The Dissertation Committee for Lonnie Kent Wen
Certifies that this is the approved version of the following dissertation:

THE RELATIONSHIP OF FAMILY ENVIRONMENT AND OTHER SOCIAL COGNITIVE VARIABLES ON DIET AND EXERCISE IN OLDER ADULTS WITH TYPE 2 DIABETES

Committee:

Marvin D. Shepherd, Supervisor

Carolyn M. Brown

Kenneth A. Lawson

Michael L. Parchman

James P. Wilson

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by

Lonnie Kent Wen, B.S., M.S.

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Dedication

This dissertation is dedicated to my husband, Tony and my children, Nicole and Michael, for their love, patience and support.

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THE RELATIONSHIP OF FAMILY ENVIRONMENT AND OTHER SOCIAL COGNITIVE VARIABLES ON DIET AND EXERCISE IN OLDER ADULTS WITH TYPE 2 DIABETES

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Lonnie Kent Wen, Ph.D.
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Supervisor: Marvin D. Shepherd

The role of the family environment and other social cognitive factors in the management of type 2 diabetes is poorly understood in older adults. With a better understanding of the social cognitive factors that contribute to diabetes self-care behaviors, interventions can be designed to improve these outcomes. The Social Cognitive Theory was employed to derive a model that depicts the complex and multidimensional aspects of the diabetes self-care regimen. The main objective of the study was to analyze the relationships among the family environment and other psychosocial variables on levels of diet and exercise self-care activities. A non-experimental, descriptive study design was utilized to meet the objectives of the study. Data were collected from a convenience sample of older patients (55 years or older) who were receiving care from a university medical center outpatient facility. The researcher or trained Spanish-speaking interviewer administered the survey to the patients while they were in the clinic. The majority of the items on the survey were chosen from existing instruments.

A model for family environment and social cognitive variables was supported empirically in predicting diet and exercise self-care behaviors. High levels of perceived family support specific to the diabetic regimen were directly associated with levels of exercise and diet self-care behaviors. Additionally, high levels of self-efficacy were associated with higher levels of diet and exercise self-care. Perceived barriers to self-care were associated with the levels of exercise and self-care behavior. Self-efficacy had both a direct and indirect effect on the levels of exercise and diet self-care. Knowledge about diabetes and its management had a direct effect (although weak) on levels of exercise self-care but not on diet self-care.

The results suggest that interventions that address family support specific to diabetes, self-efficacy, general knowledge about diabetes, and barriers

to self-care may be important components for diabetes management. The results of the study have implications on how pharmacists and other health care providers can have a greater impact on their patients by having a better understanding of the family systems on diabetes management.

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

PURPOSE OF THE STUDY

In 2000, the total number of adults who suffered from diabetes mellitus was estimated to be 17 million or 6.2 percent of the population in the United States.[1] Of the 17 million, it is estimated that 11.1 million people are diagnosed and 5.9 million are undiagnosed. Approximately one million new cases are diagnosed per year among people aged 20 years and older. The prevalence of diabetes increases with age, with approximately half of all diabetes cases occurring in individuals who are age 55 or older.

Diabetes is not only common but also has serious long-term complications such as cardiac disease, stroke, vision loss/blindness, amputations and renal disease. Older patients may be more vulnerable to the long-term complications because these complications can develop at an accelerated rate.[2] Evidence of coronary heart disease is present in 7.5 to 20 percent of diabetics over the age of

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[1] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[2] Mooradian A.D., McLaughlin S., Boyer C.C., et al. Diabetes care for older adults. *Diabetes Spectrum* 12: 70-77, 1999.

45 and its revalence increases with age.[3] Older adults with diabetes also have a higher rate of hospitalization than the general population.[4] Diabetes is the sixth leading cause of death in the United States.[5]

Although there is a strong consensus that excellent glycemic control can reduce the microvascular complications in type 2 diabetes, little is known about which characteristics of the patient lead to better glycemic control.[6] There are many factors that interact to determine adherence to the diabetic regimen, metabolic control and adjustment to the disease. Patient management is complicated because it requires the patient to perform numerous tasks at home on a daily basis such as meal planning, blood glucose monitoring, taking proper care of feet, exercise and possibly taking medications. Diabetes care involves personal self-management by the individual and/or significant others. Older adults are faced with additional challenges in the management of their chronic illnesses.

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[3] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[4] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D., editor, St. Louis, Mosby, 759-780, 1996.

[5] Diabetes At-A-Glance, Diabetes: disabling, deadly, and on the rise, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/health/diabetes/htm. Accessed July 31, 2002.

[6] American Diabetes Association: Implications of the United Kingdom Prospective Diabetes Study. *Diabetes Care* 23 (Supp 1): S27-S31, 2000.

There are physical, psychological and environmental barriers to adherence that are unique to the elderly population. Thus, the environment in which the individuals live can impact the management and outcomes of their diabetes.[7]

Social environment and psychological factors are related to an individual's self-care behavior and may influence an individual's ability and willingness to provide self-care.[8] Research on the influence of the family environment and social support among older adults with diabetes is sparse. Most of the research on the families' influences on diabetes management focuses on children and adolescents, because the family is very important in child development.[9] Although the literature on family influences on diabetes management among older adults is limited, several studies have demonstrated that strong family and social support appear to have a positive impact on glycemic control and/or self-

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[7] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[8] Glasgow R.E. and Osteen V.I. Evaluating diabetes education. Are we measuring the most important outcome? *Diabetes Care* 15(10): 1423-1432, 1992.

[9] Pendley J.S., Kasmen L.J., Miller D.L., et al. Peer and Family Support in Children and Adolescents with Type 1 Diabetes, *Society of Pediatric Psychology* 429-438, 2002.

management behaviors among adults.[10,11,12] However, these studies have been conducted mostly in younger adults. Since a large percentage of the population with diabetes is over 65 years of age, further research is needed in this special population.[13]

The overall purpose of this study is to improve the understanding of how family support and other social cognitive variables influence diabetes self-care behaviors in older adults with type 2 diabetes. Other social cognitive variables include perceived barriers to diabetes self-care, self-efficacy and general knowledge regarding diabetes and its management. The specific aims include the following:

1. to determine the level of perceived family support and family functioning in older adults with type 2 diabetes;

2. to evaluate the level of diabetes self-care activities; and

3. to analyze the relationships among perceived family support and family functioning and other psychosocial variables and levels of self-care behaviors.

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[10] Glasgow R.E. and Toobert D.J. Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.
[11] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.
[12] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European- American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.
[13] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

A conceptually driven model that specifies the relationships among the relevant factors was developed. If the variables are shown to be predictive of adherence to self-care activities, adherence might be improved by modifying those predictors.

BACKGROUND TO THE STUDY

This section provides an overview of diabetes mellitus including the complications of the disease. Additionally, this section briefly covers the prevalence, incidence, mortality and economic burden of the illness.

OVERVIEW OF DIABETES MELLITUS

Definition and Description

Diabetes mellitus is defined as a group of metabolic diseases characterized by hyperglycemia as a result of defects in insulin secretion, insulin action or both.[14] Diabetes can be associated with long-term damage, dysfunction, and failure of various organs, including the eyes, kidneys, nerves, heart and blood vessels. Several pathogenic processes are involved in the development of diabetes. One process involves the autoimmune destruction of the ß- cells of the pancreas with consequent insulin deficiency.[15] Another process involves abnormalities in carbohydrate, fat, and protein metabolism that results in resistance to insulin action. This deficient action of insulin on target tissues

[14] The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 25 (Supp 1) S5-S20, 2002.
[15] Ibid.

results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in the pathway of hormone action. It is often unclear which of the two abnormalities— impairment of insulin secretion or defects in insulin action— is the primary cause of hyperglycemia.

Symptoms of marked hyperglycemia include polyuria, polydipsia, and weight loss, sometimes with polyphagia and blurred vision.[16] Other problems associated with diabetes include impairment of growth and susceptibility to certain infections. The acute, life-threatening consequences of diabetes are hyperglycemia with ketoacidosis or nonketotic hyperosmolar syndrome. The long-term complications of diabetes include retinopathy with potential loss of vision, nephropathy leading to renal failure, peripheral neuropathy with risk of foot ulcers and amputation and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction.

