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Personal Factors, Perceptions, Influences and Their Relationship with Adherence Behaviors in Patients with Diabetes

Glenn E. Hagerstrom
Georgia State University

ACCEPTANCE

This dissertation, PERSONAL FACTORS, PERCEPTIONS, INFLUENCES AND THEIR RELATIONSHIP WITH ADHERENCE BEHAVIORS IN PATIENTS WITH DIABETES by Glenn Hagerstrom was prepared under the direction of the candidate's dissertation committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Nursing in the Byrdine F. Lewis School of Nursing in the College of Health and Human Sciences, Georgia State University.

____
Cecelia Gatson Grindel, PhD, RN, FAAN
Committee Chairperson

____
Mary Catherine Gebhardt, PhD, RN
Committee Member

____
Michael P. Eriksen, ScD
Committee Member

____
Date

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____
Cecelia Gatson Grindel, PhD, RN, FAAN
Associate Director for Graduate Nursing Programs
Byrdine F. Lewis School of Nursing

____
Barbara C. Woodring, EdD, RN, CPN
Professor & Director
Byrdine F. Lewis School of Nursing

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Glenn Hagerstrom
100 N. Arlington Ave, 11K
Reno, NV 89501

The director of this dissertation is:

Dr. Cecelia Gatson Grindel
Associate Director for Graduate Nursing Programs
Byrdine F. Lewis School of Nursing
College of Health and Human Sciences
Georgia State University
PO Box 4019
Atlanta, GA 30302-4019

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VITA

Glenn Hagerstrom

ADDRESS: 100 N. Arlington Ave, 11K
Reno, NV 89501

EDUCATION:

PhD	2010	Georgia State University Byrdine F. Lewis School of Nursing Atlanta, GA
MSN	2000	University of Central Florida School of Nursing Orlando, FL
BSN	1999	University of Central Florida School of Nursing Orlando, FL
ADN	1994	Valencia Community College Orlando, FL
BA	1991	Rhode Island College Providence, RI

PROFESSIONAL EXPERIENCE:

2007 – Present	Assistant Professor of Nursing University of Nevada, Reno	Reno, NV
Summer 2005	Nurse Practitioner, Diabetes Education Informed Care	Columbus, GA
2001 – 2002	Nurse Practitioner Summit Ridge Center for Behavioral Care	Lawrenceville, GA
2001 -2002	Staff Nurse/Educator, Diabetes Unit Piedmont Hospital	Atlanta, GA
2001 – 2007	Instructor of Nursing University of Central Florida	Orlando, FL
1995 – 1999	Staff Nurse, Med-Surg Float Pool Orlando Regional Healthcare System	Orlando, FL
Summer 1996	Private Duty Nurse Hospice of Central Florida	Maitland, FL
1995 – 1996	Staff Nurse, Diabetes Unit Florida Hospital Medical Center	Orlando, FL
1993 – 1995	Staff Nurse/Educator, Diabetes Unit Lucerne Medical Center	Orlando, FL

LICENSE/CERTIFICATION:
Registered Professional Nurse (Florida, California, Nevada)
Family Nurse Practitioner (through 2011), American Nurses Credentialing Center

PROFESSIONAL ORGANIZATIONS:

American Association of Diabetes Educators	2010 – Present
Northern Nevada Advanced Practice Nursing Association	2007 – Present
Western Institute of Nursing	2007 – Present
Nevada Nurses Association	2007 – Present
Canadian Diabetes Association	2002 – Present
Southern Nursing Research Society	2002 – 2007
Georgia Nurses Association	2001 – 2007
Florida Nurses Association	2001 – 2005
Sigma Theta Tau International Honor Society of Nursing	2000 – Present
American Diabetes Association	1999 – Present

PUBLICATIONS (REFERRED JOURNALS):
Grindel, C. G. & Hagerstrom, G. (2009). Nurses nurturing nurses: Outcomes and lessons learned. *MedSurg Nursing, 18*(3), 183-187, 194.

GRANTS:

2006	Research Grant Award, Sigma Theta Tau International Honor Society of Nursing, Theta Epsilon Chapter, University of Central Florida

AWARDS:

2008	Most Inspirational Faculty Award, University of Nevada, Reno
2007	Unsung Hero Award for Extraordinary and Outstanding Service to Students, Program, College, and University for 2006-2007, University of Central Florida
2001	Outstanding Graduate Student, University of Central Florida
1999	Outstanding Student, University of Central Florida
1999	United States Air Force Health Professions Salute Award, University of Central Florida

ABSTRACT

PERSONAL FACTORS, PERCEPTIONS, INFLUENCES AND THEIR RELATIONSHIP WITH ADHERENCE BEHAVIORS IN PATIENTS WITH DIABETES

by

GLENN HAGERSTROM

Problem and significance: Adherence to health-promoting behaviors in a diabetes self-care regimen is essential for individuals with diabetes and can assist providers and individuals with diabetes management. The purpose of this research was to explore the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and patient adherence to health-promoting behaviors (blood glucose monitoring, diet, and exercise) and health outcomes (A1c and body mass index) in a diabetes self-care regimen.

Methods: A descriptive correlational analysis was performed using baseline data from the National Health and Nutrition Examination Survey (NHANES) [2007-2008]. Constructs from the Health Promotion Model were used to predict health-promoting behaviors and health outcomes in diabetes self-management. The 713 participants with diabetes were primarily Black or Hispanic (57.5%), older (*M* 62.2 years, *SD* 12.9), and married or living with a partner (56.2%). Approximately half of the participants were female (50.8%); 59% were obese.

Results: The longer the time since diagnosis and the more barrier days

experienced per month, the more frequently blood glucose monitoring was performed (R^2 = .076, R^2_{adj} = .060, F (6, 363) = 4.875, p < .001). The greater the body weight, the more likely participants were to implement diet management behaviors (R^2 = .097, R^2_{adj} = .081, F (7, 413) = 6.209, p < .001). The younger the age and the higher perceived health status, the more minutes per week were spent in exercise (R^2 = .054, R^2_{adj} = .038, F (7, 412) = 3.307, p < .01). The older the age and the shorter time since diagnosis, the lower the A1c levels (R^2 = .054, R^2_{adj} = .044, F (6, 568) = 5.391, p < .001). The younger the age, the more barrier days per month and the more diet management behaviors reported, the higher the BMI (R^2 = .149, R^2_{adj} = .140, F (6, 581) = 16.764, p < .001). Findings indicate that treatment measures, not preventative, are being practiced, and that predictors of behaviors and outcomes are multifaceted and require further investigation.

PERSONAL FACTORS, PERCEPTIONS, INFLUENCES AND THEIR RELATIONSHIP WITH ADHERENCE BEHAVIORS IN PATIENTS WITH DIABETES

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GLENN HAGERSTROM

A DISSERTATION

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ABBREVIATIONS

A1c	Hemoglobin A1c
ADA	American Diabetes Association
BGM	Blood Glucose Monitoring
BMI	Body Mass Index
CDC	Centers for Disease Control
DCCT	Diabetes Control and Complications Trial
HPM	Health Promotion Model
IRB	Institutional Review Board
NCHS	National Center for Health Statistics
NHANES	National Health and Nutrition Examination Survey
SAS	Statistical Analysis System
SPSS	Statistical Package for the Social Sciences
U.S.	United States

Chapter I

Introduction

In today's health care environment, individuals with chronic disease are expected to assume an increasing number of responsibilities involving their own care. The advent of managed care and its many restrictions have caused the actual time that an individual can spend with a health care professional to be reduced significantly. The individual is often required to self-manage a medical condition at home with very little formal education on the disease or the treatment regimen. Where the treatment of a mild infection might only involve seven days of oral antibiotic therapy, the treatment of a chronic disease can become a lifelong, complex regimen of care that requires a thorough understanding of the disease and continued adherence to the prescribed therapy. Diabetes is an example of a chronic disease that requires this level of care.

Diabetes mellitus continues to be a significant public health challenge in the U.S. There are approximately 1,644,000 new cases being diagnosed each year. Changing demographic patterns of the U.S. are expected to increase the number of people who are at risk for developing the disease. Presently, there are 23.6 million Americans who have diabetes, and an estimated 5.7 million of those individuals are unaware that they have the disease. Diabetes continues to be the seventh leading cause of death in the U.S., primarily from the associated cardiovascular disease that results as a complication (Centers for Disease Control, 2010). The increase in the number of cases of diabetes has occurred particularly within African-American, Hispanic, and Native American populations (U.S. Department of Health and Human Services, 2007).

Compared to other chronic disease treatments, the diabetes self-management regimen is one of the most complex and challenging, requiring a high level of patient involvement. The original findings of the Diabetes Control and Complications Trial (DCCT), the longest and largest prospective study concerning blood glucose levels and clinical outcomes, have shown that tighter control of blood glucose levels will dramatically reduce the complications of diabetes (McKay, Feil, Glasgow, & Brown, 1998). These conclusions demonstrate that the adherence to a care regimen, which should result in better glycemic control, may improve the clinical outcomes of patients with diabetes. Therefore, adherence to a diabetes care regimen must be strongly encouraged.

Adherence can be defined as the extent to which a person’s behavior (medication-taking and lifestyle practices) coincides with medical or health advice (McNabb, 1997). It is important to note the difference between the terms “adherence” and “compliance”. Compliance suggests the notion of patients “doing as they are told” while the definition of adherence recognizes that patients make independent decisions about their self-care behavior (McNabb). The aim of diabetes treatment is to attain glycemic control sufficient to reduce the risk of acute and chronic complications (Lustman & Clouse, 2004). Unfortunately, the adherence required for the management regimen associated with achieving the level of diabetes control defined by the DCCT can be taxing, overwhelming, and exhausting for patients (Solowiejczyk, 2010).

Statement of the Problem

Adherence to the health-promoting behaviors which are part of the diabetes self-care regimen is an absolute necessity for individuals with diabetes. There are many

factors which affect the likelihood of whether an individual with diabetes will adhere to their regimen or not. Determining the factors that are associated with adherence to health-promoting behaviors and to overall health outcomes can assist individuals with diabetes and their health care providers plan appropriate interventions to ensure optimal care of the disease. Focusing on individual factors provides a feasible and stepwise approach that may have a cumulative effect on the overall adherence to health-promoting behaviors necessary for the maintenance of diabetes.

Purpose of the Study

The purpose of this research was to explore the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and patient adherence to health-promoting behaviors (blood glucose monitoring, diet, and exercise) and overall health outcomes (hemoglobin A1c and body mass index) in a diabetes self-care regimen.

Significance of the Study

This research is significant because it focused on the various personal factors, perceptions, and influences which might affect the health-promoting behaviors of an individual with diabetes. A better understanding of the individual factors which relate to the adherence required for the diabetes self-care regimen allows the health care provider to plan more attainable goals for the individual with diabetes. This can facilitate improved health outcomes.

Research Questions

The research will attempt to answer the following questions:

1. What is the relationship between personal factors (age, length of diabetes diagnosis, perceived health status), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and adherence to blood glucose monitoring?
2. What is the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and adherence to diet?
3. What is the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and adherence to exercise?
4. What is the relationship between personal factors (age, length of diabetes diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (social support), health-promoting behaviors (diet, exercise), and A1c?
5. What is the relationship between personal factors (age, length of diabetes diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (social support), health-promoting behaviors (diet, exercise), and body mass index?

Theoretical Framework

Nola J. Pender developed one of the most widely used health promotion models in nursing, hypothesizing that the determinants of health promotion behaviors include individual perceptions, modifying factors, and other variables which influence the likelihood of engaging in health-promoting behaviors (Riffle, Yoho, & Sams, 1989). The concept of adherence was thoroughly explored with Pender's Health Promotion Model.

The concept of health promotion has been a popular one in nursing practice (Tomey & Alligood, 1998). Individual risk reduction through health-promoting behaviors is a significant area of individual patient responsibility. Health-promoting behaviors are activities in which the patient engages to achieve well-being and self-actualization, thereby preventing risk factors from developing; such behaviors include physical activity, nutrition practices, the development of social support, and the use of stress management techniques (Fleetwood & Packa, 1991). Pender's theory focuses on this premise.

The Health Promotion Model (HPM) first appeared in the nursing literature in the early 1980s. It was originally proposed as a framework for integrating nursing and behavioral science perspectives on factors influencing health behaviors (Pender, Murdaugh, & Parsons, 2002). The term "health behavior" was being used with increasing frequency in health literature as there was a renewed interest in the earlier work of Halbert Dunn, which focused on high-level wellness and behaviors that were motivated by a desire to promote personal health and well-being (Pender et al., 2002). Pender based the HPM on various theories including Bandura's Social Cognitive Theory and the Health Belief Model.

Bandura's Social Cognitive Theory is a framework most frequently used to design behavior change interventions and is integrated in Pender's conceptual model. This theory has provided a conceptual framework for understanding principles of behavior change. The theory specifically postulated that environmental factors influence the behavior of the individual, and at the same time the individual has the capacity to structure supportive environments and also resist environmental pressures (Cameron & Best, 1987).

The Health Belief Model, first proposed in the 1960s by Lewin (and later modified by Becker) as a framework for exploring why some people who are illness-free take actions to avoid illness, has also been incorporated into the HPM. This model was viewed as a potentially useful tool to predict those individuals who would or would not use preventive measures or engage in health-protecting behaviors (Pender et al., 2002). Elements of this model have been synthesized and extended for nursing's purposes in Pender's revised Health Promotion Model.

Major Assumptions of the Health Promotion Model

The major assumptions of the HPM, which reflect both nursing and behavioral science perspectives, are as follows (Pender et al., 2002):

- Persons seek to create conditions of living through which they can express their unique human health potential.
- Persons have the capacity for reflective self-awareness, including assessment of their own competencies.

- Persons value growth in directions viewed as positive and attempt to achieve a personally acceptable balance between change and stability.
- Individuals seek to actively regulate their own behavior.
- Individuals in all their biophysical complexity interact with the environment, progressively transforming the environment and being transformed over time.
- Health professionals constitute a part of the interpersonal environment, which exerts influence on persons throughout their life span.
- Self-initiated reconfiguration of person-environment interactive patterns is essential to behavior change.

These major assumptions emphasize the active role that an individual has in shaping and maintaining their own health behaviors and in modifying the environmental context for health behaviors.

