☐ YES  
If yes, please list approximate date of your last menstrual period.  

2. Do you currently, or have you ever, used hormone replacement therapy?  
If yes, please list approximate dates.

START DATE  
☐ NO  ☐ YES  
STOP DATE
3. Do you have diabetes?  
   □ NO □ YES  
   If yes, please list approximate date of diagnosis.  
   DATE

4. Are you currently under medical supervision for any type of cancer?  
   □ NO □ YES

5. Do you have any known food allergies or intolerances?  
   □ NO □ YES  
   If yes, please list:
   ________________________________________________________________
   ________________________________________________________________

6. Do you have any drug allergies?  
   □ NO □ YES  
   If yes, please list:
   ________________________________________________________________
   ________________________________________________________________

7. Have you had an infection (requiring antibiotics) in the last 3 months?  
   □ NO □ YES

8. In the last year, have you ever drank or used drugs more than you meant to?  
   □ NO □ YES

9. Have you felt you wanted or needed to cut down on your drinking or drug use in the last year?  
   □ NO □ YES

10. Do you check your own blood sugar?  
   □ NO □ YES  
   If yes, during the past 7 days, about how many times have you checked your blood sugar?  
   _______ TIMES  
   □ NO □ YES  
   If yes, are you willing to provide information from your own logs of blood sugar levels to the study staff?  
   (This part of the study is optional.)
11. Have you ever been hospitalized for diabetic ketoacidosis (DKA)? □ NO □ YES

12. Have you ever been told by a health care provider that you have any problems with your eyes that are not correctable with eye glasses? □ NO □ YES

13. Have you ever been told by a health care provider that you have any of the following problems related to your heart or circulation:
   - High blood pressure? □ NO □ YES
   - Heart attack? □ NO □ YES
   - Heart failure? □ NO □ YES
   - High cholesterol? □ NO □ YES
   - Angina? □ NO □ YES
   - Stroke? □ NO □ YES

14. Have you ever had any of the following operations or procedures related to your heart:
   - Coronary artery bypass surgery (open heart surgery)? □ NO □ YES
   - Coronary angioplasty ("balloon" heart procedure)? □ NO □ YES
   - Heart catheterization (angiogram)? □ NO □ YES

15. Have you ever been told by a health care provider that you have any of the following bladder, kidney, or urinary problems:
   - Kidney or bladder infections? □ NO □ YES
   - Kidney failure? □ NO □ YES
   - Protein in your urine? □ NO □ YES

16. Have you ever been told by a health care provider that you have any of the following problems with your feet or legs:
Peripheral vascular disease (poor circulation in the legs)? □ NO □ YES

Intermittent claudication (cramping in the calves after exercise)? □ NO □ YES

Peripheral neuropathy (nerve problems causing numbness, tingling, or burning)? □ NO □ YES

Gangrene? □ NO □ YES

Foot ulcers? □ NO □ YES

Athlete’s foot or fungus infection of the feet? □ NO □ YES

17. Have you ever had an amputation of a toe, foot, part of a leg, or all of a leg for a poorly healing sore or poor circulation (not due to injury or accident)? □ NO □ YES

18. Have you ever been told by a health care provider that you have any of the following problems with your breathing?

   Emphysema? □ NO □ YES

   Chronic bronchitis? □ NO □ YES

   Asthma? □ NO □ YES

19. Have you ever been told by a health care provider that you have any gastrointestinal diseases or disorders? □ NO □ YES

   If yes, please list:

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

20. Have you ever been told by a health care provider that you have any type of liver disease? □ NO □ YES
21. Have you ever been told by a health care provider that you have any of the following conditions?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoarthritis or degenerative joint disease?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheumatoid arthritis?</td>
<td></td>
<td></td>
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<tr>
<td>Slipped or herniated disc in your back?</td>
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<tr>
<td>Osteoporosis (or thinning bones)?</td>
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</tr>
</tbody>
</table>

22. Are there any other health conditions that you feel might affect your ability to participate in this study? If yes, please list:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

23. Have you ever had any of the following operations or procedures related to your heart:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary artery bypass surgery (open heart surgery)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary angioplasty (“balloon” heart procedure)?</td>
<td></td>
<td></td>
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<tr>
<td>Heart catheterization (angiogram)?</td>
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</tbody>
</table>
24. Have you ever been told by a health care provider that you have any of the following bladder, kidney, or urinary problems:

- Kidney or bladder infections? [ ] NO [ ] YES
- Kidney failure? [ ] NO [ ] YES
- Protein in your urine? [ ] NO [ ] YES

25. Have you ever had an amputation of a toe, foot, part of a leg, or all of a leg for a poorly healing sore or poor circulation (not due to injury or accident)? [ ] NO [ ] YES
26. Are you taking any **supplements (including herbals)** on a regular basis? □ NO □ YES (If YES, please list.)