[16] The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 25(Supp 1) S5-S20, 2002.

Complications of Diabetes in the General Population

Cardiovascular disease is the leading cause of diabetes-related deaths.[17] The risk of cardiovascular death is two to four times higher in adults with diabetes than those adults without diabetes. The risk of stroke is also two to four times higher in diabetics. It has been estimated that 60 to 65 percent of diabetics have high blood pressure. Diabetes is the most frequent cause of blindness among working-age adults and there are 12,000 to 24,000 new cases of blindness each year due to diabetic retinopathy. Approximately 40 percent new cases of end-stage renal disease are due to diabetes. In 1995, there were over 27,000 diabetics who developed end-stage renal disease.[18]

About 60 to 70 percent of diabetics have a mild to severe form of nervous system damage.[19] This may include impaired sensation or pain in the feet or hands, slowed digestion of food in the stomach, carpal tunnel syndrome and other nerve problems. Severe forms of diabetic nerve disease are a major contributing cause of lower extremity amputations.

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[17] Diabetes At-A-Glance, Diabetes: disabling, deadly, and on the rise, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/health/diabetes/htm. Accessed July 31, 2002.
[18] Ibid.
[19] Ibid.

Classification and Diagnosis

Classification

The majority of cases of diabetes mellitus falls into two broad categories–– type 1 or type 2. Type 1 diabetes, previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, may account for five to ten percent of all diagnosed cases of diabetes.[20] The pathophysiology of type 1 diabetes is an absolute deficiency of insulin secretion.[21] This is usually secondary to an autoimmune process which results in destruction of the ß- cells in the islet of Langerhan and the loss of ability to produce and secrete insulin.

Type 2 diabetes, previously called non-insulin dependent diabetes mellitus (NIDDM), is much more prevalent and is caused by a combination of resistance to insulin action and an inadequate compensatory insulin secretory response.[22] In type 2 diabetes, the degree of clinically asymptomatic hyperglycemia, sufficient to cause pathological and functional changes at various target tissues, may be present for a long period of time before diabetes is diagnosed. Type 2 diabetes

[20] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[21] The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 25 (Supp 1) S5-S20, 2002.

[22] Ibid.

may account for approximately 90 to 95 percent of all diagnosed cases of diabetes.[23] Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes. Gestational diabetes is another type of diabetes that complicates two to five percent of all pregnancies, but the diabetes is not present when the pregnancy is over.[24] Gestational diabetes occurs more frequently in African Americans, Hispanic/Latino Americans, American Indians, and women with a family history of diabetes. Women with a history of gestational diabetes are at increased risk for developing type 2 diabetes.

There are other types of diabetes that result from specific genetic syndromes, drugs, malnutrition, infections and other illnesses. Such other types of diabetes may account for one to five percent of all diagnosed cases of diabetes.[25] Specific genetic syndromes include genetic defects of the ß- cells or

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[23] Diabetes Surveillance Report, Centers for Disease Control and Prevention Available at http://www.cdc.gov/health/diabetes/htm. Accessed July 31, 2002.
[24] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.
[25] Ibid.

genetic defects in insulin action.[26] In drug- or chemical-induced diabetes, the drugs may not cause the diabetes by themselves but may precipitate diabetes in those individuals with insulin resistance. Other illnesses include damage or trauma to the pancreas or endocrinopathies, where excess amounts of some hormone may antagonize insulin action.

Diagnostic Criteria

The diagnostic criteria for diabetes mellitus have been recently revised and are depicted in Table 1.1. Three different methods are available to diagnose diabetes and each method must be confirmed on a subsequent day by any of the three methods shown in Table 1.1.

Impaired glucose homeostasis refers to the condition in which the blood sugar levels are higher than normal but not high enough to be classified as diabetes. The two categories of impaired glucose homeostasis are impaired glucose tolerance (IGT) and impaired fasting glucose (IFG). In the absence of pregnancy, IFG and IGT are both risk factors for future diabetes and cardiovascular disease.[27] IGT occurs when the results of a 2-hour oral glucose

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[26] The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 25 (Supp 1) S5-S20, 2002.
[27] Ibid.

tolerance test are between 140-200 mg/dL.[28] IFG refers to the conditions when the results of an eight-hour fasting plasma glucose test are greater than 110 but less than 126 mg/dL. Approximately 16 million (15.6%) adults in the U.S. between 40 and 74 years of age have IGT and ten million (9.7%) have IFG.[29]

Table 1.1 Criteria for Diagnosis of Diabetes Mellitus

1. Symptoms of diabetes plus casual plasma glucose concentration ≥ 200mg/dl (11.1mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss. OR
2. Fasting Plasma Glucose ≥ 126mg/dl (7.0mmol/l). Fasting is defined as no caloric intake for at least 8 hours. OR
3. Two-hour post-prandial glucose ≥ 200mg/dl (11.1mmol/l) during an OGTT (oral glucose tolerance test). The test should be performed as described by World Health Organization (WHO) using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. The OGTT is not recommended for routine clinical use.

Source: The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 25(Supp1): S5-S20, 2002.

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28 Ibid.

29 National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

Prevalence and Incidence

In 2000, the prevalence of diabetes in adults in the United States was 6.2 percent (approximately 17 million people) and the incidence was one million cases per year.[30] The most recent published data on national trends of diabetes prevalence are from the Behavioral Risk Factor Surveillance System for the time period from 1990 to 1998.[31] The study found that the prevalence of diabetes among adults increased rapidly during this eight-year period across all regions, demographic groups and nearly all states in the United States. The prevalence of diabetes was highly correlated with the prevalence of obesity. The trends show that elderly and ethnic minority populations are disproportionately affected by diabetes. Based on 2000 census estimates, the prevalence rates of diabetes by gender in diabetics 20 years or older were 8.3 percent (7.8 million) for men and 9.1 percent (8.9 million) for women.[32]

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[30] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[31] Mokdad A.H., Ford S. E., Bowman B.A. et al. Diabetes Trends in the U.S.: 1990-1998. *Diabetes Care* 23(9): 1278-1283, 2000.

[32] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

Studies have shown that the prevalence of diabetes is quite high among the elderly and the incidence increases with age.[33, 34] Approximately 20 percent of the U.S. population age 65 and older (7 million people) have diabetes. [35] Nearly half of all diabetes cases occur in people older than 55 years of age. In 1996, the incidence of diabetes by age group was 0.6% for those between 45 and 64 years of age and 0.8% for those over 65 years of age.[36]

Diabetes disproportionately affects the ethnic minority populations. In the United States, two million or 10.2 percent of all Hispanic/Latino Americans adults over 20 years of age have diabetes. [37] The Hispanic/Latino Americans are almost twice as likely to have diabetes as non-Hispanic whites of similar age. Approximately 2.8 million or 13.0 percent of all non-Hispanic blacks over the age

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[33] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[34] Mokdad A.H., Ford S. E., Bowman B.A., et al. Diabetes trends in the U.S.: 1990-1998. *Diabetes Care* 23(9): 1278-1283, 2000.

[35] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[36] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999. Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed July 31, 2002.

[37] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

of 20 years have diabetes.[38] Table 1.2 depicts the prevalence of diabetes by race/ethnicity in people 20 years or older in the United States.

Table 1.2 Prevalence of Diabetes by Race/Ethnicity in People 20 Years of Age or Older in the United States

Race/Ethnicity	Prevalence
Non-Hispanic Whites	11.4 million 7.8 %
Non-Hispanic Blacks	2.8 million 13.0%
Hispanic/Latino Americans	2.0 million 10.2%
American Indians and Alaska Natives	105,000 15.1%
Asian Americans and Native Hawaiian or Pacific Islanders	Limited data. Data collected from 1996 to 2000 suggest Native Hawaiians are 2.5 times as likely to have diagnosed diabetes as white residents of Hawaii.

Source: National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

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[38] Ibid.