Major Concepts and Definitions

The major concepts utilized in the HPM are separated into three different categories, as noted along the top of the model in Appendix A. The three categories are "Individual Characteristics and Experiences", "Behavior-Specific Cognitions and Affect", and "Behavioral Outcome" (Pender et al., 2002). The major concepts in the "Individual Characteristics and Experiences" category are *prior related behavior* and *personal factors* (biological, psychological, and sociocultural). Prior related behaviors are defined as those past or baseline behaviors, which relate to the specific aspect of health being studied. Personal factors are defined as those distinguishing characteristics, which might affect behavior. They are divided into the sub-categories of biological (age

and body mass), psychological (self-esteem and self-motivation), and sociocultural (ethnicity and education).

The major concepts in the "Behavior-Specific Cognitions and Affect" category are *perceived benefits of action*, *perceived barriers to action*, *perceived self-efficacy*, *activity-related affect*, *interpersonal influences*, and *situational influences*. Perceived benefits of action are defined as the mental representations of the positive or reinforcing consequences of a behavior. Perceived barriers to action are defined as the real or imagined perceptions concerning the unavailability or difficulty of a particular action. Perceived self-efficacy is defined as the judgment of personal capacity to organize and execute a particular course of action. Activity-related affect is defined as the subjective feeling states that occur prior to, during, and following an activity. Interpersonal influences are defined as the cognitions concerning the behaviors, beliefs, or attitudes of others. Situational influences are defined as those perceptions of options available, demand characteristics, and aesthetic features of the environment in which a given behavior is proposed to take place.

The major concepts in the "Behavioral Outcome" category are *commitment to a plan of action*, *immediate competing demands and preferences*, and *health promoting-behavior*. Commitment to a plan of action is defined as "that which initiates a behavioral event"; it propels the individual into and through the behavior. Immediate competing demands and preferences are defined as alternative behaviors, which interfere with the courses of action immediately prior to the intended occurrence of a health-promoting behavior. A health promoting-behavior is defined as a behavior, which is "ultimately directed toward attaining positive health outcomes for the client (Pender et al., 2002).

Adherence to a diabetes care regimen could be considered to be the degree that an individual regularly practices health promoting behaviors. These conceptual definitions demonstrate the various and numerous aspects that need to be considered when determining the likelihood of an individual engaging in health promoting or adherence behaviors.

Propositions of the Health Promotion Model

The theoretical propositions of the HPM are as follows (Pender et al., 2002):

- Prior behavior and inherited and acquired characteristics influence beliefs, affect, and enactment of health-promoting behavior.
- Persons commit to engaging in behaviors from which they anticipate deriving personally valued benefits.
- Perceived barriers can constrain commitment to action, a mediator of behavior, as well as actual behavior.
- Perceived competence or self-efficacy to execute a given behavior increases the likelihood of commitment to action and actual performance of the behavior.
- Greater perceived self-efficacy results in fewer perceived barriers to a specific health behavior.
- Positive affect toward a behavior results in greater perceived self-efficacy, which can, in turn, result in increased positive affect.
- When positive emotions or affect are associated with a behavior, the probability of commitment and action are increased.

- Persons are more likely to commit to and engage in health-promoting behaviors when significant others model the behavior, expect the behavior to occur, and provide assistance and support to enable the behavior.
- Families, peers, and health care providers are important sources of interpersonal influence that can increase or decrease commitment to and engagement in health-promoting behavior.
- Situational influences in the external environment can increase or decrease commitment to or participation in health promoting behavior.
- The greater the commitment to a specific plan of action, the more likely health-promoting behaviors are to be maintained over time.
- Commitment to a plan of action is less likely to result in the desired behavior when competing demands over which persons have little control require immediate attention.
- Commitment to a plan of action is less likely to result in the desired behavior when other actions are more attractive and thus preferred over the target behavior.
- Persons can modify cognitions, affect, and the interpersonal and physical environments to create incentives for health actions.

These propositions demonstrate the multiple factors that can influence an individual to choose to engage in health promoting or adherence behaviors.

Summary

Upon reviewing the major concepts and propositions of the HPM, the framework has great potential for use in adherence behavior research with individuals with diabetes. The HPM has a logical format that encompasses the existing biological factors and prior experiences of the individual; the current circumstances, environmental influences, and beliefs and attitudes of the individual; and the forthcoming behavioral outcomes that may result from the previous two factors.

The HPM has been tested in over 38 explanatory or predictive studies by various nurse researchers (Pender et al., 2002). Pender has specifically concentrated her research interests (using the conceptual model) in the behavior of exercise in adults. Other examples of research utilizing this model are studies on exercise in adolescents and the use of hearing protection devices in occupational settings. Although the HPM has been successfully used in prior research, Pender revised the model in 2002. Additional constructs included in the latest version were not present in the original version from 1984. The revised model (see Appendix A) should be tested empirically with particular attention to the newer constructs (Pender et al., 2002). Nevertheless, there is empirical evidence which already supports the predictive value for health behavior. It is recommended that rigorous measures of behavior-specific variables be developed (if they do not already exist) before testing the model with any specific health behavior.

This research will specifically focus on the concepts of personal factors of individuals (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), adherence to health-promoting behaviors (blood

glucose monitoring, diet, exercise), and overall health outcomes (A1c, body mass index) in a diabetes self-care regimen. The concepts of prior related behaviors, perceived benefits of action, perceived self-efficacy, activity-related affect, and immediate competing demands and preferences were not specifically examined in this study due to insufficient variable data to adequately represent these concepts. Although some of the concepts in the HPM were not included in this study, the concepts that were included in the study should be sufficient to explore potential relationships. The HPM could be used to research specific determinants of diabetes adherence behaviors. The results of this research may yield more person-specific interventions for future use in individuals with inadequate adherence behaviors.

Chapter II

Literature Review

This chapter summarizes a review of the research literature that focuses on the personal factors; perceived barriers to action, interpersonal influences, situational influences, health-promoting behaviors, and health outcomes related to the management of diabetes.

Diabetes mellitus continues to be a significant public health challenge in the U.S. This chronic disease usually requires a combination of treatments including exercise, diet, and regular blood glucose monitoring. According to Healthy People 2010, the toll of diabetes on the health status of the U.S. is expected to worsen, especially in vulnerable, high-risk populations including African Americans, Hispanics, American Indians or Alaska Natives, Asians or other Pacific Islanders, elderly persons, and economically disadvantaged persons. It is crucial for individuals living with diabetes to adhere to a recommended self-care regimen in order to maintain proper metabolic control of the disease (U.S. Department of Health and Human Services, 2007). The following examples of research literature illustrate the relationship between various determinant factors, adherence to health promoting behaviors involved in diabetes self-management, and overall health outcomes.

Personal Factors

According to the Health Promotion Model, personal factors are categorized as either biologic, psychological, or sociocultural (Pender et al., 2002). Personal factors such as age can affect the diabetes care regimen, especially in older patients. Older individuals with diabetes often have a poorer socioeconomic situation, experience greater

social isolation, have a higher frequency of depression, and are often more vulnerable to episodes of hypoglycemia (Sinclair, 2006). Age is also associated with worsening complications as aging eyes become more impaired with diabetic retinopathy, and aging feet become more impaired with diabetic neuropathy. Psychosocial changes associated with aging include older individuals dealing with multiple losses of family and friends, and changes in function and roles (Trief, 2007). This can cause diabetes self-management to be more challenging for the older patient.

Studies have demonstrated a relationship between personal factors and health-promoting behaviors and health outcomes. This is especially prevalent in the biologic factors such as age or duration of disease. Although these factors cannot be changed within an individual, they can sometimes be reliable predictors. Many studies simply classify these variables as demographic and they are not necessarily the variables of interest when looking at predictors of adherence or health outcomes. However some studies have surprisingly found an association between personal factors and health outcomes, even though they are not always significant.

Vincze, Barner, & Lopez (2004) explored the relationship between personal factors and adherence to blood glucose monitoring. The personal factors of age, length of diabetes diagnosis, and perceived health status were included. No significant relationship was found between these personal factors and adherence to blood glucose monitoring.

Mitchell, Bowker, Majumdar, Toth, & Johnson (2004) explored the relationship between perceived health status, BGM, and A1c levels. No significant relationship was found between these variables.

Two studies by Rhee et al. (2005) and Lee et al. (2009) explored the relationship between personal factors and glycemic control, which was defined as A1c levels. Rhee et al. explored the relationship between age, length of diabetes diagnosis, and A1c levels. The study obtained significant results. The length of diabetes diagnosis was found to be positively related to A1c level; the longer the diagnosis the higher the A1c level. Age was negatively related to A1c level, indicating that the older the individual the lower the A1c level. Conversely Lee et al. explored the relationship between the same variables (age, length of diabetes diagnosis, and A1c levels) but no significant relationship was found. The Rhee et al. study had a sample size of 1560 whereas the Lee et al. study only had a sample size of 55.

These studies demonstrate that personal factors can be valid predictors of health-outcomes, but it is not consistently seen in the literature.

Perceived Barriers to Action

According to the HPM, barriers to action have been found to affect intentions to engage in a particular behavior and to execute the behavior. These barriers may be imagined or real, and they consist of perceptions concerning the unavailability, inconvenience, expense, difficulty, or the time-consuming nature of a particular action (Pender et al., 2002).

Nagelkerk, Reick, & Meengs (2006) provided examples of common barriers to diabetes self-management. Frequently reported barriers were time constraints, limited social support, limited coping skills, lack of knowledge related to diet management, helplessness and frustration from lack of glycemic control, and continued disease progression despite adherence. Although some of these barriers may appear static and

not likely to change; many of these perceived barriers can vary in intensity from day to day. An individual with diabetes may be able to cope and overcome these barriers on a “good day”, but on other days these barriers could present a real obstacle to performing health-promoting behaviors in a diabetes care regimen.

Vincze, et al. (2004) explored the relationship between environmental barriers and adherence to blood glucose monitoring. These barriers included lifestyle interference and pain involved in monitoring. A significant relationship was found between these barriers and a decreased adherence to blood glucose monitoring. This study did not explore the relationship between barriers and health outcomes. The researchers discussed that blood glucose monitoring is more of a tool than a treatment in diabetes management, and that it was unclear if decreased adherence to blood glucose monitoring would yield poor health outcomes.

Perceived barriers that will interfere with adherence to health-promoting behaviors is prevalent in the literature (Glasgow, McCaul, & Schafer, 1986; Jones, Remley, & Engberg, 1996), however, the literature does not routinely explore the relationship between perceived barriers and health outcomes.

Interpersonal Influences

According to the HPM, interpersonal influences are cognitions concerning the behaviors, beliefs, or attitudes of others. These cognitions may or may not correspond with reality. The primary sources of interpersonal influences on health-promoting behaviors are family, peers, and health care providers. These interpersonal processes affect the predisposition to engage in health-promoting behaviors (Pender et al., 2002). In the literature these interpersonal influences are generally defined as social support.

Various research studies have been conducted which demonstrate that social support may benefit individuals with diabetes, particularly in their adherence to their care regimen. Although many studies report a significant relationship between support and adherence behaviors, they do not always show a relationship with health outcomes. A research study, focusing on adolescents with Type 1 diabetes, found that there was improved metabolic control among those adolescents that reported having more peer support from their friends (Skinner, Petzing, & Johnston, 1999). The adolescents reported that their daily diabetes management tasks made it difficult to be spontaneous and to feel socially acceptable. However, they also reported that their friends and peers were a major source of emotional support. This support was instrumental in helping the adolescent feel accepted; thus they were more adherent to their diabetes care needs. There was a significant increase in adherence behaviors, particularly with their dietary requirements and daily insulin injections. There was also an improvement in A1c levels, although the improvement was not significant (Skinner, Petzing, & Johnston, 1999).

Nicklett and Liang (2010) explored the relationship between social support, regimen adherence, and health outcomes. Regimen specific support was provided to participants including assistance with diet, exercise, and blood glucose monitoring. Although a significant positive relationship was found between support and regimen adherence, there was no significance found between support and health outcomes. The researchers concluded that, although illness-related support was significantly related to adherence, this did not necessarily translate to improved or maintained health outcomes (Nicklett & Liang, 2010).

McKay et al. (2001) used the Internet to provide support and encouragement to individuals with type 2 diabetes in an attempt to increase the participants' physical activity. Although the study did reveal an increase in physical activity with those individuals receiving the support treatment, the findings were not significant. Ruggiero, Moadsiri, Butler, Oros, Berbaum, Whitman, & Cintron (2010) compared the A1c levels between groups of individuals with diabetes where one group received additional support from medical assistant coaches while the other group received the usual treatment intervention. No significant differences were observed in A1c levels between the two groups. Sacco, Malone, Morrison, Friedman, & Wells (2009) explored the relationship between a telephone social support intervention and both health-promoting behaviors and health outcomes. Diet and exercise adherence were the health-promoting behaviors in this study, while A1c and BMI were the health outcomes. The social support intervention was found to have a significant positive relationship on the adherence behaviors of diet and exercise, but there was no significant relationship found between social support and the health outcome variables of A1c and BMI. Although the Sacco et al. (2009) study was conducted over a six month period, there was no significant change in A1c levels or BMI for the experimental or the control groups.

These examples from the literature demonstrate an association between support and health promoting behaviors, but the findings were not always significant. They also demonstrate that no significant relationship has been found between support and health outcomes.

Situational Influences

According to the HPM, situational influences are personal perceptions and cognitions of any situation or context which may facilitate or impede a behavior. Situational influences on health-promoting behaviors would include perceptions of the options that are available in which a given behavior is proposed to take place (Pender et al., 2002).

Depression is a condition that may affect or be affected by diabetes. Depression negatively affects the course of diabetes and is associated with the increased risk of complications. Depression may exert its effect through poor self-care behaviors such as overeating, not exercising, or failing to keep medical appointments (Trief, 2007). The overall depression rate in people with chronic illnesses is 20-70% compared to the approximate 5% found in the general population. The prevalence of depression in people with type 2 diabetes has been estimated to be approximately 25% (Madden, 2010). Identifying and treating depression in diabetes is strongly recommended (Trief). One of the issues associated with diabetes is that many individuals are not clinically depressed but still experience feelings that are very close to depression in the course of living with their disease. This state is sometimes referred to as “diabetes distress”, and is related to depression but not sufficiently severe to merit a diagnosis of depression (Solowiejczyk, 2010).