<table>
<thead>
<tr>
<th>Supplement (list brand, if known)</th>
<th>Start date</th>
<th>Stop date</th>
<th>Dose (mg, units, etc)</th>
<th>Frequency (per day, week, etc)</th>
<th>Reason (diagnosis, prescription, etc)</th>
<th>Form (liquid, pill, injectable, etc)</th>
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</thead>
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</table>

27. Are you currently on any **medications**? □ NO □ YES (If YES, please list.)

<table>
<thead>
<tr>
<th>Medication (list brand, if known)</th>
<th>Start date</th>
<th>Stop date</th>
<th>Dose (mg, units, etc)</th>
<th>Frequency (per day, week, etc)</th>
<th>Reason (diagnosis, prescription, etc)</th>
<th>Form (liquid, pill, injectable, etc)</th>
</tr>
</thead>
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</tbody>
</table>
### Vital Signs

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Blood Pressure (mmHg)</th>
<th>Pulse (bpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### Anthropometric Data

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Body Mass Index (kg/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Blood Measurements

1. Have you fasted (consumed no food or drink except for water) for the past 12 hours?  □ NO  □ YES

2. Did you take any diabetes medications this morning?  □ NO  □ YES

3. Did you drink 4 – 6 fl oz of water after waking up this morning?  □ NO  □ YES

<table>
<thead>
<tr>
<th>Glucose (mg/dl)</th>
<th>HbA1c (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Time of Blood Draw (HH:MM)</th>
<th>Time Fasting Began (HH:MM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COORDINATOR  NURSE
APPENDIX B

ILLNESS PERCEPTION QUESTIONNAIRE: REVISED
YOUR VIEWS ABOUT YOUR DIABETES

Listed below are a number of symptoms that you may or may not have experienced since your diabetes. Please indicate by circling Yes or No, whether you have experienced any of these symptoms since your diabetes, and whether you believe that these symptoms are related to your diabetes.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>I have experienced this symptom since my diabetes</th>
<th>This symptom is related to my diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Sore Throat</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Nausea</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Breathlessness</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Stiff Joints</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Sore Eyes</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Wheeziness</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Headaches</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Upset Stomach</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Sleep Difficulties</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Dizziness</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
<tr>
<td>Loss of Strength</td>
<td>Yes     No</td>
<td>Yes  No</td>
</tr>
</tbody>
</table>

We are interested in your own personal views of how you now see your current diabetes.

Please indicate how much you agree or disagree with the following statements about your diabetes by ticking the appropriate box.