Mortality

Diabetes is a leading cause of mortality and the number of deaths is increasing. Research has found that death rates are twice as high among middle-aged adults with diabetes as among the same age group without diabetes.[39] The Center for Disease Control and Prevention's (CDC's) National Center for Health Statistics reported that diabetes was the sixth leading cause of death listed on U.S. death certificates in 1999.[40] This figure is based on the 68,399 death certificates in which diabetes was listed as the underlying cause of death. On an additional 141,265 death certificates, diabetes was listed as a contributing cause of death. According to the CDC, many decedents with diabetes do not have the disease entered on their death certificate. Only about 35 percent to 40 percent have diabetes listed anywhere on the certificate and only 10 percent to 15 percent have it listed as the underlying cause of death.[41] Thus, the toll of diabetes is believed to be much higher than officially reported.

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[39] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999. Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed July 31, 2002.

[40] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

[41] Ibid.

Increased mortality rates among people with diabetes are seen for all ages and races. The highest rates are seen among ethnic minority populations and the older population. When causes of death were examined by race, diabetes ranked as the seventh leading cause of death for whites, Chinese, and Filipinos and as the sixth leading cause among blacks, Japanese persons and persons of Hispanic origin. [42]

Economic Burden

In 1997, the total direct and indirect cost of diabetes was $98 billion in the United States. [43] Direct medical costs totaled $44 billion and indirect costs were $54 billion. Indirect costs include disability, work loss and premature mortality. This estimate includes only costs resulting from diabetes. Krop and associates examined the patterns of expenditures and use of services among Medicare

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[42] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999., Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed July 31, 2002.

[43] American Diabetes Association. Economic consequences of diabetes mellitus in the U.S. in 1997. *Diabetes Care* 21(2): 296-309, 1998.

beneficiaries with diabetes in 1992.[44] The authors found large variations in expenditures among older adults with diabetes. The results of the study indicated that, on average, Medicare beneficiaries with diabetes were 50 percent more expensive than all other beneficiaries.

Additional facts on the direct and indirect costs of diabetes are listed below.

Direct Costs of Diabetes

- Represent 5.8 percent of total personal health-care expenditures in the U.S.
  Diagnosed patients account for only 3.8 percent of the total U.S. civilian population.

- Estimated $27.5 billion spent for inpatient hospital care and $5.5 billion for nursing home care.

- Diabetes-related hospitalizations totaled 13.9 million days in 1997. Rates of outpatient care were highest for physician office visits (30.3 million visits to treat persons with diabetes).[45]

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[44] Krop J.S., Poe N.R., Weller W.E., et al. Patterns of expenditures and use of services among older adults with diabetes. *Diabetes Care* 21(5): 747-752, 1998.

[45] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999. Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed July 31, 2002.

Indirect Costs of Diabetes:

- Disability costs estimated to be $37.1 billion and mortality approximately $16.9 billion.

- In 1997, diabetes accounted for a loss of nearly 88 million disability days. Of those, over 14 million work loss days from jobs outside the home were attributed to diabetes.

- In 1997, a total of 74,927 workers were reported to be permanently disabled due to diabetes.

Indirect Costs of Diabetes:

- On average, persons with diabetes age 18 to 64 years lost 8.3 days from work compared to 1.7 days for persons without diabetes.[46]

- In 1999, based on death certificate data, diabetes was the underlying cause of death for 68,399 people.[47]

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[46] Ibid.

[47] National Diabetes Fact Sheet, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/diabetes/pubs/estimates.htm. Accessed July 31, 2002.

REVIEW OF THE LITERATURE

SCOPE OF THE LITERATURE REVIEW

The literature review is divided into four major sections. The first section covers diabetes in older adults. This section includes the misconceptions, pathogenesis, presentation and clinical features, complications and treatment of diabetes in the older population.

The second section reviews the literature on adherence to the diabetes treatment regimen and includes the prevalence of non-adherence and the challenges to adherence in older adults. This section presents the barriers to adherence that are specific to the elderly, such as the physical, psychological and environmental barriers.

The third section of the literature review includes a review of the methodological issues with measuring and defining adherence in diabetes. The complexity of the diabetes treatment regimen and the different methods employed to measure adherence in diabetes will be described.

The fourth section covers the Social Cognitive Theory (SCT) and provides an overview, brief history, and limitations of the theory. The relationship of selected major concepts of the SCT with diabetes self-care behavior will be described. In addition, the role of the family in diabetes management will be included. The literature review will include studies that have examined the role of the family environment or social support in diabetes adherence and/or glycemic control.

DIABETES IN OLDER ADULTS

Misconceptions of Diabetes in Older Adults

There are many misconceptions regarding diabetes in older adults among health care professionals and the general public. These misconceptions constitute a major barrier to optimal management of diabetes in older adults.[48] Many older adults with newly diagnosed diabetes may view diabetes as a natural part of the aging process and may not take it seriously.[49, 50] Other common misconceptions are that mild hyperglycemia is usually innocuous and that reduced life expectancy makes the consequences of chronic hyperglycemia irrelevant to the elderly.

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[48] Mooradian A.D., McLaughlin S., Boyer C.C., et al. Diabetes care for older adults. *Diabetes Spectrum* 12(2): 70-77, 1999.

[49] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[50] Davis W.K., Hess G.E., Van Harrison R., et al. Psychological adjustment to and control of diabetes mellitus: differences by disease type and treatment. *Health Psychology* 6(1): 1-14, l987.

However, the truth is that diabetes continues to be a major cause of morbidity and mortality in the elderly.[51]

Pathogenesis

Several factors contribute to type 2 diabetes in the elderly. Aging is considered a major risk factor for the development of type 2 diabetes and this has led some to believe that glucose intolerance is inevitable in the elderly.[52] Tissue sensitivity to the action of insulin decreases as one gets older. However, certain risk factors are essentially modifiable. These include sedentary life style, poor dietary habits and obesity with central fat distribution.

Other risk factors that are more difficult to control include coexisting diseases, the use of medications with adverse effects on carbohydrate tolerance, and age-related changes in insulin secretion or action. The exact mechanism of age-related changes in insulin secretory reserve or insulin action at target sites remains unknown. The United Kingdom Prospective Diabetes Study found that carbohydrate tolerance decreased over a period of ten years, regardless of the

[51] CDC Surveillance Report "The public health of diabetes mellitus in the United States" Available at http://www.cdc.gov/diabetes/survl/surveill.htm#preval. Accessed July 31, 2001.

[52] Mooradian A.D., McLaughlin S., Boyer C.C., et al. Diabetes care for older adults. *Diabetes Spectrum* 12(2): 70-77,1999.

antidiabetic regimen used.[53] It is thought that this may be due to the gradual depletion of pancreatic insulin secretory capacity.

Presentation and Clinical Features

The clinical presentation of diabetes is different in the elderly than in younger individuals. Diabetes in the elderly is often asymptomatic at onset.[54] Polyuria is less common in the elderly due to the increase in the renal threshold for glucose. Polydipsia is infrequent because the thirst mechanism is impaired in the elderly. The elderly usually present with nonspecific symptoms such as weight loss, fatigue and confusion. In the elderly, diabetes is often diagnosed during the evaluation of another illness.

Complications

There are acute and long-term complications related to diabetes mellitus. The burden and the complications of diabetes are immense and disproportionately affect ethnic minority populations and the elderly. Black and associates reported that the prevalence and health burden of diabetes are greater in older Mexican

[53] U.K. Prospective Diabetes Study Group: Intensive blood glucose control with sulfonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *Lancet* 352(9131): 837-853, 1998.

[54] Meneilly G.S. and Tessier D. Diabetes in the elderly. *Diabetic Medicine* 12(11): 949-960, 1995.

Americans than in older non-Hispanic Whites and African Americans, especially among elderly men.[55] A summary of the complications of diabetes in the elderly is summarized in Table 1.3. A brief discussion of both the acute and long-term complications is provided.

[55] Black S.A., Ray L.A. and Markides K.S. The prevalence and health burden of self-reported diabetes in older Mexican Americans: findings from the Hispanic established populations for epidemiologic studies of the elderly. *American Journal of Public Health* 89(4): 546-552, 1999.