Many studies have demonstrated a relationship between depression and decreased adherence to health-promoting behaviors. In individuals with diabetes, depression has been associated with poor glycemic control and an increase in the occurrence of diabetes complications (McKellar, Humphreys, & Piette, 2004). Although some studies often

show that depression can be linked directly to decreased adherence, they do not necessarily demonstrate a significant link to decreased health outcomes. McKellar, et al. (2004) explored the relationship between depression, diabetes regimen adherence, and glucose dysregulation and found that depression has little direct impact on diabetes-related health outcomes. However, a significant relationship was found between depression and a decrease in diabetes regimen adherence. The research suggests that depression may exert an indirect effect on diabetes-related symptoms by interfering with patients' ability to adhere to their self-care regimen.

A study by Lee et al. (2009) explored the relationship between depression and glycemic control, which was defined A1c levels. Adherence behaviors were not explored in this particular study. No significant relationship was found between depression and A1c levels in the participants.

Depression can be a transient condition in many individuals where its effects are worse on some days compared to others. Symptoms of depression can definitely affect adherence to health-promoting behaviors in diabetes care on a day to day basis, but the literature does not consistently support depression's negative effect on overall health outcomes.

Health Promoting Behavior

According to the HPM, health-promoting behavior is the endpoint or action outcome in the model. A health-promoting behavior is ultimately directed toward attaining positive health outcomes for the client. When integrated into a healthy lifestyle, health promoting behavior results in improved health and better quality of life (Pender et al., 2002). Blood glucose monitoring (BGM), diet, and exercise are often identified as

health-promoting behaviors. Hemoglobin A1c (A1c) and body mass index (BMI) are frequently reported health outcomes of diabetes management.

Diabetes management includes BGM as a critical component of clinical decision-making. According to the American Diabetes Association's 1996 consensus statement on BGM, healthcare professionals should use this data to make clinical decisions concerning nutritional and pharmacological management of diabetes and to teach patients how to make self-care management decisions (Kalergis, Nadeau, Pacaud, Yared, & Yale, 2006).

Exercise has long been recognized as an essential component of diabetes management. Diabetes practitioners have established exercise as one of the four cornerstone of care, along with diet, medication, and monitoring. Exercise appears to aid in the loss of visceral fat. More recent research suggests that exercise may exert favorable effects on emerging vascular disease risk factors. Exercise may also play a protective role by increasing patient resilience to the emotional stress and depression often experienced with diabetes management (Zacker, 2004).

Body Mass Index (BMI) and body fat distribution are both recognized as strong predictors of obesity-related health risks, notably type 2 diabetes. The BMI scale is used to classify whether individuals are underweight (<18.5), normal weight (18.5 - 24.9), overweight (25.0 - 29.9), or obese (30 or greater) (Lau, 2007). Nearly 90% of individuals with type 2 diabetes are overweight or obese. The American Diabetes Association has stated that modest weight loss and reduced energy intake will help insulin-resistant individuals improve their glycemic control (Boucher, Benson, Kovarik, Solem, & Van Wormer, 2007). Achieving an ideal BMI has been recommended for patients with diabetes. Diet and exercise both contribute to the loss of weight, which reduces BMI

(Franz, 2007). A weight loss of as little as 5-10% of initial weight can improve weight-related complications such as hypertension, dyslipidemia, and type 2 diabetes, even if the person is still considered overweight. Unfortunately, dieters may not be satisfied with such modest goals and sometimes conclude that a desirable weight loss is unachievable (Kazaks & Stern, 2003). Franz (2007) states that although a reduction of BMI has been associated with an improvement in diabetes, it is unclear if the weight loss itself is associated with a reduction in A1c levels or if it is from the dietary changes of a decrease in total energy intake.

Plotnikoff, Karunamuni, Taylor, & Schmidt (2009) explored the relationship between dietary behaviors, BMI, and exercise. A statistically significant effect was found for both BMI and exercise for participants who reported more fruit and vegetable consumption. The practice of the dietary behavior was associated with lower BMI and an increase in exercise frequency. This study demonstrated that the health-promoting behavior of diet can be related with another health-promoting behavior and a health outcome.

Williams-Piehota et al. (2009) explored the relationship between age, gender, support, BMI, and exercise. A significant relationship was found between the predictor variables and exercise. An increase in exercise was related to being younger, being male, having a lower BMI, and having support from provider in finding a place to exercise.

Diedrich, Munroe, & Romano (2010) explored the effect of an exercise program on weight, body fat, A1c levels, and blood pressure. The participants who completed the program demonstrated a significant decrease in weight, body fat, A1c, and in their diastolic blood pressure. The participants also demonstrated an increase in their daily steps as indicated by a pedometer. This study demonstrated that the health-promoting

behavior of exercise can be related with the health outcome of A1c, and the loss of weight and body fat could be interpreted as an improvement in the health outcome of BMI.

Sometimes a thorough educational program focusing on the self-management skills involved in diabetes is the best predictor of health-promoting behaviors and health outcomes. Castillo et al. (2010) explored the effect of a diabetes empowerment education program on diet, exercise, BGM, depression, and A1c levels. A significant effect was found on all the variables from the diabetes empowerment program. A significant increase in dietary behaviors, exercise, and BGM was found while a significant decrease in reported depression and A1c levels were noted. Vallis, Higgins-Bowser, Edwards, Murray, & Scott (2005) explored the effect of a diabetes self-management education program on BGM, diet, exercise, and A1c levels. A significant effect was found on all the variables from the diabetes self-management education program. A significant increase in BGM, dietary behaviors, and exercise was found while significant decreases in A1c levels were noted.

Many research studies have explored various factors which might be associated with adherence to health-promoting behaviors, but they do not always reach significance. It is logical that an increase in adherence behaviors in diabetes care should yield an improvement in health outcomes, but this relationship was not often explored in the literature or no significant relationship was found. More often the relationship of various predictors and adherence behaviors are explored or the relationship of predictors and health outcomes is studied.

Summary

These various studies demonstrate that although the relationship between personal factors, perceived barriers, social support, depression, adherence to diabetes health-promoting behaviors, and health outcomes have been explored, there are very few studies which simultaneously explore all of these predictors to determine the individual or cumulative effect. There is also very little consistency in the study findings except perhaps for the variable of participant age. Variation in sample sizes, instruments that were used, and variables that were explored would explain this lack of consistency in the literature. Research is needed to determine if there is a direct relationship between the predictor variables and health outcomes, and whether there is a direct relationship between the health-promoting behaviors and the health outcomes.

Chapter III

Methodology

This chapter describes the methodology involved in the completion of this study. The following sections are included: study design, sample, protection of human subjects, instrument, measures, and data analysis.

Study Design

A descriptive correlational analysis was performed utilizing secondary data to explore the relationship between various determinant factors and patient adherence to health-promoting behaviors and health outcomes in individuals with diabetes. Health-promoting behaviors included blood glucose monitoring, diet, and exercise. Health outcomes included hemoglobin A1c (A1c) measurements and calculated body mass index (BMI). The data came from the National Health and Nutrition Examination Survey (NHANES) from 2007-2008. Participants in this study were asked to complete a series of questionnaires on their personal factors, perceptions of their health, and their various health practices. Participants also received standardized physical examinations to assess body measurements including height and weight, and laboratory analysis was performed to measure A1c levels. The data from an extremely large sample of over 10,000 participants in this study was reduced to a final sample size of 713, which only included those participants who reported a past diagnosis of diabetes.

NHANES

The NHANES is a program of studies used to assess the health and nutritional status of adults and children in the U.S. (U.S. Department of Health and Human Services, 2007). The survey is unique because it combines interviews and physical examinations.

The NHANES is a major program of the National Center for Health Statistic (NCHS), which is part of the Centers for Disease Control and Prevention (CDC). The survey has become a continuous program which has a changing focus on a variety of health and nutrition measurements to address emerging needs. The survey examines a nationally representative sample of about 5000 persons each year. These persons are located in counties across the country. The sample for the survey is selected to represent the U.S. population of all ages, and to produce reliable health-related statistics, persons over 60 years and older; African Americans, and Hispanics are over-sampled (U.S. Department of Health and Human Services, 2007). The data from the NHANES 2007-2008 study was accessed and downloaded from the NHANES web site located at http://www.cdc.gov/nchs/nhanes/nhanes2007-2008/nhanes07_08.htm.

Sample

Participants for the NHANES study were recruited from the civilian noninstitutionalized population of the U.S.. The desired sample size of the final data set used for this study was one that would ensure a statistical power of 0.80 with a moderate effect size. To determine a minimum acceptable sample size, Nunnally and Bernstein (1994) state “you should have 10 subjects per predictor in order to even hope for a stable prediction equation” (p. 201). Since there were a total of 12 variables in this study, a target sample size of 120 was established. The complete sample of individuals diagnosed with diabetes was 713 and the smallest sample size of the multivariate analyses that were performed for this study was 364, so the minimum sample size for statistical significance was achieved.

Protection of Human Subjects

Approval of the NHANES study procedures and the verification of the protection of human subjects for the participants of the study was performed by the Research Ethics Review Board at the National Center for Health Statistics. Selected individuals who agreed to participate in the study were asked to sign an Interview Consent Form before beginning the household survey. Participants were then asked to sign a second informed consent form before submitting to the health examination component. Approval of the use of the NHANES data for this study was obtained from the Georgia State University IRB, as noted in Appendix B.

Instrument

The NHANES study entailed participants completing a health interview questionnaire and a physical exam that included various body measurements and laboratory analyses. Health interviews were often administered by laptop computer in the participant's home and the physical exam was conducted in mobile trailers that were brought to the participant's community.

Measures

The following variables were used in the analysis for this study. They were obtained from the NHANES data set utilizing the following procedures. These variables have been categorized in the constructs of the HPM.

Personal Factors

The following variables are categorized under the construct of Personal Factors.

Age. NHANES study participants were asked to self report their age in years. The age values ranged from 20 to 80 within the 713 participants who identified as being diagnosed with diabetes. Due to the small number of participants in their 80s, the participants who reported being over 80 years in age were grouped with the participants who reported an age of 80 by the NHANES researchers. The total number of participants within the sample of 713 who were age 80 or over was 72 or 10.1% of the sample. The variable "age" was used as a personal factor in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Weight. NHANES study participants received body measurements including weight. The weight measurements were reported in kilograms and these values were used in the direct calculation of body mass index by the NHANES researchers. Weight measurements were converted from kilograms to pounds by the researcher for reporting purposes. This conversion was performed by multiplying the kilogram value by a factor of 2.2 using SPSS 14.0. Weights were reported in pounds and ranged from 92.2 to 444.0 pounds among the 689 participants who self-identified as being diagnosed with diabetes. The variable "weight" was used as a personal factor in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Perceived Health Status. NHANES study participants were asked to rate their general health condition using a 5-point Likert scale indicating excellent, very good, good, fair, and poor. These values were reverse scored by the researcher and used to represent the variable perceived heath status in the study where a value of 1 indicated poor and a value of 5 indicated excellent. The reported health status values ranged from 1 through 5 among the 659 participants who identified as being diagnosed with diabetes.

The variable "perceived health status" was used as a personal factor in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Length of Diabetes Diagnosis. NHANES study participants were asked to report their age at the time when they were first diagnosed with diabetes. The researcher calculated length of diabetes diagnosis by subtracting the participants' reported age when they were diagnosed with diabetes from the participants' reported age. The calculated length of diabetes diagnosis values ranged from 0 to 70 years in the sample of 713 participants. Participants who reported being diagnosed at the same age that they completed the NHANES study have a value of 0 years for their length of diabetes diagnosis. The total number of participants in the sample of 713 with a calculated value of 0 years for length of diabetes diagnosis is 44 or 6.2%. The variable "length of diabetes diagnosis" was used as a personal factor in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Perceived Barriers to Action

The following variables are categorized under the construct of Perceived Barriers to Action.

Number of Barrier Days. NHANES study participants were asked to answer four items in the current health status survey that addressed poor physical health, poor mental health, inactivity due to poor health, and pain that made usual activities difficult. The participants were asked to report the total number of days, out of the previous 30 days, that they experienced problems related to the four items. The researcher calculated the variable "number of barrier days" by taking the mean of the participant's responses from

these four items. The calculated number of barrier day values ranged from 0 to 30 in the sample of 657 participants who identified as being diagnosed with diabetes. The variable "number of barrier days" was used as a perceived barrier to action in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Interpersonal Influences

The following variables are categorized under the construct of Interpersonal Influences.

Social Support. NHANES study participants were asked to answer three items in the social support survey that addressed availability of someone to provide emotional support, whether the participant felt a need for more support within the past year, and to rate how much additional support was needed. The researcher calculated the variable "social support" by weighting the responses of these three items to create a possible score ranging from 1 through 5, where a value of 1 indicates minimal support and a value of 5 indicates maximal support. Participants who reported having no one to provide emotional support received a score of 1. Participants who reported having someone to provide emotional support and who did not feel a need for more support within the past year received a score of 5. Participants who reported having someone to provide emotional support and who felt a need for more support within the past year received a score of either 2, 3, or 4. Participants who reported needing a great deal more support within the past year received a score of 2, while participants who reported needing only a moderate or small amount of additional support within the past year received a score of 3 or 4 respectively. The calculated support values ranged from 1 to 5 in the sample of 651

participants who identified as being diagnosed with diabetes. The variable "social support" was used as an interpersonal influence in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Situational Influences

The following variables are categorized under the construct of Situational Influences.

Depressive Symptoms. NHANES study participants were asked to answer ten items in the depression survey that addressed level of interest in doing things, feeling down, sleeping too little or too much, feeling tired, poor appetite, feeling bad, difficulty in concentrating, moving or speaking too slowly or too fast, feeling they would be better off dead, and reporting difficulty that the above problems have caused. The participants were asked to rate the frequency that they experienced the problems in each item within the previous two weeks using a scale of 0 through 3 indicating none, several, more than half, and nearly every day. The researcher calculated the variable "depressive symptoms" by recoding each item response from 0 to 3 to a new value of 1 to 4 and then taking the sum of the ten items to create a possible score ranging from 10 to 40, where a value of 10 indicates minimal depressive symptoms and a value of 40 indicates maximal depressive symptoms. The calculated number of depressive symptoms values ranged from 11 to 37 in the sample of 465 participants who identified as being diagnosed with diabetes. The variable "depressive symptoms" was used as a situational influence in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Health-Promoting Behavior

The following variables are categorized under the construct of Health-Promoting Behavior.