<table>
<thead>
<tr>
<th>VIEWS ABOUT YOUR DIABETES</th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>NEITHER AGREE NOR DISAGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>121 My diabetes will last a short time</td>
<td></td>
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<td></td>
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<tr>
<td>122 My diabetes is likely to be permanent rather than temporary</td>
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<tr>
<td>123 My diabetes will last for a long time</td>
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</tr>
<tr>
<td></td>
<td>VIEWS ABOUT YOUR DIABETES</td>
<td>STRONGLY DISAGREE</td>
<td>DISAGREE</td>
<td>NEITHER AGREE NOR DISAGREE</td>
<td>AGREE</td>
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</tr>
<tr>
<td>124*</td>
<td>This diabetes will pass quickly</td>
<td></td>
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</tr>
<tr>
<td>125*</td>
<td>I expect to have this diabetes for the rest of my life</td>
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<tr>
<td>126</td>
<td>My diabetes is a serious condition</td>
<td></td>
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<tr>
<td>127</td>
<td>My diabetes has major consequences on my life</td>
<td></td>
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<tr>
<td>128*</td>
<td>My diabetes does not have much effect on my life</td>
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<tr>
<td>129</td>
<td>My diabetes strongly affects the way others see me</td>
<td></td>
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<tr>
<td>130</td>
<td>My diabetes has serious financial consequences</td>
<td></td>
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<tr>
<td>131</td>
<td>My diabetes causes difficulties for those who are close to me</td>
<td></td>
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</tr>
<tr>
<td>132</td>
<td>There is a lot which I can do to control my symptoms</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>133</td>
<td>What I do can determine whether my diabetes gets better or worse</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>134</td>
<td>The course of my diabetes depends on me</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>135*</td>
<td>Nothing I do will affect my diabetes</td>
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<tr>
<td>136</td>
<td>I have the power to influence my diabetes</td>
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<tr>
<td>137*</td>
<td>My actions will have no affect on the outcomes of my diabetes</td>
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<tr>
<td>138*</td>
<td>My diabetes will improve in time</td>
<td></td>
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<tr>
<td>139*</td>
<td>There is very little that can be done to improve my diabetes</td>
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<tr>
<td>140</td>
<td>My treatment will be effective in curing my diabetes</td>
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<tr>
<td>141</td>
<td>The negative effects of my diabetes can be prevented (avoided) by my treatment</td>
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<tr>
<td>142</td>
<td>My treatment can control my diabetes</td>
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<tr>
<td>143*</td>
<td>There is nothing which can help my condition</td>
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<tr>
<td>144</td>
<td>The symptoms of my condition are puzzling to me</td>
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<tr>
<td>145</td>
<td>My diabetes is a mystery to me</td>
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<tr>
<td>ID</td>
<td>Statement</td>
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<td>----------------------------------------------------------------------------</td>
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<tr>
<td>1226</td>
<td>I don't understand my diabetes</td>
<td></td>
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</tr>
<tr>
<td>1227</td>
<td>My diabetes doesn't make any sense to me</td>
<td></td>
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<tr>
<td>1228</td>
<td>I have a clear picture or understanding of my condition</td>
<td></td>
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<tr>
<td>1229</td>
<td>The symptoms of my diabetes change a great deal from day to day</td>
<td></td>
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<tr>
<td>1230</td>
<td>My symptoms come and go in cycles</td>
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<tr>
<td>1231</td>
<td>My diabetes is very unpredictable</td>
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<tr>
<td>1232</td>
<td>I go through cycles in which my diabetes gets better and worse.</td>
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<tr>
<td>1233</td>
<td>I get depressed when I think about my diabetes</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>1234</td>
<td>When I think about my diabetes I get upset</td>
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<tr>
<td>1235</td>
<td>My diabetes makes me feel angry</td>
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<tr>
<td>1236</td>
<td>My diabetes does not worry me</td>
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<tr>
<td>1237</td>
<td>Having this diabetes makes me feel anxious</td>
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<tr>
<td>1238</td>
<td>My diabetes makes me feel afraid</td>
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</table>
# CAUSES OF MY DIABETES

We are interested in what you consider may have been the cause of your diabetes. As people are very different, there is no correct answer for this question. We are most interested in your own views about the factors that caused your diabetes rather than what others including doctors or family may have suggested to you. Below is a list of possible causes for your diabetes. Please indicate how much you agree or disagree that they were causes for you by ticking the appropriate box.

<table>
<thead>
<tr>
<th>POSSIBLE CAUSES</th>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>NEITHER AGREE NOR DISAGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 Stress or worry</td>
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<tr>
<td>C2 Hereditary - it runs in my family</td>
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<td>C3 A Germ or virus</td>
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<td>C4 Diet or eating habits</td>
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<td>C5 Chance or bad luck</td>
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<td>C6 Poor medical care in my past</td>
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<td>C7 Pollution in the environment</td>
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<td>C8 My own behaviour</td>
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<tr>
<td>C9 My mental attitude e.g. thinking about life negatively</td>
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<tr>
<td>C10 Family problems or worries</td>
<td></td>
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<td>C11 Overwork</td>
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<tr>
<td>C12 My emotional state e.g. feeling down, lonely, anxious, empty</td>
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<tr>
<td>C13 Ageing</td>
<td></td>
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<tr>
<td>C14 Alcohol</td>
<td></td>
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<tr>
<td>C15 Smoking</td>
<td></td>
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<tr>
<td>C16 Accident or injury</td>
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<td>C17 My personality</td>
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<td>C18 Altered immunity</td>
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In the table below, please list in rank-order the three most important factors that you now believe caused YOUR diabetes. You may use any of the items from the box above, or you may have additional ideas of your own.