Table 1.3 Complications of Diabetes in the Elderly

Acute	Long-Term
Osmotic Diuresis Dehydration Hypotension Fluid and electrolyte loss Impaired cognition	**Macrovascular** Cardiovascular disease Cerebrovascular disease Peripheral vascular disease
Weight loss Muscle loss Loss of strength and mobility	**Microvascular** Retinopathy Nephropathy Peripheral and autonomic neuropathy
Infection	**Impaired cognition**
Hyperosmolar coma	
Hypoglycemia	

Source: Meneilly G.S. and Tessier D. Diabetes in the elderly. *Diabetic Medicine* 12(11): 949-60, 1995 and Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

Acute Complications

Several acute metabolic complications may occur in the elderly. These complications include hypoglycemia and hyperglycemia-related complications such as hyperosmolar hyperglycemia nonketotic coma.[56] Hyperosmolar coma usually occurs in patients with slight abnormalities of glucose metabolism who have a major precipitating acute illness. Hyperosmolar coma is characterized by insulin deficiency, elevated stress hormone, marked hyperglycemia and intravascular volume depletion. Osmotic diuresis causes further fluid and electrolyte losses, dehydration, hypotension and impaired cognitive function. Hyperglycemia causes an increased risk of infections and poor wound healing. Hypoglycemia is a complication that may occur in patients treated with oral hypoglycemia agents or insulin.

Long-Term Complications

Older patients are subject to the same long-term complications of diabetes mellitus as those for the younger age groups. However, in the elderly, there is a decline in the functional reserve of many organ systems from underlying organ system impairment and/or other coexisting diseases.[57] Thus, the recognition and

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[56] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[57] Ibid.

prevention of these complications are especially important in the elderly. The chronic complications involve macrovascular and microvascular diseases.

Macrovascular Disease

Artherosclerotic disease affecting major blood vessels increases with age and the presence of diabetes accelerates the process. [58] The most common cause of death among people with diabetes is coronary artery disease and the incidence of peripheral vascular disease and stroke in the elderly are influenced by the presence of diabetes mellitus. In 1996, approximately 43 percent of all diabetes-related deaths had cardiovascular disease listed as an underlying cause of death.[59]

Microvascular Disease

Other complications of diabetes include renal disease and diabetic retinopathy, which are most strongly related to duration of diabetes rather than age per se.[60] Diabetes is the leading cause of end-stage renal disease and is

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[58] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[59] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999. Centers for Disease Control and Prevention. Available at http:// www.cdc.gov/diabetes/statitstics/sur199/chap1/mortality.htm. Accessed July 31, 2001.

[60] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

responsible for approximately 40 percent of all new cases in the United States.[61] Elderly diabetics are at an increased risk for end-stage renal disease.

Somatosensory neuropathy, a loss of sensation particularly in the feet and hands, is a contributing factor to the high risk of amputation in the older diabetics.[62] Lower extremity disease is more common among persons with diabetes than among persons without the disease.[63] More than half of all the nontraumatic lower extremity amputations (LEA) occur in persons with diabetes. Blacks and the elderly are disproportionately affected. In 1996, almost 60 percent of diabetes-related LEA occurred in those greater than 65 years of age.

[61] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999, Centers for Disease Control and Prevention. Available at http:// www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed August 1, 2002.

[62] Anderson L.A. and Halter J.B. Diabetes care in older adults: current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[63] The public health burden of diabetes mellitus in the United States, Diabetes Surveillance, 1999. Centers for Disease Control and Prevention. Available at http:// www.cdc.gov/diabetes/statitstics/surv199/chap1/mortality.htm. Accessed July 31, 2002.

In addition to the microvascular and macrovascular diseases, other disorders such as impaired cognition and depression are associated with diabetes. The next section covers impaired cognitive function and depression.

Other Diabetes- Related Disorders

Impaired Cognitive Function

Approximately five to 10 percent of adults over age 65 are affected by a decline in cognitive function.[64] The cognitive changes that occur with normal aging include slowing but not elimination of the ability to create and retrieve memory. Over the past 30 years, a number of studies have been conducted that have examined the relationship between type 2 diabetes and cognitive impairment. Overall, these studies have suggested that patients with type 2 diabetes exhibit moderate degrees of cognitive dysfunction, particularly with

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[64] Tun P.A., Nathan D.M. and Perlmuter L.C. Cognitive and affective disorders in elderly diabetics. *Clinical Geriatric Medicine* 6: 731-746, 1990.

respect to verbal memory.[65, 66, 67] However, the results of the studies must be interpreted with caution, due to the methodological differences between the studies.[68] For example, a large number of different batteries of psychological tests have been used in the studies. This makes it difficult for a valid comparison between the different studies. Other methodological issues include failure to control for major confounding factors, heterogeneous populations and small samples.

The precise mechanism by which elevated glucose levels appear to impair cognitive function is not clear.[69] Since type 2 diabetes is such a complex metabolic disorder, there are many potential factors associated with cognitive impairment. Patients with type 2 diabetes are at risk for developing other complications such as retinopathy, nephropathy and neuropathy. These complications can result in impaired vision, impaired renal function and

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[65] Strachan M.W.J., Deary I.J., Ewing F.E., et al. Is Type II diabetes associated with an increased risk of cognitive function? A critical review of published studies. *Diabetes Care* 20(3): 438-455, 1997.
[66] Stewart R. and Liolitsa D. Type 2 diabetes mellitus, cognitive impairment and dementia. *Diabetic Medicine* 16(2): 93-112, 1999.
[67] Tun P.A., Nathan D.M. and Perlmuter L.C. Cognitive and affective disorders in elderly diabetics. *Clinical Geriatric Medicine* 6: 731-746, 1990.
[68] Strachan M.W.J., Deary I.J., Ewing F.E., et al. Is Type II diabetes associated with an increased risk of cognitive function? A critical review of published studies. *Diabetes Care* 20(3): 438-455, 1997.
[69] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

diminished hand coordination, and can interfere with the performance on the psychometric evaluations. Other disorders that are prevalent in patients with type 2 diabetes, such as hypertension, ischemic heart disease, cerebrovascular disease and depression can be associated with impaired cognitive function.[70] The cognitive dysfunction that is observed in type 2 diabetes may result from the interaction between the metabolic abnormalities, diabetes- specific complications and other diabetes-related disorders.

Depression

A number of studies have reported that comorbid depressive symptoms are especially prevalent among adults with diabetes.[71, 72, 73] Older adults appear to be more susceptible to comorbid depression and diabetes.[74,75] Depressive symptoms

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[70] Strachan M.W.J., Deary I.J., Ewing F.E., et al. Is Type II diabetes associated with an increased risk of cognitive function? A critical review of published studies. *Diabetes Care* 20(3): 438-455, 1997.

[71] Peyrot M. and Rubin R.R. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 20(4): 585-590, 1997.

[72] Konen J.C., Curtis L.G., and Summerson J.H. Symptoms and complications of adult diabetic patients in a family practice. *Archives of Family Medicine* 5(3): 135-145, 1996.

[73] Anderson R.J., Freedland K.E., Clouse R.E., et al. The prevalence of comorbid depression in adults with diabetes. *Diabetes Care* 24(6): 1069-1078, 2001.

[74] Black S. Increased health burden associated with comorbid depression in older diabetic Mexican Americans: results from the Hispanic Established Population for the Epidemiologic Study for the elderly survey. *Diabetes Care* 22(1): 56-64, 1999.

[75] Amato L., Paolisso G., Caccitore F., et al. Non-insulin dependent diabetes mellitus is associated with a greater prevalence of depression in the elderly. *Diabetes & Metabolism* 22(5): 314-318, 1996.

and poorer well-being have been found to be associated with poor glucose control and inadequate treatment adherence.[76]

Anderson and associates conducted a meta-analysis to estimate the odds and prevalence of depression in adults with type 1 or type 2 diabetes.[77] In their meta-analysis, the researchers found that, in controlled studies, the odds of depression in the diabetic group were twice that of the nondiabetic comparison group. The prevalence of depression was significantly higher in diabetic women (28%) than in diabetic men (18%), in uncontrolled (30%) than in controlled studies (21%), in clinical (32%) than in community (20%) samples, and when assessed by self-report questionnaires (31%) than by standardized diagnostic interviews (11%).

Estimates of the prevalence of depression in older adults with type 2 diabetes vary widely. The prevalence of depression ranged from 11.5 percent to

[76] Van der Does F.E., De Neeling J.N., Snoel F.J., et al. Symptoms and well-being in relation to glycemic control in type II diabetes. *Diabetes Care* 19(3): 204-210, 1996.