Blood Glucose Monitoring Adherence. NHANES study participants were asked to self report the frequency that they tested their blood glucose level. Most participants reported this frequency as a "per day" value, however some were also reported as either "per week", "per month", or "per year". The researcher converted the daily, monthly, and yearly frequencies into weekly frequencies for consistency and reporting purposes; the mean weekly frequency that participants tested their blood glucose level was considered to be their blood glucose monitoring (BGM) adherence. The researcher converted the daily frequencies into weekly frequencies by multiplying by a factor of 7 using SPSS 14.0. The researcher converted the monthly frequencies into weekly frequencies by dividing the value by a divisor of 4.34 using SPSS 14.0. The researcher converted the yearly frequencies into weekly frequencies by dividing the value by a divisor of 52 using Statistical Package for the Social Sciences 14.0. The calculated BGM adherence values ranged from .02 to 42 times per week in the sample of 594 participants who identified as being diagnosed with diabetes. The variable "BGM" was used as a health-promoting behavior in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Diet Adherence. NHANES study participants were asked to answer eleven items in the weight history survey that addressed their participation in various behaviors related to weight loss. The participants were asked to answer the same eleven items a second

time to address their participation in those same behaviors related to maintaining their current weight. The behaviors included eating less food, eating lower calorie foods, eating less fat, skipping meals, eating diet foods, using liquid diet formulas, following a special diet, eating fewer carbohydrates, eating more fruits & vegetables & salads, changing eating habits, and eating less sugar & candy & sweets. The participants simply answered yes or no as to their engagement in each behavior. The researcher assigned a single point to each behavior that the participant acknowledged engagement and then took the sum of the points to calculate a possible score ranging from 0 to 22, where a value of 0 indicates no diet adherence and a value of 22 indicates maximal diet adherence. The calculated diet adherence values ranged from 0 to 6 in the sample of 713 participants who identified as being diagnosed with diabetes. The variable "diet" was used as a health-promoting behavior in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Exercise Adherence. NHANES study participants were asked to answer ten items in the physical activity survey that addressed their frequency of engagement in moderate and vigorous work activity, moderate and vigorous recreational activity, and walking/bicycling for transportation. The items assessed the number of minutes per day and the number of days per week for each activity. The researcher calculated the exercise adherence variable by multiplying the values of the number of minutes per day for each activity with the value of the number of days per week for the respective activity, and then taking the sum of the products as a total number of minutes per week of exercise. It should be noted that the value of minutes of vigorous work activity and minutes of vigorous recreational activity were doubled per the suggestion of the NHANES

researchers before being included in the total sum of minutes of weekly exercise which represents the exercise adherence variable. The calculated exercise adherence values ranged from 0 to 5400 minutes per week in the sample of 706 participants who identified as being diagnosed with diabetes. The variable "exercise" was used as a health-promoting behavior in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Body Mass Index. NHANES study participants received body measurements including height and the previously mentioned weight. The height measurements were reported in centimeters and these values were used in the direct calculation of body mass index by the NHANES researchers. Body mass index (BMI) values were calculated by the NHANES researchers using the formula of weight in kilograms divided by the squared value of the height in centimeters. BMI values ranged from 19.3 to 67.3 in the 690 participants who identified as being diagnosed with diabetes. Height measurements were converted from centimeters to inches by the researcher for standard reporting purposes for this study. This conversion was performed by dividing the centimeter value by a divisor of 2.54 using SPSS 14.0. The variable "BMI" was used as a health outcome in the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Hemoglobin A1c. NHANES study participants received laboratory analysis including Glycohemoglobin percentage measurements, also referred to as A1c level. Analysis was completed with the use of a Tosoh A1c 2.2 Plus Glycohemoglobin Analyzer. The A1c values ranged from 4.6 to 15.2 in the 662 participants who identified as being diagnosed with diabetes. The variable "A1c" was used as a health outcome in

the study design. Appendix C demonstrates how the variable information was obtained NHANES dataset.

Data Analysis

The data sets for this study were downloaded from the CDC NHANES website in the form of SAS (Statistical Analysis System) .xpt file format. The files were then converted into SPSS data files using SAS Version 8 software. A total of 10 data files were merged into a single data file using the common participant identification number as the linking variable. The merged data file in SPSS format was analyzed with SPSS release 14.0 software. Variable calculation, conversion, and recoding were all performed as previously discussed in the Measures section of this chapter. Frequencies and descriptive statistics were run on demographic and other variables used for analysis. Linear multiple regression analyses were then performed using five different models to test each of the three health-promoting behavior variables of BGM, diet, and exercise and the two health outcome variables of A1c and BMI.

Summary

This chapter described the methodology involved in the completion of this study utilizing secondary data from the NHANES study. The following sections were included: study design, sample, protection of human subjects, instrument, measures, and data analysis. A power analysis was also included.

Chapter IV

Results

This chapter presents the results of this descriptive, correlational study to explore the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (support), situational influences (depressive symptoms), and patient adherence to health-promoting behaviors (blood glucose monitoring, diet, and exercise) and overall health outcomes (A1c and body mass index) in a diabetes self-care regimen. A description of the sample and the results of the research questions are reported.

Sample Characteristics

From an initial data set of over 10,000 participants originally in the NHANES study, 713 individuals reported that they had been diagnosed with diabetes. These individuals comprised the sample that was used for analysis in this chapter. Table 4-1 shows the mean and standard deviation of the participants' age and a summary of the frequency distributions by gender for ethnicity, education, marital status, annual household income, and perceived health status.

Approximately half of the participants were female (50.8%); the mean age of the sample was 62.2 years (*SD* = 12.94). Participant age ranged from 20 to 80 years. Although white participants (39.7%) comprised the largest racial group, more than half of the participants (57.5%) were either Black or Hispanic which represents part of the populations often affected by diabetes. Almost half of the male participants (45.5%) were white. More than half of the participants (55.9%) had obtained at least a high school diploma or equivalent, and over a third of the male participants (34.4%) reported

having either some college or being college graduates. More than half of the participants (56.2%) reported being married or living with a partner. Two thirds of the male participants (67.1%) were married and one quarter of the female participants (25.7%) were widowed. Approximately half of the participants (50.8%) reported an annual household income of less than $35,000, although more than a quarter of the male participants (26.5%) reported a salary of $55,000 or more. The majority of the participants (68.7 %) reported a perceived health status of either fair or good, with 10.7% reporting a perception of poor health. More than half of the male participants (51.2%) reported a perception of good health or better.

Descriptive Statistics for Major Study Variables

Table 4-2 shows the bivariate correlations between all of the predictor variables of age, perceived health status, length of diagnosis, weight, perceived barrier days, social support, depressive symptoms and the health-promoting behaviors of BGM, diet, exercise, and the health outcome variables of A1c and BMI. Many significant relationships were found between these variables. Notably there were significant relationships found between the predictor variables of perceived health status and perceived barrier days and the health-promoting behavior of BGM. Perceived health status was negatively correlated with BGM [r (547) = -.106, p = .013]. Participants who perceived better health performed BGM less frequently each week. Perceived barrier days was positively correlated with BGM [r (545) = .170, p < .001]. Participants experiencing more barrier days performed BGM more frequently each week. A significant relationship was found between the variables of age, length of diagnosis, and diet and the outcome of BMI. Age was negatively correlated with BMI [r (690) = -.228,

$p < .001$]. Older participants were found to have lower BMI values. Length of diagnosis was negatively correlated with BMI [r (690) = -.087, $p = .022$]. Participants diagnosed with diabetes for a longer period of time were found to have a lower BMI. Diet was positively correlated with BMI [r (690) = .300, $p < .001$]. Participants engaging in diet management behaviors were found to have a higher BMI. A significant relationship was also found and between the variable of age and the outcome of A1c. Age was negatively correlated with A1c [r (662) = -.140, $p < .001$]. Older participants were found to have lower A1c values. Some of the directions of these correlations were unexpected and warranted further investigation. The correlations demonstrate the potential for these demographic variables to be used to predict the likelihood of health-promoting behaviors and health outcomes associated with a diabetes care regimen. The relationship of these variables was further investigated using linear multiple regression models to predict the health promoting behaviors of BGM, diet, exercise, and the health outcomes of A1c and BMI.

Table 4-3 shows the means and standard deviations and Table 4-4 shows the frequency distributions for participants' personal factors of weight, length of diabetes diagnosis, and perceived health status. Weight ranged from 92.2 to 444 pounds, with a mean of 197.5 pounds (*SD* = 51.8). The body weight variable is a personal factor of the participants and is not an indicator of participant preferred weight range. The variable of BMI will be discussed later in this chapter. Length of diabetes diagnosis ranged from less than one year to 70 years, with a mean duration of 11.9 years (*SD* = 12.0) and a median of 9.0 years. More than half of the participants (59.5%) reported having diabetes

Table 4-1

Subject Characteristics (N=713)

Characteristic	Male		Female		Total	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Age (years)	62.2	12.58	62.3	13.30	62.2	12.94

Characteristic	Male		Female		Total	
	n	*(%)*	*n*	*(%)*	*n*	*(%)*
Gender	351	(49.2)	362	(50.8)	713	(100.0)
Race/Ethnicity						
Black	96	(27.4)	118	(32.6)	214	(30.0)
Hispanic	87	(24.8)	109	(30.1)	196	(27.5)
Other or Multi Racial	8	(2.3)	12	(3.3)	20	(2.8)
White	160	(45.5)	123	(34.0)	283	(39.7)

(Table 4-1 Continues)

(Table 4-1 Continued)

Characteristic	Male		Female		Total	
	n	*(%)*	*n*	*(%)*	*n*	*(%)*
Education						
Less than 9th Grade	75	(21.4)	78	(21.5)	153	(21.5)
9-12th Grade—No Diploma	81	(23.1)	80	(22.1)	161	(22.6)
High School Graduate/GED	74	(21.1)	95	(26.2)	169	(23.7)
Some College or AA Degree	70	(19.9)	82	(22.7)	152	(21.3)
College Graduate or Above	51	(14.5)	27	(7.5)	78	(10.9)
Marital Status						
Married	235	(67.1)	146	(40.3)	381	(53.4)
Widowed	25	(7.1)	93	(25.7)	118	(16.6)
Divorced	38	(10.8)	60	(16.6)	98	(13.8)
Separated	12	(3.4)	21	(5.8)	33	(4.6)
Never Married	31	(8.8)	32	(8.8)	63	(8.8)
Living with Partner	10	(2.8)	10	(2.8)	20	(2.8)

(Table 4-1 Continues)

(Table 4-1 Continued)

Characteristic	Male		Female		Total	
	n	*(%)*	*n*	*(%)*	*n*	*(%)*
Annual Household Income *(n=631)*						
$0 to $14,999	56	(16.0)	83	(22.9)	139	(19.5)
$15,000 to $34,999	115	(32.8)	108	(29.8)	223	(31.3)
$35,000 to $54,999	52	(14.8)	62	(17.1)	114	(16.0)
$55,000 to $74,999	39	(11.1)	23	(6.4)	62	(8.7)
$75,000 to $99,999	22	(6.3)	22	(6.1)	44	(6.2)
$100,000 and Over	32	(9.1)	17	(4.7)	49	(6.9)
Perceived Health Status *(n=659)*						
Poor	35	(10.0)	41	(11.3)	76	(10.7)
Fair	111	(31.6)	141	(39.0)	252	(35.3)
Good	123	(35.0)	115	(31.8)	238	(33.4)
Very Good	45	(12.8)	32	(8.8)	77	(10.8)
Excellent	12	(3.4)	4	(1.1)	16	(2.2)

Table 4-2

Bivariate Correlations

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	1	-.040	.202**	-.260**	-.006	.088*	-.118*	-.089*	-.127**	-.224**	-.140**	-.228**
2. Health Status		1	.006	-.056	-.389**	.120**	-.352**	-.106*	.032	.172**	-.054	-.168**
3. Length of Diagnosis			1	-.064	.006	.054	-.032	.149**	-.044	-.058	.109**	-.087*
4. Weight				1	.098*	.064	.044	.090*	.284**	.031	-.019	.868**
5. Barrier Days					1	-.128**	.567**	.170**	-.050	-.110**	-.021	.163**
6. Social Support						1	-.286**	.017	.021	-.004	-.055	.018
7. Depressive Symptoms							1	.051	-.081	-.072	-.100*	.101*
8. BGM								1	.018	-.003	.075	.082*
9. Diet Management									1	.052	.004	.300**
10. Exercise										1	.030	-.061
11. A1c											1	-.030
12. BMI												1

**p* < .05 ***p* < .01

for 10 years or less. Perceived health status ranged from 1 to 5, with a mean of 2.5 (*SD* = 0.9). Participants reported fair to good health.

Table 4-3 presents the means and standard deviations and Table 4-4 presents the frequency distributions for the influence and perceived barriers variables of social support, depressive symptoms, and number of barrier days. Social support ranged from 1 to 5, with a mean score of 4.2 (*SD* = 1.4). The majority of the participants reported high levels of social support. Internal consistency was determined on the scale that was used to calculate depressive symptoms. The alpha coefficient of the scale was .81 and the depressive symptoms score ranged from 11 to 37, with a mean score of 16.0 (*SD* = 5.2) and a median score of 14.0. The majority of the participants in this study reported low levels of depressive symptoms. Number of barrier days, which represents the calculated number of days that participants reported having difficulty performing usual tasks within a 30 day period, ranged from 0 through 30, with a mean of 5.2 days (*SD* = 7.0) and a median of 1.7 days of reported difficulty. Over half of the participants (53.1%) reported having no more than 2 barrier days out of a 30 day period.

Table 4-3 presents the means and standard deviations and Table 4-4 presents the frequency distributions for the health-promoting behaviors of blood glucose monitoring, diet, and exercise. BGM ranged from less than one to 42 times per week, with a mean of 8.9 times per week (*SD* = 8.1) and a median of 7.0 times per week. Participants on average measured their blood glucose more than once per day. Internal consistency was determined on the scale that was used to calculate diet management. The alpha coefficient of the scale, which was equivalent to the Kuder-Richardson 20 coefficient, was .60 and the diet management score, which is represented by the calculated score

indicating the number of diet management behaviors practiced by the participants, ranged from 0 through 6, where the number represents the average number of different diet management behaviors that the participant reported practicing. A mean number of 1.2 behaviors (SD = 1.5) and a median number of 1.0 behaviors indicated that over half of the participants (63.8%) reported practicing only one type of diet management behavior or less. Exercise ranged from 0 to 5400 minutes per week, with a mean of 356.7 minutes (*SD* = 766.6) and a median of 17.5 minutes per week. More than half of the participants (56.9%) reported exercising 60 minutes or less per week.