The most important causes for me:

1. ____________________________________________
2. ____________________________________________
3. ____________________________________________

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APPENDIX C

DIABETES KNOWLEDGE TEST
NUTRITION QUIZ

Below are questions about diabetes. These will enable us to counsel you most effectively and provide the best care possible.

Please circle your response to each question. Some questions have more than one answer. Please answer to the best of your knowledge, and RELAX – this is a learning experience for us all.

(Items used for analysis in the IRT2DM are BOLDED)

1. The diabetes diet is:

   A. The way most American people eat.
   B. A healthy diet for most people.
   C. Too high in carbohydrate for most people.
   D. Too high in protein for most people.

2. Which of the following is highest in carbohydrate?

   A. Baked chicken.
   B. Swiss cheese.
   C. Baked potato.
   D. Peanut butter.

3. Which of the following is highest in fat?

   A. Low-fat milk.
   B. Orange juice.
   C. Corn.
   D. Honey.

4. Which of the following feelings may result from a low blood sugar reaction? Circle all that might happen, not just those that have happened to you.

   A. Difficulty thinking.
   B. Blurred vision.
   C. Nervousness or shakiness.
   D. Numbness.
   E. Sweating.
5. What should you do if you have a low blood sugar reaction? Circle all that apply.

   A. Walk it off.
   B. Sit down and rest.
   C. Eat crackers or cheese.
   D. Drink milk

6. Glycosylated hemoglobin (Hemoglobin A₁c) is a test that is a measure of your average blood sugar for the past:

   A. Day.
   B. Week.
   C. 6 – 10 weeks.
   D. 6 months.

7. When planning vigorous exercise (e.g., swimming, tennis), what changes should you make in your daily diabetes routine? Circle all that apply.

   A. Monitor your blood sugar.
   B. Carefully time when to do your exercising.
   C. Increase the amount of carbohydrates you eat.
   D. Increase the amount of protein you eat.

8. On days when you are sick, what steps should you take to control your diabetes?

   A. Increase the amount of water or other fluids you eat and drink.
   B. Do not take your medicine.
   C. Call your doctor.
   D. Try to eat something (e.g., saltines, broth, toast).

9. For people with diabetes, the target range for blood sugar before eating is:

   A. 40 – 150 milligrams per deciliter.
   B. 70 – 100 milligrams per deciliter.
   C. 100 – 200 milligrams per deciliter.
   D. 90 – 130 milligrams per deciliter.
10. What effect does unsweetened fruit juice have on blood glucose?

   A. Lowers it.
   B. Raises it.
   C. Has no effect.

11. A specific meal plan has been devised for you by the dietitian. Which of the following statements about your meal plan are correct? Circle all that apply.

   A. You should eat everything on your meal plan.
   B. You can reduce the amount of food you eat if you’re not hungry.
   C. You should control the amount of food you eat all the time.
   D. You can eat your meals any time during the day as long as you eat everything on your plan.
   E. I don’t know.

12. Bedtime snacks are an important part of your meal plan because they help you avoid having low blood sugar reactions overnight.

   A. True.
   B. False.

13. Margarine is mainly:

   A. Protein.
   B. Carbohydrate.
   C. Fat.
   D. Mineral and vitamin.

14. Rice is mainly:

   A. Protein.
   B. Carbohydrate.
   C. Fat
   D. Mineral and vitamins
15. If you don’t feel like having the egg on your meal plan for breakfast, you can (circle two):

   A. Have extra toast.
   B. Substitute one small piece of meat.
   C. Have an ounce of cheese instead.
   D. Skip the egg, and don’t eat anything else.

16. For a person in good control, what effect does exercise have on blood sugar?

   A. Lowers it.
   B. Raises it.
   C. Has no effect.

17. Infection is likely to cause:

   A. An increase in blood sugar.
   B. A decrease in blood sugar.
   C. No change in blood sugar.

18. Eating foods lower in fat reduces your risk for:

   A. Nerve disease.
   B. Kidney disease.
   C. Heart disease.
   D. Eye disease.

19. Which of the following is usually not associated with diabetes?

   A. Vision problems.
   B. Kidney problems.
   C. Nerve problems.
   D. Lung problems.

20. Please list a few nutrition and/or diabetes topics you’d like learn more about.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________


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