[77] Anderson R.J., Freedland K.E., Clouse R.E., et al. The prevalence of comorbid depression in adults with diabetes. *Diabetes Care* 24(6): 1069-1078, 2001.

13.6 percent for older community-based samples with type 2 diabetes.[78, 79, 80] The rates are one and one-half to three times the prevalence of major depressive disorders found in the non-diabetic comparison groups.

The rates of depression among various ethnic groups of older adults differ significantly. Reported rates of depressive symptoms are generally in the range of nine percent to 17 percent among older community-dwelling non-Hispanic Whites and African Americans.[81, 82, 83] Data from the Hispanic Established Population for the Epidemiologic Study of the Elderly (EPESE) were used to examine the health burden associated with concomitant depressive symptoms and

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[78] Amato L., Paolisso G., Caccitore F., et al. Non-insulin dependent diabetes mellitus is associated with a greater prevalence of depression in the elderly. *Diabetes & Metabolism* 22(5): 314-318, 1996.

[79] Viinamaki H., Niskanen L. and Uusitupa M. Mental well-being in people with non- insulin –dependent diabetes. *Acta Psychiatrica Scandinavica* 92(5): 392-397, 1995.

[80] Palinkas L.A., Barrett-Connor E. and Wingard D.L. Type 2 diabetes and depressive symptoms in older adults: a population-based study. *Diabetic Medicine* 8(6): 532-539, 1991.

[81] Callahan C.M. and Wolinsky F.D. The effect of gender and race on the measurement properties of the CES-D in older adults. *Medical Care* 32(): 341-356, 1994.

[82] Berkman L.F., Berkman C.S., Kasl S., et al. Depressive Symptoms in relation to physical health and functioning in the elderly. *American Journal of Epidemiology* 124(3): 372-388, 1986.

[83] O'Hara M.W., Kohout F.J. and Wallace R.B. Depression among the rural elderly: a study of prevalence and correlates. *Journal of Nervous and Mental Disorders* 173(10): 582-589, 1985.

diabetes in older Mexican Americans.[84] In the sample of over 600 older Mexican American diabetics, 31 percent of the individuals reported high levels of depressive symptoms. Depression was measured with the Center for Epidemiologic Studies of Depression Scale (CES-D).

Treatment

Diabetes places many behavioral demands on the patient. Its management depends on the active participation of the patient over a long period of time in obtaining medical care and following a treatment regimen.

Treatment of type 2 diabetes in the elderly involves a stepwise approach which includes the following:

1. lifestyle changes;
2. oral monotherapy;
3. combination oral therapy; and
4. insulin alone or with an oral agent.[85]

It is generally recommended that lifestyle changes such as diet, exercise and weight loss be attempted before initiating drug therapy. If the lifestyle changes do not adequately control the blood glucose, then pharmacotherapeutic

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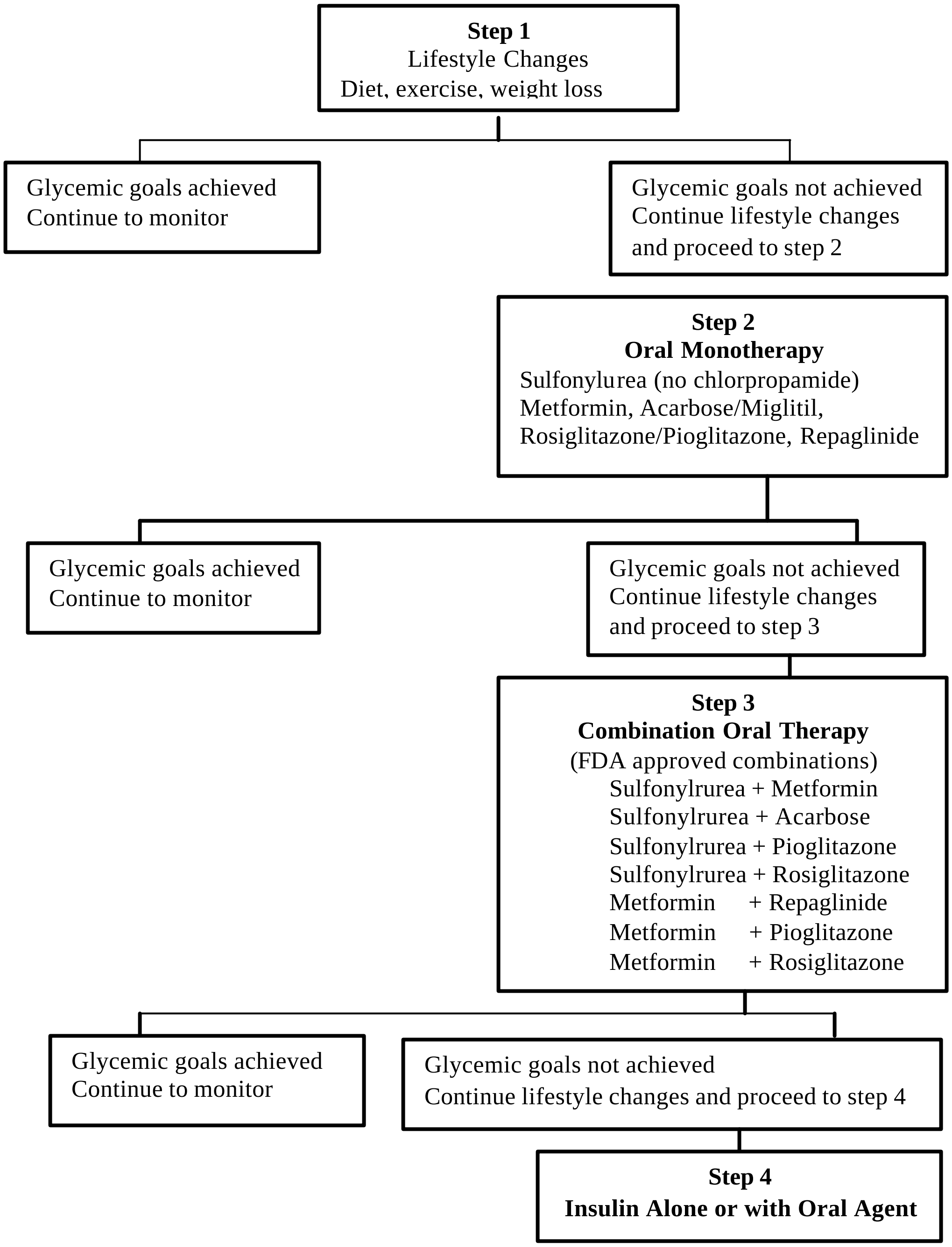
[84] Black S. Increased health burden associated with comorbid depression in older diabetic Mexican Americans: results from the Hispanic Established Population for the Epidemiologic Study for the elderly survey. *Diabetes Care* 22(1): 56-64, 1999.

[85] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

agents should be the next consideration. Figure 1.1 depicts a therapeutic algorithm that may be used as a guide in the treatment of type 2 diabetes in older adults.

Figure 1.1 Therapeutic Algorithm for the Treatment of Type 2 Diabetes



Source: Konzem S.L. Optimization of treatment of type 2 diabetes in elderly. *U.S. Pharmacist* 25(11): 32-49, 2000.

Lifestyle Changes

Lifestyle changes for people with diabetes include diet, weight loss and exercise. Diet and weight loss, if needed, are considered the treatment of choice in the elderly. Some of the barriers to following a diet plan in the elderly include the following: difficulty in chewing and swallowing, decreased ability and interest in cooking, changes in taste perceptions, unwillingness to change eating habits, physical and functional limitations, limited finances, and dependence on others for meals.[86]

Diet

Obese elderly patients should restrict their caloric intake. Caloric restriction is not recommended in patients over 70 years of age who are less than 20 percent over their ideal body weight.[87] Today, there is not one "diabetic" or "American Diabetes Association (ADA)" diet. The recommended diet is defined as a nutrition program based on assessment, treatment goals and outcomes.[88] Medical nutritional therapy of diabetics should be individualized, taking into regards cultural, lifestyle and economic considerations.

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[86] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[87] Fonseca V. and Wall J. Diet and diabetes in the elderly. *Clinical Geriatric Medicine* 11: 613-624, 1995.

[88] American Diabetes Association. Standards of medical care for patients with Diabetes Mellitus. *Diabetes Care* 25 (Supp 1): S33-S49, 2002.