Table 4-3 presents the means and standard deviations and Table 4-4 presents the frequency distributions for the health outcome variables of A1c and BMI. A1c values ranged from 4.6% to 15.2%, with a mean A1c of 7.3% (*SD* = 1.7) and a median A1c of 6.9%. More than half of the participants (52.1%) had a A1c of 6.9% which indicated their blood glucose levels were in good control. BMI values ranged from 19.3 through 67.3, with a mean BMI of 32.5 (SD = 7.4) and a median BMI of 31.2. More than half of the participants (59.0%) had a BMI over 30 which indicated obesity.

Table 4-3

Subject Characteristics (N=713)

Personal Factors	*M*	*(SD)*	Range
Body Weight (in pounds)	197.5	51.8	92.2 – 444.0
Length of Diabetes Diagnosis (years)	11.9	12.0	0 – 70
Perceived Health Status *(n=659)*	2.6	0.9	1 – 5

(Table 4-3 Continues)

(Table 4-3 Continued)

Perceptions	*M*	*(SD)*	Range
Social Support Score *(n=651)*	4.2	1.4	1 – 5
Depressive Symptoms Score *(n=465)*	16.1	5.3	11 – 37
Number of Barrier Days *(n=657)*	5.2	7.0	0 – 30
Health Promoting Behaviors	*M*	*(SD)*	Range
Blood Glucose Monitoring (per week) *(n=594)*	8.9	8.1	0.1 – 42
Diet Management Score	1.2	1.5	0 – 6
Exercise (minutes per week) *(n=706)*	356.7	766.6	0 – 5400
Health Outcomes	*M*	*(SD)*	Range
Hemoglobin A1c (%) *(n=662)*	7.3	1.7	4.6 – 15.2
Body Mass Index *(n=690)*	32.5	7.4	19.3 – 67.3

Table 4-4

Subject Characteristics (N=713)

Characteristic	*n*	*(%)*
Length of Diabetes Diagnosis		
0 – 5 years	260	(36.5)
6 – 10 years	164	(23.0)
11 – 15 years	113	(15.8)
16 – 25 years	104	(14.6)
26 – 40 years	49	(6.9)
41 – 55 years	12	(1.7)
56 – 70 years	11	(1.5)
Perceived Health Status *(n=659)*		
Poor	76	(10.7)
Fair	252	(35.3)
Good	238	(33.4)
Very Good	77	(10.8)
Excellent	16	(2.2)
Social Support Score *(n=651)*		
1	79	(11.1)
2	35	(4.9)
3	43	(6.0)
4	38	(5.3)
5	456	(64.0)

(Table 4-4 Continues)

(Table 4-4 Continued)

Characteristic	*n*	*(%)*
Depressive Symptoms Score *(n=465)*		
11 - 15	282	(39.5)
16 - 20	101	(14.1)
21 - 25	43	(6.0)
26 - 37	39	(5.4)
Number of Barrier Days *(n=657)*		
0 - 5	430	(60.3)
6 - 10	99	(13.9)
11 - 15	57	(8.0)
16 - 20	34	(4.8)
21 - 30	37	(5.2)
Blood Glucose Monitoring (per week) *(n=594)*		
0 - 3	188	(26.4)
4 - 7	211	(29.6)
8 - 14	113	(15.8)
15 - 21	47	(6.6)
22 - 42	35	(4.9)
Diet Management Score		
0	345	(48.4)
1	110	(15.4)
2	107	(15.0)
3	75	(10.5)
4	52	(7.3)
5	17	(2.4)
6	7	(1.0)

(Table 4-4 Continues)

(Table 4-4 Continued)

Characteristic	*n*	*(%)*
Exercise (minutes per week) *(n=706)*		
0 - 30	377	(52.9)
30 - 45	3	(0.4)
46 - 60	22	(3.1)
61 - 90	20	(2.8)
91 - 120	30	(4.2)
>2 hours – 8 hours	113	(15.8)
>8 hours – 16 hours	63	(8.8)
>16 hours	78	(10.9)
Hemoglobin A1c (%) *(n=662)*		
4.6 – 6.0	128	(18.0)
6.1 – 7.0	235	(33.0)
7.1 – 8.0	139	(19.5)
8-1 – 10.0	113	(15.8)
>10.0	47	(6.6)
Body Mass Index *(n=690)*		
25.0 – 30.0	188	(26.4)
30.1 – 35.0	189	(26.5)
35.1 – 40.0	114	(16.0)
40.1 – 45.0	53	(7.4)
> 45.1	42	(5.9)

Relationships between Independent Variables and Health Behaviors and Outcomes

Research Question One. Table 4-5 presents the findings for the exploration of the relationship between personal factors (age, health status, length of diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (support), situational influences (depressive symptoms), and adherence to blood glucose monitoring. A linear multiple regression indicated that the overall model significantly predicted the dependent variable, adherence to blood glucose monitoring, $R^2 = .076$, $R^2_{adj} = .060$, $F\ (6, 363) = 4.875$, $p < .001$. The model accounted for 6% of the variance of the dependent variable, adherence to blood glucose monitoring. The β weights indicated that two predictor variables, length of diagnosis, ($\beta = .164$, $t_{(363)} = 3.164$, $p < .01$), and number of barrier days, ($\beta = .204$, $t_{(363)} = 3.198$, $p < .01$) significantly contributed to the model. The model predicted that for each additional year of diabetes diagnosis, the participant is likely to increase their frequency of blood glucose monitoring by 0.1 times per week. It also predicted that for each additional barrier day, the participant is likely to increase their frequency of blood glucose monitoring by 0.2 times per week. Having diabetes longer and experiencing more barrier days were associated with more blood glucose monitoring.

Research Question Two. Table 4-6 presents the findings for the exploration of the relationship between personal factors (age, health status, length of diagnosis, weight), perceived barriers to action (number of barrier days), interpersonal influences (support), situational influences (depressive symptoms), and adherence to diet. A linear multiple regression indicated that the overall model significantly predicted the dependent variable, adherence to diet, $R^2 = .097$, $R^2_{adj} = .081$, $F\ (7, 413) = 6.209$, $p < .001$. The model

Table 4-5

Multiple Linear Regression for Variables Associated with Blood Glucose Monitoring N=364

Regression Variable	*B*	*SE B*	*β*
Personal Factors			
Age	-.033	.040	-.043
Perceived Health Status	-.791	.526	-.084
Length of Diagnosis	.115	.036	.164**
Perceptions and Influences			
Social Support Score	.252	.327	.042
Depressive Symptoms Score	-.117	.104	-.074
Number of Barrier Days	.218	.068	.204**
R^2		0.076	
Adjusted R^2		0.060	
F (p-value for model)		4.875 (p < .001)	

** p < .05   ** p < .01*

accounted for 8% of the variance of the dependent variable, adherence to diet. The β weights indicated that one predictor variable, body weight, (β = .289, $t_{(413)}$ = 5.925, *p* < .001), significantly contributed to the model. The model predicted that for each additional pound of body weight, the participant is likely to increase their practice of diet management by an additional .008 behaviors, which translates to for every 125 pounds of body weight, the participant is likely to increase their practice of diet management by an

Table 4-6

Multiple Linear Regression for Variables Associated with Diet Management Score N=414

Regression Variable	*B*	*SE B*	*β*
Personal Factors			
Age	-.005	.007	-.035
Perceived Health Status	.070	.090	.040
Length of Diagnosis	.000	.006	-.002
Body Weight	.008	.001	.289**
Perceptions and Influences			
Social Support Score	-.032	.053	-.029
Depressive Symptoms Score	-.024	.017	-.083
Number of Barrier Days	-.008	.012	-.041
R^2		0.097	
Adjusted R^2		0.081	
F (p-value for model)		6.209 ($p < .001$)	

* $p < .05$ ** $p < .01$

additional 1.0 behavior. Weighing more was associated with increased diet management practice.

Research Question Three. Table 4-7 presents the findings for the exploration of the relationship between personal factors (age, health status, length of diagnosis, weight), perceived barriers to action (number of barrier days), interpersonal influences (support),

Table 4-7

Multiple Linear Regression for Variables Associated with Exercise
N=413

Regression Variable	*B*	*SE B*	*β*
Personal Factors			
Age	-10.624	3.647	-.148**
Perceived Health Status	96.021	45.930	.111*
Length of Diagnosis	-4.029	3.292	-.061
Body Weight	.403	.719	.028
Perceptions and Influences			
Social Support Score	-9.413	27.102	-.018
Depressive SymptomsScore	-.126	8.873	-.001
Number of Barrier Days	-8.251	6.068	-.084
R^2		0.054	
Adjusted R^2		0.038	
F (p-value for model)		3.307 (p < .01)	

* *p < .05* ** *p < .01*

situational influences (depressive symptoms), and adherence to exercise. A linear multiple regression indicated that the overall model significantly predicted the dependent variable, adherence to exercise, $R^2 = .054$, $R^2_{adj} = .038$, $F\ (7, 412) = 3.307$, $p < .01$. The model accounted for 3.8% of the variance of the dependent variable, adherence to

exercise. The β weights indicated that two predictor variables, age, ($\beta = -.148$, $t_{(412)} = -2.913$, $p < .01$), and perceived health status, ($\beta = .111$, $t_{(412)} = 2.091$, $p < .05$) significantly contributed to the model. The model predicted that for each additional year of age, the participant was likely to decrease their exercise by 10.6 minutes per week; it also indicated that for each additional level of perceived health status, the participant was likely to exercise an additional 96.0 minutes per week. Being younger and feeling more healthy were associated with more exercise.

Research Question Four. Table 4-8 presents the findings for the exploration of the relationship between personal factors (age, length of diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (support), health-promoting behaviors (diet, exercise), and A1c level. A linear multiple regression indicated that the overall model significantly predicted the dependent variable, A1c level, $R^2 = .054$, $R^2_{adj} = .044$, $F\,(6, 568) = 5.391$, $p < .001$. The model accounted for 4% of the variance of the dependent variable, A1c level. The β weights indicated that two predictor variables, age, ($\beta = -.202$, $t_{(568)} = -4.689$, $p < .001$), and length of diagnosis, ($\beta = .144$, $t_{(568)} = 3.445$, $p < .01$) significantly contributed to the model. The model predicted that for each additional year of age, the participant's A1c level is likely to decrease by 0.03%; it also indicated that for each additional year of diabetes diagnosis, the participant's A1c level is likely to increase by 0.02%. Being younger and having diabetes longer were associated with higher A1c levels.

Research Question Five. Table 4-9 presents the findings for the exploration of the relationship between personal factors (age, length of diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (support), health-promoting

Table 4-8

Multiple Linear Regression for Variables Associated with Hemoglobin A1c N=569

Regression Variable	*B*	*SE B*	*β*
Personal Factors			
Age	-.032	.007	-.202**
Length of Diagnosis	.020	.006	.144**
Perceptions and Influences			
Social Support Score	-.054	.049	-.046
Number of Barrier Days	-.010	.010	-.041
Health Promoting Behaviors			
Diet Management Score	.009	.046	.008
Exercise	.000	.000	-.009
R^2		0.054	
Adjusted R^2		0.044	
F (p-value for model)		5.391 (p < .001)	

* $p < .05$ ** $p < .01$

behaviors (diet, exercise), and BMI. A linear multiple regression indicated that the overall model significantly predicted the dependent variable, BMI, $R^2 = .149$, $R^2_{adj} = .140$, $F\,(6, 581) = 16.764$, $p < .001$. The model accounted for 14% of the variance of the dependent variable, BMI. The β weights indicate that three predictor variables, age, ($\beta = -.169$, $t_{(581)} = -4.205$, $p < .001$), number of barrier days, ($\beta = .187$, $t_{(581)} = 4.776$, $p < .001$),

and diet, ($\beta = .270$, $t_{(581)} = 6.940$, $p < .001$) significantly contributed to the model. The model predicted that for each additional year of age, the participant's BMI is likely to decrease by 0.1; it predicted that for each additional barrier day, the participant's BMI is likely to increase by 0.1; and it indicated that for each additional diet management behavior that is practiced, the participant's BMI is likely to increase by 1.2. Being younger, experiencing more barrier days, and more diet management were associated with a higher BMI.

Summary

These results demonstrate the significant relationship between the personal factor variables (age, health status, length of diagnosis, weight), the perceived barriers variable (number of barrier days), and the health promoting behavior variables (blood glucose monitoring, diet, exercise). A significant relationship was also found between two of the personal factor variables (age, length of diagnosis), the perceived barriers variable, number of barrier days, one of the health promoting behavior variables, diet, and the health outcome variables (A1c, BMI). The length of diabetes diagnosis and the number of barrier days significantly predicted an increase in blood glucose monitoring frequency. Body weight significantly indicated an increase in adherence to diet. Participant age predicted a decrease in adherence to exercise, while perceived health status supported an increase in exercise. Older age predicted a decrease in A1c levels, while length of diabetes diagnosis indicated an increase in A1c. Participant age predicted a decrease in BMI, while both the number of barrier days and adherence to diet supported an increase in BMI. The significance of these results will be discussed more thoroughly in the next chapter.

Table 4-9

Multiple Linear Regression for Variables Associated with Body Mass Index N=582

Regression Variable	*B*	*SE B*	*β*
Personal Factors			
Age	-.116	.028	-.169**
Length of Diagnosis	-.015	.023	-.025
Perceptions and Influences			
Social Support Score	.253	.198	.050
Number of Barrier Days	.188	.039	.187**
Health Promoting Behaviors			
Diet Management Score	1.291	.186	.270**
Exercise	-.001	.000	-.069
R^2		0.149	
Adjusted R^2		0.140	
F (p-value for model)		16.764 ($p < .001$)	

* $p < .05$ ** $p < .01$

Chapter V

Discussion and Conclusions

This chapter presents a discussion of the results from this descriptive, correlational study to explore the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and patient adherence to health-promoting behaviors (blood glucose monitoring, diet, and exercise) and overall health outcomes (A1c and body mass index) in a diabetes self-care regimen. A discussion of the study limitations, implications for nursing practice, and recommendations for future research will also be included.

Relationships between Independent Variables and Health Behaviors and Outcomes

Research Question One. The results of the regression analysis demonstrated that the model exploring the relationship between personal factors (age, length of diabetes diagnosis, perceived health status), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and adherence to blood glucose monitoring explained 6% of the variance of adherence to blood glucose monitoring. Two predictor variables, length of diabetes diagnosis and number of barrier days, significantly contributed to the model. The longer the time since diagnosis and the more barrier days experienced per month, the more frequently blood glucose monitoring was performed.