Exercise

Exercise in addition to diet and weight loss can help the elderly achieve glycemic control. Research has shown that regular exercise can prevent the progressive decrease in fitness, muscle mass and strength that occurs with aging.[89] Barriers to exercise in the elderly include cardiovascular disease, arthritis, and peripheral neuropathy. The exercise program, like the nutritional therapy, should be individualized.

Drug Therapy

When changes in lifestyle are not sufficient for achieving glycemic control, then drug therapy should be initiated. The choice of the agent is dependent on factors such as the following: severity of the hyperglycemia, coexisting medical conditions, concomitant use of other medications, and pharmacodynamic and economic considerations.[90] Presently, there are five classes of oral antidiabetic agents. These include the sulfonylureas, biguanides, alpha-glucosidase inhibitors, thiazolidinediones and meglitinides.

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[89] American Diabetes Association, Diabetes mellitus and exercise. *Diabetes Care* 23(Supp 1): S50-S56, 2000.
[90] Mooradian A.D., McLaughlin S., Boyer C.C., et al. Diabetes care for older adults. *Diabetes Spectrum* 12(2): 70-77, 1999.

The sulfonylureas increase insulin secretion from the pancreas and are a good therapeutic choice in the lean elderly who tend to exhibit impaired first and second phase postprandial insulin release.[91] The sulfonylureas are the least expensive of the agents. The clinical efficacy and safety of the sulfonlyurea agents are comparable with the exception of chlorpropamide. Chlorpropamide has a long half-life and has antidiuretic hormone potentiating effects and should not be used in older patients.[92]

Metformin is a biguanide that decreases hepatic glucose production and improves the utilization of insulin. Metformin is a good choice for the obese elderly who are prone to insulin resistance.[93] The alpha glucosidase inhibitors decrease the gastrointestinal absorption of carbohydrates thus decreasing postprandial glucose. A disadvantage of this class of drug is that they must be taken several times per day and have a smaller reduction in hemoglobin A1C levels (HbA1C) when compared to other agents. The alpha glucosidase inhibitors are usually used as monotherapy in those with mild hyperglycemia or as an adjunct with other therapy. The biguanides and the alpha glucosidase inhibitors

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[91] Davidson M.B. Oral antidiabetic agents IN *Diabetes Mellitus: Diagnosis and Treatment*. Philadelphia, W.B. Saunder, 127-157, 1998.
[92] Mooradian A.D., McLaughlin S., Boyer C.C., et al. Diabetes care for older adults. *Diabetes Spectrum* 12(2): 70-77, 1999.
[93] Ibid.

are not associated with hypoglycemia when used as monotherapy. However, both are associated with a high incidence of gastrointestinal discomfort.

The thiazolidinediones improve insulin utilization and decrease hepatic glucose production.[94] Research evaluating the use of this class in the elderly is limited. The meglitinides increase insulin release from the pancreases in a glucose dependent fashion. The meglitinides may be an alternative to the sulfonylureas in the brittle elderly diabetic who is prone to hypoglycemia.

If the diabetes is not under control, the next step involves a combination of oral therapy agents. Combination therapy has been shown to achieve greater blood glucose lowering than monotherapy because the different classes have different mechanisms of action. The last step in the treatment algorithm is insulin either alone or in combination with oral agents. Although there is an increased incidence of hypoglycemia in the elderly, studies have demonstrated that insulin can be used safely in the elderly without severe hypoglycemia.[95]

The advantages of insulin therapy are that it is usually possible to lower the plasma glucose value and the dosage can be better adjusted to avoid symptoms. Factors that should be considered in initiating insulin therapy in older adults include the following: 1.) functional ability of the patient to draw up and

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[94] Ibid.

[95] Saudek C.D. and Golden S.H. Feasibility and outcomes of insulin therapy in elderly patient with diabetes mellitus. *Drugs and Aging* 14: 375-385, 1999.

administer correct doses of insulin; 2.) ability to monitor blood glucose; 3.) ability to follow a meal pattern; and 4.) ability to manage potential hypoglycemic reactions.[96] Insulin is commercially available in rapid, short, intermediate and long acting forms. The insulins may be injected separately or mixed in the same syringe. The dose of insulin is dependent on the individual glycemic response to food intake and exercise regimen. It is recommended that insulin-using patients should practice self-monitoring of blood glucose.[97] The dosage adjustments should be made based on blood glucose measurements.

Table 1.4 summarizes the oral antidiabetic agents used in the elderly and Table 1.5 summarizes the advantages and disadvantages of the five major classes of oral agents.

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[96] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[97] American Diabetes Association. Standards of medical care for patients with Diabetes Mellitus. *Diabetes Care* 25(Supp 1): S33-S49, 2002.

Table 1.4 Dosing of Oral Antidiabetic Agents Used in the Elderly

Antidiabetic Agent Generic	Trade Name	Recommended Starting Dose Per Day (milligram)	Maximum Dose Per Day (milligram)
Sulfonylureas			
Acetohexamide	Dymelor	125-250	1500
Tolazamide	Tolinase	100	1000
Tolbutamide	Orinase	250-500	3000
Glimepiride	Amaryl	0.5	8
Glipizide	Glucotrol	2.5	40
Glipizide, extended release	Glucotrol XL	2.5	20
Glyburide	Diabeta Micronase	1.25	20
Glyburide, micronized	Glynase	0.75-1.5	12
Biguanide			
Metformin	Glucophage	500	2550
Alpha-glucosidase Inhibitors			
Acarbose	Precose	25	300
Miglitol	Glyset	25	300
Thiazolidinediones			
Pioglitazone	Actos	15	45
Rosiglitazone	Avandia	4	8
Meglitinide			
Repaglinide	Prandin	0.5-1.5	16

Source: Konzem S.L. Optimization of treatment of type 2 diabetes in elderly. *U.S. Pharmacist* 25(11): 32-49, 2000.

Table 1.5 Advantages and Disadvantages of Oral Antidiabetic Agents in the Elderly

Class	Advantages	Disadvantages
Sulfonylureas	Increase insulin secretion (lean diabetic) Low cost	Hypoglycemia Weight gain
Biguanides	No hypoglycemia as montherapy No weight gain Beneficial lipid profile effect Improve insulin utilization (obese)	Gastrointestinal side effects Contraindicated in renal insufficiency and congestive heart failure
Alpha-gluosidase Inhibitors	No hypoglycemia as monotherapy No weight gain Little systemic absorption Decrease postprandial glucose	Gastrointestinal side effects Multiple daily dosing Less HbA1C reduction than other agents
Thiazolidinediones	No hypoglycemia as monotherapy Improve insulin utilization (obese) Improve triglycerides and HDL[a]	Weight gain High cost Increase LDL[b] Frequent monitoring of liver function tests
Meglitinides	Less hypoglycemia than sulfonylureas Increase insulin release (lean) Decrease postprandial glucose	Hypoglycemia Weight gain Multiple daily dosing High cost

Source: Konzem S.L. Optimization of treatment of type 2 diabetes in elderly. *U.S. Pharmacist* 25(11): 32-49, 2000.

[a] HDL = high density lipoprotein

[b] LDL = low density liporprotein

Monitoring Glycemia

Diabetic patients can work on achieving and maintaining specific glycemic goals. The results of studies such as the Diabetes Control and Complications Trial (DCCT) demonstrated that intensive glycemic control can delay or prevent the development of microvascular complications in type 1 diabetes.[98] The United Kingdom Prospective Diabetes Study results confirmed these results in patients with type 2 diabetes.[99] The optimal frequency of self-monitoring of blood glucose for patients with type 2 diabetes is not known, but should be sufficient to facilitate reaching desired glucose levels.[100] Self-monitoring of blood glucose is recommended for all diabetic patients treated with insulin. Blood glucose monitoring may be desirable in patients treated with sulfonylureas and in all patients not achieving glycemic goals.

Historically, urine glucose and ketone testing were the only practical methods for diabetics to assess their glycemic status on a daily basis. Today, self-

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[98] The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England Journal of Medicine 329*(14): 977-986, 1993.

[99] U.K. Prospective Diabetes Study Group: Intensive blood glucose control with sulfonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *Lancet* 352(9131): 837-853, 1998.