The greater the elapsed time since the initial diagnosis of diabetes was associated with a higher frequency of weekly BGM. The longer individuals have lived with diabetes the more frequently they monitored their glycemic control. The practice of

BGM does not affect actual blood glucose levels, but it does provide the diabetic individual with an indicator of their own control of blood glucose levels. The longer an individual has lived with diabetes increases the probability of the development of complications, which may eventually become a catalyst in encouraging more active participation in diabetes self-management. As the diabetic individual ages and the disease progresses, more intense BGM is required. It is possible that over time, living with diabetes also facilitates better acceptance of the disease condition and the diabetic individual has more time to become proficient with the self-management responsibilities and the incorporation of these activities in their daily lives.

In this study, number of barrier days also contributed to the prediction of BGM. The greater number of barrier days experienced was associated with a higher frequency of BGM. In this study, the most reported type of barrier days were “days where physical health was not good” (Mean = 6.3 days per month; *SD* = 10.0) and “days where pain made usual activities difficult” (Mean = 6.6 days per month; *SD* = 10.9). Approximately 72% of the sample reported at least 6 days of both “days where physical health was not good” and “days where pain made usual activities difficult”. It could be that diabetic individuals attribute “bad days” with higher blood glucose levels and therefore would be inclined to test their blood glucose levels more often on these days, especially if they have been instructed to do this by their health care provider. Encountering days where normal activities cannot be routinely performed also provides the diabetic individual with more time to test their blood glucose levels. Testing blood glucose levels on bad days may provide an explanation to the source of the problem and allow the diabetic individual to treat the condition for possible resolution of the problem.

The findings from this study differ from previous research when personal factors were used to predict BGM. Vincze, et al. (2004) found no significant relationship between age, length of diabetes diagnosis, perceived health status and BGM. Mitchell, Bowker, Majumdar, Toth, & Johnson (2004) also found no significant relationship between perceived health status, BGM, and A1c levels. However, Vincze et al. (2004) found a significant relationship between environmental barriers and adherence to BGM. The barriers identified in their study included lifestyle interference and pain involved in monitoring. A decrease in BGM was associated with these environmental barriers. The results in the Vincze et al. (2004) study differ from the findings in this study as their results indicated a decrease in BGM associated with participant perceived barriers. The sample size in the Vincze et al. (2004) study was 933 and logistic regression was used to associate barriers and BGM frequency; however the barriers identified in their study related to continuous barriers to performing BGM while the barriers in this study were defined as a limited number of "bad days" per month. This difference in measurement of perceived barriers may account for the difference in the findings.

The findings from this study adds new information to the literature on predictive relationships between length of diabetes diagnosis, participant perceived barrier days, and adherence to BGM in individuals with diabetes. Since the findings indicated more adherence to BGM with a longer diagnosis of diabetes, it could be postulated that individuals may not actively manage their disease in its initial stages. BGM is often encouraged by health care providers at the onset of the disease so that diabetic individuals can incorporate this self-assessment into their daily routine and have an advanced awareness of inadequate glycemic control. This awareness is essential to prevent or slow

the development of complications of the disease. If individuals are not adhering to their BGM until later in the disease process, damage from complications may have already occurred. Health care providers should emphasize the importance of BGM early in the progression of the disease.

Individuals who engage in more frequent BGM when experiencing barrier days have demonstrated that diabetes education has been somewhat effective. Diabetic individuals are usually instructed to perform more frequent BGM when they are ill, especially since glycemic control is more difficult to achieve during illness. More BGM during barrier days empowers the diabetic individual to assess their condition and treat hyperglycemia when necessary. This also enables the individual to have some control of the issues which may contribute directly to their barrier days. Health care providers should continually encourage diabetic individuals to engage in regular BGM, especially during barrier days, to actively and effectively manage their disease.

Since this regression model only explained 6% of the variance of adherence to BGM, it is clear that additional significant predictor variables which were not included in this model must be considered. Other predictors that could affect BGM include participant perception of the overall benefit of BGM and participant self-efficacy of performing BGM.

Research Question Two. The results of the regression analysis demonstrate that the model exploring the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, body weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive

symptoms), and adherence to diet explained 8% of the variance of adherence to diet. Only one predictor variable, body weight, significantly contributed to the model. The greater the individuals' weight the more likely they were to engage in diet management behaviors, possibly to better manage blood glucose levels or to address the issue of the elevated weight or both. Maintaining glycemic control is usually more difficult with increased body weight in individuals with type 2 diabetes because of insulin resistance. Individuals may engage in diet management behaviors as their body weight increases because their blood glucose readings have increased, although individuals may have already been practicing diet management behaviors for some time without any effect on weight.

While no studies were found that examined the effect of body weight on adherence to diet management, the findings from this study can be compared to the findings from Plotnikoff, et al. (2009) who reported a significant relationship between dietary behaviors, BMI, and exercise. The practice of the dietary behavior of increased fruit and vegetable consumption was associated with lower BMI and an increase in exercise frequency, indicating that diet is positively associated with exercise and negatively associated with BMI. The practice of eating more fruits and vegetables predicted an increase in exercise and a lower BMI.

The findings in this study only demonstrated that increased body weight is associated with adherence to diet management behaviors. The participants may engage in diet management to lose weight, however it is not known when the diet management behaviors were actually started by the participants or how intensely they were implemented. Improving glycemic control may be the actual motivation for the diet

management behaviors. The Plotnikoff et al. (2009) study yielded quite different results as a significant relationship between fruit and vegetable diet adherence and a lowered BMI was found, indicating a loss in weight.

The findings from this study add new information to the literature on predictive relationships between body weight and the adherence to diet in individuals with diabetes. Participants who reported engaging in diet management behaviors in this study were not asked to report the consistency of their diet management. A participant might report engaging in two or three different diet management behaviors, but if these behaviors are not practiced regularly and effectively, weight loss may not occur. Individuals with diabetes can be asked to monitor their blood glucose at least four times per week, and they can be encouraged to engage in exercise such as walking for at least 30 minutes at least three times per week. However diet management is not as easily defined or quantified, and it is often the most difficult health-promoting behavior for a diabetic individual to perform. Some individuals do have adequate knowledge regarding nutrition and can develop meal plans for themselves, however most individuals need diet planning education with occasional reinforcement in order to be successful in maintaining adequate glycemic control and weight loss or weight management. Health care providers need to assess their diabetic patients' adherence to diet management by obtaining detailed information about the type of foods, the quantity, and the frequency that their patients are consuming them. A food diary, which a diabetic individual can complete for three days before a scheduled appointment with a health care provider, is an example of an assessment tool that could be utilized to determine the quality and the consistency of the diet management behaviors being practiced. If diabetic individuals are able to practice

effective diet management, their effort may yield an actual weight loss and perhaps not yield the findings that were identified from this study.

Since this regression model only explained 8% of the variance of adherence to diet management, there must be additional significant predictor variables which were not included in this model. Other predictors could include participant perception of the overall benefit of diet management, participant attitudes about diabetes and required diet modifications, and participant self-efficacy of diet management specific for diabetic individuals.

Research Question Three. The results of the regression analysis demonstrated that the model exploring the relationship between personal factors (age, length of diabetes diagnosis, perceived health status, body weight), perceived barriers to action (number of barrier days), interpersonal influences (social support), situational influences (depressive symptoms), and adherence to exercise explained 3% of the variance of adherence to exercise. Two predictor variables, age and perceived health status, significantly contributed to the model. The younger the age and the higher perceived health status, the more minutes per week were spent in exercise.

The older age of the diabetic individual was associated with a decrease in minutes of exercise per week. As might be expected, the older the age the less frequently exercise was performed. As individuals age, mobility, flexibility, strength, and endurance related to physical activity decrease. Complications of diabetes over time also contribute to a decrease in exercise. A decrease in visual acuity and vestibular balance contribute to a decrease in regular exercise. Although exercise is a significant part of diabetes self-management, diet and taking medications are also part of this process. Older individuals

with diabetes may choose to more aggressively engage in other self-management activities when the physical demands of frequent exercise are no longer possible. The results of this study did not indicate that older individuals with diabetes avoided exercise; these individuals simply do not exercise as much as younger diabetic individuals. Further analysis of the study findings indicated that the participants aged 59 years and less exercised an average of 528 minutes (8.8 hours) per week ($SD = 967.8$) and a median of 90 minutes (1.5 hours) per week. The participants aged 60 years and above exercised significantly less ($t(704) = 4.85$, $p < .001$) at an average of 245 minutes or 4 hours per week ($SD = 576.7$) and a median of 0 minutes per week. Despite the significant difference in adherence to exercise between the two age groups, the older participants were in better glycemic control than the younger participants. The participants aged 59 years and less had an average A1c of 7.6 ($SD = 2.0$) and a median A1c of 7.1. The participants aged 60 years and above had a significantly lower ($t(660) = 3.68$, $p < .001$) average A1c of 7.1 ($SD = 1.3$) and a median A1c of 6.8.

In this study, perceived health status also contributed to the prediction of adherence to exercise. The better the perception of health of the diabetic individual was associated with an increase in minutes of exercise per week. Thus, better perceived health status influenced more frequent exercise. Perceived health is related to an increased self-efficacy in the ability to perform regular exercise. Individuals who do not suffer from pain, weakness, or other disabilities encounter fewer obstacles that could decrease their overall physical activity. A positive perception of health leads to performance of behaviors that will maintain that status of health. Although age is a significant predictor of exercise, it did not have any significant association with perceived

health in this study $r(657) = -0.040$, $p = .309$. Further analysis of the study findings indicated that the participants aged 59 years and less reported an average perceived health status of 2.53 ($SD = .921$) with a median of 3.0 (range 1 – 5) for perceived health. The participants aged 60 years and above reported a similar average perceived health status of 2.57 ($SD = .931$) and a median of 2.0 perceived health. Both age groups reported a perceived health status of fair to good.

While no studies were found that examined the effect of perceived health status on exercise, the findings from this study can be compared to the results from another study which used personal factors as a predictor of exercise. Williams-Piehota et al. (2009) found a significant relationship between age, gender, support, BMI, and exercise. An increase in exercise was related to being younger. This study's findings concur with the results of the Williams-Piehota et al. (2009) study involving age as a predictor of exercise. The findings from the current study support the information on predictive relationships between older age and decreased adherence to exercise in individuals with diabetes. Research continues to show that exercise is important for all individuals of all ages. Although the reasons that diabetic individuals may engage in less exercise as they age have been previously discussed in this chapter, it is important for health care providers to encourage older diabetic individuals to engage in some form of exercise that is appropriate for their current state of health. The benefits of exercise for older diabetic individuals exceed weight loss and glycemic control. Exercise can facilitate improved circulation, increase bone strength, and help to control hypertension. Improved circulation is also essential to help prevent or slow the onset of cardiovascular complications associated with diabetes. The findings from this study indicated that the

older participants did have good glycemic control, but that should not be a reason for older individuals with diabetes to decrease their adherence to exercise.

The findings from this study add new information to the literature on predictive relationships between a perception of good health and increased adherence to exercise in individuals with diabetes. Individuals with a perception of good health who engage in exercise demonstrate the premise of primary prevention. Actively exercising when health is perceived as being good would most likely be performed to maintain that good health. Exercise facilitates weight loss and weight maintenance and it can contribute to glycemic control. Exercise also greatly contributes to maintaining cardiovascular health, which is essential for diabetic individuals. It is ironic that the participants in this study who perceived their health as being good would engage in exercise, while participants who perceived their health as not being good were less likely to engage in a behavior which had the potential of improving their health. Individuals with diabetes should be encouraged by their health care providers to exercise despite their perception of poor health. It is possible that a perception of poor health might include conditions which prevent an individual from performing vigorous exercise, however there are many simple exercises that can be performed from the seated position that have been shown to be more beneficial than performing no exercise at all.

Since this regression model only explained 3% of the variance of adherence to exercise, other significant predictor variables were not included in this model. Such predictors include participant perception of the overall benefit of exercise; participant self-efficacy of performing effective exercise for diabetes self-management; and the physical capability to perform exercise.

Research Question Four. The results of the regression analysis demonstrated that the model exploring the relationship between personal factors (age, length of diabetes diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (social support), health-promoting behaviors (diet, exercise), and A1c level explained 4% of the variance of A1c levels. Two predictor variables, age and length of diagnosis, significantly contributed to the model. The older the age and the shorter time since diagnosis, the lower the A1c levels.

The older age of the diabetic individual was associated with a lower A1c. As individuals age, both physical activity and caloric intake often decreases. The decrease in caloric intake may contribute to better glycemic control as indicated by a lower A1c. Older individuals often have more time to actively participate in self-management activities which may directly affect their glycemic control. Older individuals who are taking oral glucose-lowering medications often have an exaggerated effect from these medications as a result of decreased drug metabolism. Finally after many years of managing their diabetes, older individuals may have adapted their lifestyle wherein diabetes management is a way of life.

In this study, length of diabetes diagnosis also contributed to the prediction of A1c. The greater the elapsed time since the initial diagnosis of diabetes was associated with a higher A1c. The more time individuals had lived with diabetes, the higher their A1c level. The longer an individual has lived with diabetes increases the probability of the development of complications. Complications often make glycemic control more difficult to achieve. Individuals with type 2 diabetes taking medications eventually experience a decreased effectiveness of the medications on glycemic control over time, as

well as an increase in insulin resistance. A longer diagnosis of diabetes can also contribute to more complacency with regard to individual patient glycemic control goals. Ultimately living with any chronic illness for an extended period of time often leads to deteriorating health, which would result in a poor glycemic control that is indicated by a higher A1c level.