[100] American Diabetes Association. Standards of medical care for patients with Diabetes Mellitus. *Diabetes Care* 25(Supp 1): S33-S49, 2002.

monitoring of blood glucose has replaced urine glucose testing for most patients. Urine ketone testing is an important part of monitoring type 1 diabetics or patients with gestational diabetes. Urine glucose testing should be considered an alternative for those patients who will not or cannot perform self-monitoring of blood glucose. The American Diabetes Association (ADA) recommends that all diabetics test their urine for ketones during any of the following situations: acute illness or stress; when blood glucose levels are consistently elevated; or when there are symptoms of ketoacidosis, such as nausea, vomiting or abdominal pain.

Glycated protein testing provides a quantitative and reliable measure of glycemia over an extended period of time. Measurements of glycated proteins, such as hemoglobin and serum protein, can quantify average glycemia over weeks and months. Glycated hemoglobin (GHB), also referred to as glycohemoglobin, glycosylated hemoglobin, HbA1C or HbA1, is a term used to describe the series of hemoglobin components formed from hemoglobin and glucose. The HbA1C values have been shown to be a good predictor of the risk for the development of many of the complications in diabetes. HbA1C testing should be performed routinely in all patients with diabetes. It is recommended that HbA1C be performed approximately every three months to determine if a patient's metabolic control has remained within the target range.[101] The HbA1C value reflects a mean glycemia over the preceding two to three months. In non-diabetics, the HbA1C value ranges from four to six percent.

The ADA recommends that the goal of therapy should be a HbA1C value of less than seven percent and practitioners should evaluate the treatment regimen in patients with HbA1C consistently greater than eight percent.[102] These specific values apply only to assay methods that are certified as traceable to the DCCT reference methods.

Good glycemic control has been defined by some researchers as HbA1C values less than or equal to 7.4 percent[103] based on levels achieved in the DCCT.[104] Acceptable control has been defined as an HbA1C value between 7.5 to 8.4 percent. Based on the DCCT results, the risk of microvascular complications dramatically increase when levels are greater than 8.4 percent. Poor control has been defined as HbA1C levels greater than 8.4 percent.

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[101] American Diabetes Association. Standards of medical care for patients with Diabetes Mellitus. *Diabetes Care* 25(Supp 1): S33-S49, 2002. .

[102] Ibid.

[103] Trief P.M., Elbert K., Grant W., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

[104] The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England Journal of Medicine* 329(14): 977-986, 1993.

Foot Care

Although this study will not assess adherence with proper diabetic foot care, it is an important aspect of the diabetic regimen and will be discussed briefly, with respect to the recommendations for foot care. The ADA recommends that patients with diabetes and high-risk foot conditions be educated about the risk factors and appropriate management.[105] Patients at risk should be instructed to monitor their feet on a daily basis and on the proper care of their feet including nail and skin care and proper foot wear. Patients at low risk should be educated on foot care and appropriate foot wear.

Goals of Therapy for the Elderly

The ADA does not identify specific glycemic goals for the elderly. However, some practitioners recommend fasting plasma glucose between 120 to150 mg/dL and postprandial glucose of 150 to 200mg/dL. In addition, the HbA1C should not exceed 1.5 to two percent above the upper limit of normal.[106]

The daily management in diabetes can be quite complex. It involves diet, exercise, possible drug therapy with oral agents and/or insulin, self- monitoring of

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[105] American Diabetes Association, Preventive foot care in people with diabetes. *Diabetes Care* 23(Suppl 1): S55-S56, 2000.
[106] Henry R. and Edelman S. Advances in treatment of type 2 diabetes mellitus in the elderly. *Geriatrics* 47(4): 24-30, 1992.

blood glucose, and foot care. Although the physician provides recommendations on self-management, the rest of the responsibility usually rests with the patient.[107]

ADHERENCE TO DIABETES TREATMENT REGIMEN

Prevalence of Non-Adherence

Adherence to a diabetes treatment regimen is a challenge for patients, healthcare providers and researchers. Problems in following a diabetes regimen have been well documented.[108] The prevalence of non-adherence varies across the different areas of the diabetes regimen, across the patient's lifespan, and during the course of the disease. There are conceptual issues in defining and assessing adherence. Haynes defines *adherence* as "the extent to which a person's behavior (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice."[109] This definition requires that the patient's behavior be compared with some standard determined by the medical

[107] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

[108] Glasgow R.E. Patient Compliance in Diabetes Mellitus in *Patient Compliance in Medical Practice and Clinical Trials*. Cramer J.A. and Spilker B. editors, New York, Raven Press, 209-224, 1991.

[109] Haynes R.B. Introduction in *Compliance in Health Care*. Haynes R.B., Taylor D.W. and Sackett D.L. editors, Baltimore, John Hopkins Press, 2-3, 1979.

community. Diabetes patients often do not receive specific regimen prescriptions in several areas of the regimen. It is difficult to calculate an adherence score if there is no standard or specific criteria against which to compare the patient's behavior. [110] Thus, very few studies report actual compliance rates for either type 1 or type 2 diabetes.

For those studies in which an adherence rate was available, the rates varied widely across the studies. Adherence appeared to be primarily determined by the type of measurement and the definition of adherence used. The rates varied from 50 percent of patients who reported following their exercise prescription to over 90 percent reported adhering to their insulin regimen. [111] Thus, it is difficult to make any conclusive statements about compliance with the various tasks in the diabetes regimen. However, studies that have assessed regimen adherence across two or more aspects of the diabetes regimen have consistently concluded that adherence to the medical aspects of the regimen, such

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[110] Glasgow R.E. Patient Compliance in Diabetes Mellitus in *Patient Compliance in Medical Practice and Clinical Trials.* Cramer J.A. and Spilker B. editors, New York, Raven Press, 209-224, 1991.

[111] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

as medication and insulin injections, is higher than adherence to lifestyle changes such as diet and exercise.[112]

Challenges and Barriers to Adherence for Older Adults

Diabetes self-management is especially complex because it requires the individual to master numerous tasks at home such as monitoring blood glucose, caring for one's feet, taking medications, eating appropriate meals, and exercising regularly. Meeting the needs of older diabetics requires an understanding of the many factors that interact to determine adherence to the treatment regimen, metabolic control, and adjustment to the disease.[113] There are physical, psychological and environmental barriers to compliance that are unique to the elderly population.[114]

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[112] Glasgow, R.E. Patient Compliance in Diabetes Mellitus in *Patient Compliance in Medical Practice and Clinical Trials.* Cramer J.A. and Spilker B. editors, New York, Raven Press, 209-224, 1991.

[113] Anderson L.A. and Halter J.B. Diabetes Care in Older Adults: Current issues in management and research. *Annual Review of Gerontology and Geriatrics* 9: 35-73, 1989.

[114] Amaral P. The special case of compliance in the elderly in *Compliance- the Dilemma of the Chronically Ill.* Gerber K.E. and Nehemkis A.M. editors, New York, Springer Publishing Co. 128-157, 1986.

Physical Barriers

Physical barriers that may affect compliance include vision and hearing impairments.[115] Conditions such as glaucoma, macular degeneration, and cataracts are common in the elderly population. An estimated 60 percent of the elderly suffer from osteoarthritic degenerative joint disease that primarily affects joint cartilage and can cause significant impairment.[116] The physical barriers may make it difficult for the elderly to open their prescription vials or draw up their insulin doses. The patient with a hearing impediment can miss critical communication that can affect compliance. The need to manage more than one complex regimen and the physical limitations imposed by other chronic illnesses are more likely to impact adherence negatively among older persons.[117]

Psychological Barriers

Psychological barriers include cognitive impairment and depression. Both of these disorders have been discussed in more detail under the "Complications"

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[115] Amaral P. The special case of compliance in the elderly in *Compliance- the Dilemma of the Chronically Ill.* Gerber K.E. and Nehemkis A.M. editors, New York, Springer Publishing Co. 128-157, 1986.

[116] Ibid.