The two significant predictors of A1c in this study are somewhat contradictory. Age is negatively associated with A1c level, while length of diabetes diagnosis is positively associated with A1c level. However, there was a significant positive correlation between length of diabetes diagnosis and age [$r(711) = .202$, $p < .001$] in this study. How is it possible that as a diabetic individual ages, their A1c level will decrease due to their age and yet increase as the length of time since their diabetes diagnosis increases? Many individuals who are diagnosed with type 2 diabetes acquire it in their later years, often in their late 50s or early 60s. Further analysis of the study findings indicated that the participants who were diagnosed with diabetes at age 60 years or older comprised 32.5% of the sample. The average age of diabetes diagnosis was 50.3 years of age ($SD = 15.7$) and a median of 52.0 years of age. Although individuals in the U.S. are now being diagnosed with type 2 diabetes at much younger ages, a large percentage of the sample in this study were diagnosed with diabetes at age 50 or older. Thus, the most plausible explanation for these findings is that this percentage of the sample acquired diabetes at a time in their lifespan where they are being influenced by the effect of their age with lower A1c levels and yet have not had the disease long enough to be influenced by the effect of an extended diagnosis time which often results in higher A1c levels. This is an example of two opposing effects on A1c levels, which might yield entirely different

results when using a sample that has a different distribution of participant age at the time of diabetes diagnosis. Since individuals in the U.S. are now being diagnosed with type 2 diabetes at a younger age, future studies will most likely yield different results with respect to A1c levels.

The findings from this study concur with previous research wherein personal factors were used to predict A1c levels. Rhee et al. (2005) found a significant relationship between age, length of diabetes diagnosis, and A1c. The length of diabetes diagnosis was found to be positively related to A1c, while age was negatively related to A1c. The findings from this study support the information on predictive relationships between the age, length of diabetes diagnosis, and A1c; however, changing demographics with respect to diabetes diagnosis in this country may affect the findings in similar studies in the future. Health care providers should be more diligent in testing A1c levels of their diabetic patients to identify poor glycemic control earlier and to help their patients with interventions before diabetic complications begin to occur at younger ages. Since this regression model only explained 4% of the variance of A1c, there must be additional significant predictor variables which were not included in this model. These predictors could include participant perception of the overall benefit of glycemic control and other immediate competing demands which directly interfere with control of A1c levels.

Research Question Five. The results of the regression analysis demonstrated that the model exploring the relationship between personal factors (age, length of diabetes diagnosis), perceived barriers to action (number of barrier days), interpersonal influences (social support), health-promoting behaviors (diet, exercise), and BMI

explained 14% of the variance of BMI. Three predictor variables, age, number of barrier days, and diet, significantly contributed to the model. The younger the age, the more barrier days per month and the more diet management behaviors reported, the higher the BMI.

The older age of the diabetic individual was associated with a lower BMI. Although physical activity often decreases with age, older individuals often decrease their caloric intake. Decreased caloric intake contributes to a lower body mass index. Older individuals will often experience the gradual replacement of muscle tissue with adipose tissue as they age. Adipose tissue is less dense than muscle tissue, which contributes to a further decrease in BMI. The decrease in A1c levels in the aging diabetic individual as discussed in research question four may be related to the lower BMI, which is noted in aging diabetic individuals in this regression model. Generally a lower BMI indicates better glycemic control and lower A1c.

In this study, number of barrier days contributed to the prediction of BMI. The greater number of days that the diabetic individual experienced problems contributed to a higher body mass. If a diabetic individual is experiencing some “bad days”, it is logical to assume that the behaviors of diet and exercise may not be regularly practiced. Diet and exercise determine body weight, thus are linked to BMI. Barriers to the practice of health-promoting behaviors could directly affect an overall health outcome, such as BMI. Barrier days often prevent the diabetic individual from participation in everyday activities which may facilitate overeating, resulting in an increased BMI. Decreased activity can cause a lowered metabolism which will further contribute to a higher BMI.

In this study, adherence to diet contributed to the prediction of BMI. The engagement of diet management behaviors was associated with a higher BMI. This result is contrary to what would be expected. However, these findings are congruent with the findings of the regression model used to address research question two, which focused on increased body weight and its relationship with increased diet management. The interpretations of that model concluded that diabetic individuals would engage in diet management behaviors to better control blood glucose levels or when they perceived a need to lose or maintain weight. Similarly, the findings of this regression model indicated that diabetic individuals may engage in diet management behaviors after recognizing a large BMI.

Some of the findings from this study differ with previous research when health-promoting behaviors were used to predict BMI. Plotnikoff, et al. (2009) found a significant relationship between dietary behaviors, BMI, and exercise. The practice of the dietary behavior in the Plotnikoff et al. (2009) study was associated with lower BMI. While no studies were found that examined the effect of age on BMI, the findings from this study indicated a significant relationship between older age and decreased BMI. While no studies were found that examined the effect of perceived barriers on BMI, the findings from this study indicated a significant relationship between increased perceived barrier days and a higher BMI.

The findings from this study add new information to the literature on predictive relationships between younger age, increased perceived barrier days, increased diet management, and increased BMI in individuals with diabetes. These findings indicated a lower BMI with increasing age of the diabetic individual. The findings in research

question four indicated a lower A1c with increasing age. The association between lower A1c and lower BMI with advancing age in diabetic individuals does not negate the fact that older individuals with diabetes still need to adhere to their diabetes self-care regimen. These seemingly favorable health outcomes do not necessarily prevent the continual development or progression of diabetes-related complications. Health care providers need to emphasize the importance of continued diabetes-related care and to remind their older patients that their lowered A1c level and BMI is not a justification for relaxing their adherence to health-promoting behaviors.

The findings of this study indicated that experiencing more barrier days is associated with higher BMI for diabetic individuals. Although this finding is not unexpected, it should not be simply ignored. Diabetes management is very challenging and any perceived or real barriers that conflict with this daily disease management can result in an increase in diabetes-related complications. Although barrier days cannot necessarily be avoided, health care providers need to help their diabetic patients plan interventions to overcome or at least minimize the effect of these barriers. Living with diabetes involves the understanding that diabetes self-management must continue, even when other life-related obstacles and issues occur. Even a slight improvement in diabetes self-management despite the occurrence of barrier days may result in improved health outcomes for the diabetic individual.

The findings of this study indicated that an increase in diet management behaviors was related to a higher BMI. This is similar to the findings discussed in research question two which found increased body weight was related to an increase in diet management behaviors. The actual measurement of diet management behaviors and the

method in which study participants reported them may explain the inconsistency of these findings and the results of the Plotnikoff et al. (2009) study which found that the practice of the dietary behavior was associated with lower BMI. Previous discussion (research question two) emphasized the importance for health care providers to accurately assess the consistency and quality of the diet management practices of their diabetic patients. If the provider determines the diet management behaviors are ineffective for the patient weight loss goals, then alternative interventions can be discussed. Although it is probable that the results of this study were affected by the validity of the diet management variable, the possibility that participants did not engage in diet management behaviors until after weight gain or increased BMI has to be considered. Other findings from this study have suggested that diabetic individuals do not always practice primary prevention. Disease management of chronic illnesses, such as diabetes, is considered tertiary prevention. Ideally patients who have not developed complications of diabetes will engage in self-management of their disease to prevent these complications from occurring, as well as manage their existing level of glycemic control. Although the self-management of the diabetes is a tertiary prevention strategy, the efforts to prevent development of diabetes-related complications that have not yet occurred could be considered a primary prevention strategy. Efforts to prevent an increase in BMI by actively engaging in diet and exercise could also be considered a primary prevention strategy, for individuals with or without diabetes. Individuals with diabetes should not wait until complications have occurred before taking their self-management responsibilities seriously. Health care providers need to emphasize the importance of both primary and tertiary prevention strategies to their diabetic patients by encouraging

strict adherence to health-promoting behaviors involved in diabetes self-management to maximize the potential for improved health outcomes.

Since this regression model only explained 14% of the variance of BMI, additional significant predictor variables which were not included in this model should be examined. These predictors include participant perception of the overall benefit of maintaining a BMI below 25 and other immediate competing demands which directly interfere with control of BMI.

Limitations of the Study

The use of existing data for secondary analysis requires a researcher to accept the data "as is" and to design the study and variables of interest within the overall constraints of the available data. Although the data used for this study was meticulously obtained by the researchers of the NHANES study, the data still has some limitations because diabetes-related information was only one of many health conditions that were being studied by the NHANES researchers. Some of the variables used in this study were calculated from a scale of partially related survey items that may not have been entirely valid for the concept they were considered to represent.

Social Support. No significant relationship was found between the predictor social support and the health-promoting behaviors or health outcomes in the regression models in this study. These findings differ from previous research where social support was found to be associated with health-promoting behaviors. Nicklett and Liang (2010) found a significant relationship between social support and increased adherence to a diabetes care regimen, although there was no significance found between social support and health outcomes. Their study utilized a large sample of 1,788 participants. Sacco et

al. (2009) also found a positive significant association between social support and both diet and exercise. Sacco et al. (2009) only used a sample size of 62, however some of those participants actually received a telephone support intervention to determine its effect on diet, exercise, A1c, and BMI. No significant effect was found on A1c or BMI, but their findings of a positive effect on diet and exercise concur with the results of the Nicklett and Liang study which indicated a relationship between social support and increased adherence to health-promoting behaviors. The results from both of these studies (Nicklett and Liang; Sacco et al.) concur with the findings of no significant association between social support and health outcomes found in this study.

The social support variable in this study was a score that was calculated by the researcher using the scale information obtained from three items which assessed available and needed support by study participants. It is possible that the items used to calculate this variable were insufficient to represent an overall measurement of social support. This fact, along with the different sample size and research design used in the other studies, may explain why social support did not have any significant relationship with the other variables in the regression models used in this study.

Depressive Symptoms. No significant relationship was found between the predictor depressive symptoms and the health-promoting behaviors in the regression models in this study. This study used the variable depressive symptoms, which is not completely equivalent to clinical depression which was discussed in the literature review. These findings differ from previous research where depression was found to be negatively associated with health-promoting behaviors. McKellar et al. (2004) found a significant relationship between depression and a decrease in diabetes regimen

adherence. Their study utilized a sample of 307 participants, however repeated measurements of the variables were performed over one year. Although a significant relationship was found between depression and health-promoting behaviors in their study, no significant relationship was found between depression and their health outcome variable of glucose dysregulation. Similar findings were noted when Lee et al. (2009) found no significant relationship between depression and A1c levels, although their sample size was only 55 participants. The results from both of these studies (McKellar et al., 2004; Lee et al., 2009) concur with the findings of no significant association between depressive symptoms and health outcomes found in this study.

The depressive symptoms variable used in this study was a score that was calculated by the researcher using the scale information obtained from ten items which assessed various participant issues such as feeling down, sleeping too much, and having little interest in doing things. It is possible that the items used to calculate this variable were insufficient to represent an overall measurement of depressive symptoms. It should also be noted that the percentage of the sample that reported either moderate or severe depressive symptoms from this study was 17.6%. Madden (2010) reported that the prevalence of depression in people with type 2 diabetes has been estimated to be approximately 25%. These facts, along with the different sample size and research design used in the other studies, may explain why depressive symptoms did not have a significant relationship with any of the other variables in the regression models used in this study.

Other Issues. The diabetes-related data did not contain an identifying variable which distinguished the type of diabetes with which the participant was diagnosed. This

information would have been useful to ensure that subjects within the research sample had the same type of diabetes, since the specific type of diabetes could be a strong predictor of the adherence behaviors in diabetic individuals.

Although the statistical analyses used in this study yielded significant relationships within the regression models, each model was only able to explain a small amount of the variance of the dependent variable being studied. This suggests that additional predictor variables or stronger predictor variables should have been included to account for a larger percentage of the variance. Since each regression model only explained a small amount of the variance of the dependent variable, the findings from each regression should be incorporated into nursing practice cautiously. Since many of the findings in this study were supported by results of other research, it is probable that the majority of these findings would be useful if incorporated into clinical practice. The variables from this study which are not necessarily predictive of behaviors are only part of a cumulative effect of many variables and most likely would not contribute an overall negative effect on the desired behaviors or health outcomes of the diabetes care regimen. The small percentage of variance explained in each regression model can also be attributed to the complexity involved in the diabetes care regimen and that there are many variables involved in the prediction of health-promoting behaviors and health outcomes.

Some of the findings in this study also yielded statistically significant results, but not necessarily clinically significant results. For example, the regression model predicted that for each additional year of diabetes diagnosis, the participant is likely to increase their frequency of blood glucose monitoring by 0.1 times per week. Another example is that for each additional barrier day, the participant is likely to increase their frequency of

blood glucose monitoring by 0.2 times per week. These are significant findings statistically but they are not very helpful as a clinical recommendation or trend.

Implications for Nursing Practice

Diabetes education is a nursing responsibility. Although there are certified nursing specialists that primarily educate diabetic individuals in the concepts and procedures of diabetes self-management, all nurses have an obligation to continually provide information about this disease to their patients. The literature has demonstrated that sufficient knowledge of diabetes self-management is not a guarantee of adherence to the regimen. Diabetic individuals encounter a variety of factors on a daily basis which can have a cumulative positive or negative effect on the likelihood of engaging in health-promoting behaviors. Although it is not feasible for any one health care provider to have significant influence on all of these factors, having an awareness of at least some of the major predictors to health-promoting behaviors can be beneficial in customizing a plan of care for a diabetic individual which focuses on the positive predictors and minimizes the negative predictors that affect diabetes self-management. The more knowledge that is acquired about the complex relationship of factors which affect overall behavioral modification in chronic disease management could drastically improve the care and education that is provided to these patients.

Recommendations for Future Research

Future research should explore additional predictor variables and their interactions to determine if more clinically significant relationships can be found between the predictors and in health-promoting behaviors and health outcomes related to diabetes self-management. The concepts from the HPM that were not used in this study would be

suitable examples of additional variables to include in future research. Variables that represent the concepts of prior related behaviors, perceived benefits of action, perceived self-efficacy, activity-related affect, and immediate competing demands and preferences would be appropriate to include in future research, along with the same variables that were used in this study. This would allow the complete use of the HPM for the research. The predictors for adherence may be different for individuals with type 1 diabetes as compared to individuals with type 2 diabetes, so future studies need to focus on one group, or they should compare the results of the two groups to better identify those predictor variables which are the most significant for management of each type of the disease.

Summary

The diabetes self-management regimen is a complicated process for the majority of individuals who have been diagnosed with this disease. This study explored the relationship between various predictor variables and participant adherence to health-promoting behaviors and health outcomes associated with diabetes. The findings indicated that the predictors and the interactions which were related to diabetes self-management are very complex. The findings also indicated that participants did not always engage in prevention strategies related to their disease management and progression. Health care providers need to emphasize the importance of both primary and tertiary prevention strategies to their diabetic patients by encouraging strict adherence to health-promoting behaviors involved in diabetes self-management to maximize the potential for improved health outcomes.

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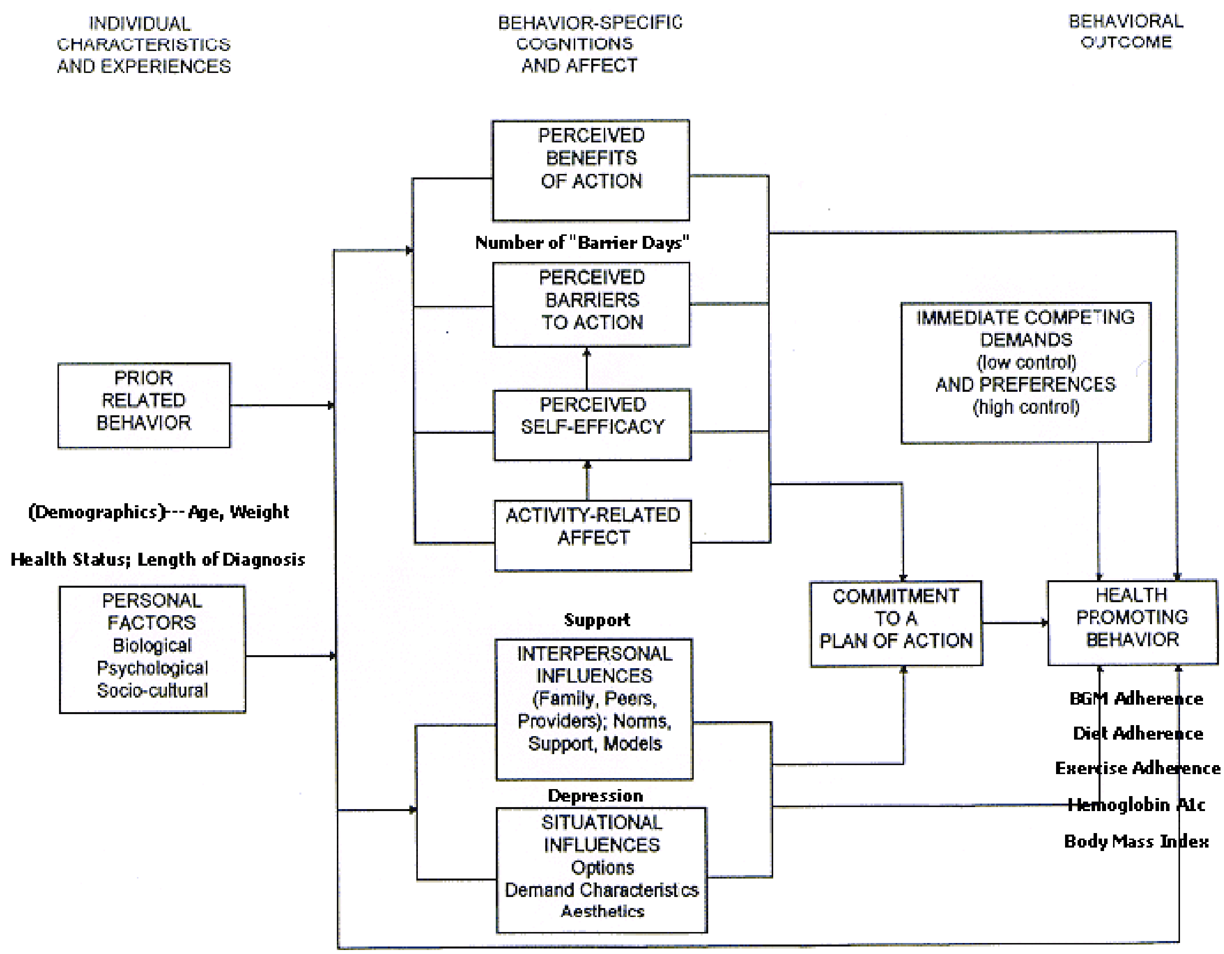
APPENDIX A

HEALTH PROMOTION MODEL

Appendix A

PENDER'S HEALTH PROMOTION MODEL



Revised Health Promotion Model

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

INSTITUTIONAL REVIEW BOARD

Mail: P.O. Box 3999
Atlanta, Georgia 30302-3999

In Person: Alumni Hall
30 Courtland St, Suite 217

Phone: 404/413-3500
Fax: 404/413-3504

November 2, 2010

Principal Investigator: Grindel, Cecelia Marie

Student PI: Glenn Hagerstrom

Protocol Department: B.F. Lewis School of Nursing

Protocol Title: Personal Factors, Perceptions, Influences and their Relationship with Adherence Behaviors in Patients with Diabetes

Funding Agency: Sigma Theta Tau-Theta Epsilon Chapter

Submission Type: Protocol H11143

Review Type: Exempt Review

Approval Date: November 2, 2010

The Georgia State University Institutional Review Board (IRB) reviewed and approved your IRB protocol entitled Personal Factors, Perceptions, Influences and their Relationship with Adherence Behaviors in Patients with Diabetes. The approval date is listed above.

Exempt protocols do not require yearly renewal. However, if any changes occur in the protocol that would change the category of review, you must re-submit the protocol for IRB review. When the protocol is complete, a Study Closure Form must be submitted to the IRB.

Any adverse reactions or problems resulting from this investigation must be reported immediately to the University Institutional Review Board. For more information, please visit our website at www.gsu.edu/irb.

Sincerely,

Laura D. Fredrick, IRB Vice-Chair

Federal Wide Assurance Number: 00000129

APPENDIX C

VARIABLE INSTRUMENT DEVELOPMENT PROCEDURES

FROM NHANES DATA

Variable	Label	NHANES Scale	Level	Description	Comments
Personal Factors					
Weight (kg)	BMXWT	Body Measure	Ratio		
Calc weight into pounds	***Weight***	***calculated variable***	***Ratio***	***convert into pounds***	
Standing Height (cm)	BMXHT	Body Measure	Ratio		
Calc height into inches	**Height**	**calculated variable**	**Ratio**	**convert into inches**	
Waist Circumference (cm)	BMXWAIST	Body Measure	Ratio		
Calc waist circumference into inches	**WaistSiz**	**calculated variable**	**Ratio**	**convert into inches**	
Age	***RIDAGEYR***	***Demographics***	***Ratio***	***0 through 80***	
Gender	RIAGENDR	Demographics	Nominal	M=1 F=2	
Race/Ethnicity	RIDRETH1	Demographics	Nominal	W, B, H, Mex, Other	
Education Level	DMDEDUC2	Demographics	Nominal	<=9, 9-11, HS, Coll, Grad	
Annl Hshld Income	INDHHIN2	Demographics	Nominal		collapse into smaller number of categories
Marital Status	DMDMARTL	Demographics	Nominal	M, D, W, Sep, Nev M, Part	
# people in House	DMDHHSIZ	Demographics	Ratio	Range 1-6 or =>7	
Citizenship	DMDCITZN	Demographics	Nominal	Citz & Non-Citz	
General health condition	***HSD010***	***Curr Health Status***	***Ordinal***	***subject asked to rank 1-5***	***reverse score (1-5 poor-excellent)***
Doctor told you have diabetes	DIQ010	Diabetes	Nominal	Yes/No	
Covered by health insurance	HIQ011	Health Insurance	Nominal		
Age when first told you had diabetes	DID040	Diabetes	Ratio	reported age when Dx	
Calc Length of Dx by subtracting from age	***lgthofdm***	***calculated variable***	***Ratio***	***Age minus "age when Dx"***	

Variable	Label	NHANES Scale	Level	Description	Comments
Perceived Barriers to Action					
no. of days physical health was **not good**	HSQ470	Curr Health Status	Ratio	within last 30 days	
no. of days mental health was **not good**	HSQ480	Curr Health Status	Ratio	within last 30 days	
inactive days due to phys./mental hlth	HSQ490	Curr Health Status	Ratio	within last 30 days	
Pain make it hard for usual activities	HSQ493	Curr Health Status	Ratio	within last 30 days	
Calc total number of barrier days	***BarrDays***	***calculated variable***	***Ratio***	***mean of the above 4 items***	***range 0-30 days***
Interpersonal Influences					
Anyone to help with emotional support	SSQ011	Social Support	Nominal	Yes/No	No = 1 pts
Needed more support in past year	SSQ031	Social Support	Nominal	Yes/No	No = 5 pts
How much more support needed	SSQ041	Social Support	Ordinal	range 1-3 (a lot more, some, a little more)	1=2 pts, 2=3 pts, 3=4pts
Calculated SS by adding "points" from nominal/ordinal items	***SocialS***	***calculated variable***	***Ratio***	***sum of above 3 items***	***range 1-5 (low to high support)***
Situational Influences					
Little interest in doing things	DPQ010	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Feeling down, depressed, or hopeless	DPQ020	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Trouble sleeping or sleeping too much	DPQ030	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Feeling tired or having little energy	DPQ040	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3

Variable	Label	NHANES Scale	Level	Description	Comments
Poor appetite or overeating	DPQ050	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Feeling bad about yourself	DPQ060	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Trouble concentrating on things	DPQ070	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Moving or speaking slowly or too fast	DPQ080	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Thought you would be better off dead	DPQ090	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Difficulty these problems have caused	DPQ100	Depression	Nom/Ord	1-4 None, several, more than half, & nearly all	recoded to 1-4 from 0-3
Calculated Depression by adding "points" from nominal/ordinal items	***Depress***	***calculated variable***	***Ratio***	***sum of above 10 items***	***range 10-40 (no depression to extreme depression)***
HPB--BGM					
Unit of measure (day/week/month/year)	DIQ260U	Diabetes	Nominal	day/week/month/year	Convert & recode "per day", "per month", & "per year" into "per week"
How often check blood for glucose/sugar	DID260	Diabetes	Ratio	Range 1-31	
Calc BGM frequency into per week	***BGMfreq***	***calculated variable***	***Ratio***	***multiplied converted "per week" value by variable DID260***	***all cases are now # of times BG checked per week***
HPB--Diet Adh					
Ate less to lose weight	WHD080A	Weight History	Nominal	1 point for Yes	
Switched to foods with lower calories	WHD080B	Weight History	Nominal	1 point for Yes	

Variable	Label	NHANES Scale	Level	Description	Comments
Ate less fat to lose weight	WHD080C	Weight History	Nominal	1 point for Yes	
Skipped meals	WHD080E	Weight History	Nominal	1 point for Yes	
Ate diet foods or products	WHD080F	Weight History	Nominal	1 point for Yes	
Used a liquid diet formula	WHD080G	Weight History	Nominal	1 point for Yes	
Followed a special diet	WHD080N	Weight History	Nominal	1 point for Yes	
Ate fewer carbohydrates	WHD080O	Weight History	Nominal	1 point for Yes	
Ate more fruits, vegetables, salads	WHD080Q	Weight History	Nominal	1 point for Yes	
Changed eating habits	WHD080R	Weight History	Nominal	1 point for Yes	
Ate less sugar, candy, sweets	WHD080S	Weight History	Nominal	1 point for Yes	
Calculated points from 11 weight losing behaviors	**WtLoss**	**calculated variable**	**Ratio**	**range 0-11**	**total number of engaged weight loss behaviors**
Ate less food	WHD100A	Weight History	Nominal	1 point for Yes	
Switched to foods with lower calories	WHD100B	Weight History	Nominal	1 point for Yes	
Ate less fat	WHD100C	Weight History	Nominal	1 point for Yes	
Skipped meals	WHD100E	Weight History	Nominal	1 point for Yes	
Ate diet foods or products	WHD100F	Weight History	Nominal	1 point for Yes	
Used liquid diet formula	WHD100G	Weight History	Nominal	1 point for Yes	
Followed a special diet	WHD100N	Weight History	Nominal	1 point for Yes	
Ate fewer carbohydrates	WHD100O	Weight History	Nominal	1 point for Yes	
Ate more fruits, vegetables, salads	WHD100Q	Weight History	Nominal	1 point for Yes	
Changed eating habits	WHD100R	Weight History	Nominal	1 point for Yes	
Ate less sugar, candy, sweets	WHD100S	Weight History	Nominal	1 point for Yes	

Variable	Label	NHANES Scale	Level	Description	Comments
Calculated points from 11 weight maintenance behaviors	**WtMaint**	**calculated variable**	**Ratio**	**range 0-11**	**total number of engaged weight maintenance behaviors**
Calculated points from 22 weight loss/maintenance behaviors	***DietMgmt***	***calculated variable***	***Ratio***	***range 0-22***	***total number of engaged weight loss & weight maintenance behaviors***
HPB--Exercise Adh					
Days vigorous work	PAQ610	Physical Activity	Ratio	Days per week range 1-7	
Minutes vigorous-intensity work	PAD615	Physical Activity	Ratio	# minutes per day	
Calculated minutes of activity per week	**VigWork**	**calculated variable**	**Ratio**		**minutes of vigorous activity are multiplied by 2**
Number of days moderate work	PAQ625	Physical Activity	Ratio	Days per week range 1-7	
Minutes moderate-intensity work	PAD630	Physical Activity	Ratio	# minutes per day	
Calculated minutes of activity per week	**ModWork**	**calculated variable**	**Ratio**		
Number of days walk or bicycle	PAQ640	Physical Activity	Ratio	Days per week range 1-7	
Minutes walk/bicycle for transportation	PAD645	Physical Activity	Ratio	# minutes per day	
Calculated minutes of activity per week	**WalkCyc**	**calculated variable**	**Ratio**		
Days vigorous recreational activities	PAQ655	Physical Activity	Ratio	Days per week range 1-7	
Minutes vigorous recreational activities	PAD660	Physical Activity	Ratio	# minutes per day	

Variable	Label	NHANES Scale	Level	Description	Comments
Calculated minutes of activity per week	**VigRec**	**calculated variable**	**Ratio**		**minutes of vigorous activity are multiplied by 2**
Days moderate recreational activities	PAQ670	Physical Activity	Ratio	Days per week range 1-7	
Minutes moderate recreational activities	PAD675	Physical Activity	Ratio	# minutes per day	
Calculated minutes of activity per week	**ModRec**	**calculated variable**	**Ratio**		
Calculated TOTAL minutes of activity per week (weighted)	***Exercise***	***calculated variable***	***Ratio***	***sum of all "minutes per week" of physical activity***	
Health Outcome-A1c					
Glycohemoglobin (%)	***LBXGH***	***Glycohemoglobin***	***Ratio***		
Health Outcome-BMI					
Body Mass Index (kg/m**2)	***BMXBMI***	***Body Measure***	***Ratio***		