[117] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

section of this chapter. The prevalence of dementia in the non-institutionalized population over 65 years of age is approximately five percent.[118] The elderly with senile dementia may have severe learning and memory defects that will interfere with their ability to comply with the therapeutic regimen. The elderly may have more difficulty understanding diabetes print materials than younger diabetics.[119] Additionally, depression is common in older adults but may be hard to recognize.[120]

Environmental Barriers

Environmental barriers include income, transportation, inappropriate therapeutic regimen, and social isolation.[121] Other environmental influences that are important include patient/provider relationships and community resources and services. However, these other factors are not elaborated on the following sections.

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[118] Amaral P. The special case of compliance in the elderly in Compliance- the Dilemma of the Chronically Ill. Gerber K.E. and Nehemkis A.M. editors, New York, Springer Publishing Co. 128-157, 1986.

[119] Kicklighter J.R. and Stein M.A. Factors influencing diabetic clients' ability to read and comprehend printed diabetic diet materials. *Diabetes Educator* 19(1): 40-46, 1993.

[120] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan*. 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[121] Amaral P. The special case of compliance in the elderly in *Compliance- the Dilemma of the Chronically Ill*. Gerber K.E. and Nehemkis A.M. editors, New York, Springer Publishing Co. 128-157, 1986.

Financial

Financial resources can impact the ability to adequately care for one's health.[122] Approximately 3.2 million elderly persons in the United States were below poverty level in 1999.[123, 124] In 1999, the poverty rate for persons older than 65 years of age was 9.7 percent. Another two million or 6.1 percent of the elderly were classified as "near-poor." "Near-poor" is defined as the income between the poverty level and 125 percent of this level.

Elderly people with chronic illnesses and patients in lower socioeconomic groups have been affected by the costs of prescription drugs.[125] A new drug costs on average more than twice as much as a drug that was available before 1992.[126] The average prescription price has increased 40 percent from 1993 to 1998 (from $26.62 to $37.38).[127] Outpatient prescription drugs, which are not covered under Medicare, are a significant out-of-pocket expense for many Medicare

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[122] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.
[123] U.S. Department of Health and Human Services, Administration on Aging, *A Profile of Older Americans: 2000,* Washington, DC, 2000.
[124] U.S. Bureau of the Census, *Poverty in the United States: 1999,* Current Population Reports, September, 2000.
[125] Brand F., Smith R.F. and Brand P.A. Effect of economic barriers to medical care on patients' noncompliance. *Public Health Report* 92(1): 72-78, 1977.
[126] Duka W. Drug stir up Medicare debate in AARP. *The Nation* 40(8): 3, 24-25, 32, 1999.
[127] Ibid.

beneficiaries.[128] The American Association of Retired Persons reported that Medicare beneficiaries age 65 and older spent approximately 20 percent of their income for out-of-pocket health care expenses in 1999.[129] After Medicare premium payment, prescription drugs were the single largest expense for the elderly, accounting for 17 percent of total spending.

Transportation

The transportation needs of the elderly vary depending on where they live, their ability to drive and their living/economic situation.[130] Multiple chronic illnesses, sensory losses, and the lack of assistance from immediate family can hamper the elderly's ability to keep appointments with physicians and other health care providers and to pick up prescriptions from their pharmacies.

Social Support

Social isolation can have a serious impact on the elderly. In 1998, approximately 31 percent of all non-institutionalized older persons lived alone.[131] The elderly may have special needs because of the physical limitations imposed

[128] Gross D. and Brangan N. Out-of-pocket spending on health care by Medicare beneficiaries age 65 and older: 1999 projections. AARP Public Policy Institute, Washington, DC. December 1999.
[129] Ibid.
[130] Amaral P. The special case of compliance in the elderly in *Compliance- the Dilemma of the Chronically Ill.* Gerber K.E. and Nehemkis, A.M. editors, New York, Springer Publishing Co. 128-157, 1986.
[131] U.S. Department of Health and Human Services, Administration on Aging, *A Profile of Older Americans: 2000, Washington*, DC, 2000.

by the aging process and the presence of other diseases. Living alone may significantly impact their ability to adhere to a diabetic regimen. The patient's social context is important in enabling him/her to manage his/her chronic illnesses effectively. The social environment and the psychological factors that are present are related to an individual's self-care behaviors and may negatively influence an individual's ability and willingness to provide self-care.[132]

Other Barriers

Inappropriate Therapeutic Regimens

Inappropriate therapeutic regimens include polypharmacy and drug interactions.[133] The elderly are often functionally impaired and are at greater risk for adverse drug reactions.[134, 135] Older adults have a greater burden of chronic illnesses such as diabetes, hypertension and arthritis. Thus, they may receive multiple medications to treat their illnesses. Some of the common reasons for

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[132] Glasgow R.E. and Osteen V. I. Evaluating diabetes education. Are we measuring the most important outcome? *Diabetes Care* 15(10): 1423-1432, 1992.

[133] Hanlon J.T., Fillenbaum G.G., Schmader K.E., et al. Inappropriate drug use among community- dwelling elderly. *Phamacotherapy* 20 (5): 575-582, 2000.

[134] Shrimp L.A., Ascione F.J., Glazer H.M., et al. Potential medication-related problems in non-institutionalized elderly. *Drug Intelligence & Clinical Pharmacy* 19: 755-772, 1985.

[135] Delafuente J.C., Meuleman J.R., Conlin M., et al. Drug use among functionally active, aged, ambulatory people. *Annals of Pharmacotherapy* 26(2): 179-183, 1992.

non-adherence to oral medication regimens in diabetics include forgetfulness and spontaneous activities.[136] The number of medications an older patient takes has been correlated with adverse patient outcomes.[137] Older adults are prescribed far more medications than other groups of patients.[138] The largest group of drug consumers in the United States is the elderly.[139] The elderly constitute 13 percent of the population and consume approximately 32 percent of all prescription drugs in the United States.[140, 141]

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[136] Ary D.V., Toobert D., Wilson W., et al. Patient perspective on factors contributing to non adherence to diabetes regimen. *Diabetes Care* 9(2): 168-172, 1986.

[137] Steel K., Gertman P.M., Crescenzi C., et al. Iatrogenic illness on a general medical service at a university hospital. *New England Journal of Medicine* 304(11): 638-642, 1981.

[138] Owens N.J., Larrat E.P. and Fretwell M.D. Improving compliance in the older patient in *Patient Compliance in Medical Practice and Clinical Trials,* Cramer J.A. and Spilker B. editors. New York, Raven Press, 107-119, 1991.

[139] Stewart R.B. Drug use in the elderly in *Therapeutics in the Elderly*. Delafuente J.C. and Stewart R.B. editors, Baltimore, Williams and Wilkins, 50-63, 1988.

[140] Levit K., Cowan C., Braden B., et al. National health expenditures in 1997: more slow growth. *Health Affairs* 17(6): 99-110, 1998.

[141] Soumerai S.B. and Ross-Degnan D. Inadequate prescription drug coverage for Medicare enrollees: a call for action. *New England Journal of Medicine* 340(9): 722-728, 1999.

METHODOLOGICAL ISSSUES WITH ADHERENCE IN DIABETES

Measuring Adherence

As mentioned previously, it is difficult to make conclusive statements about adherence with the various aspects of the diabetes regimen. The methodological issues in diabetes research include problems in defining and assessing adherence. These methodological issues are due to the complexity of the diabetes regimen, specificity of the regimen for each individual, poorly communicated or vague directions for adherence and lack of a standard against which the patient's behavior can be compared.[142, 143]

Diabetic patients are expected to follow a complicated set of behavioral tasks on a daily basis. These behaviors include following a meal plan, participating in appropriate physical activity, taking medications (oral and/or insulin), monitoring blood glucose levels, responding to and self-treating diabetes-related symptoms, and taking appropriate care of the feet.[144] In addition,

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[142] McNabb W.L. Adherence in diabetes: can we define it and can we measure it? *Diabetes Care* 20(2): 215-218, 1997.

[143] Johnson S.B., Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

[144] McNabb W.L. Adherence in diabetes: can we define it and can we measure it? *Diabetes Care* 20(2): 215-218, 1997.

the treatment regimen for diabetics varies from patient to patient and thus, it is very difficult to have a standardized set of self-care recommendations. Usually methods to measure adherence do not take this into account.[145] One other issue involves vague or nonspecific instructions.[146] Often in patients with type 2 diabetes, dietary and exercise instructions may be as non-specific as "lose a little weight" and "get more exercise."

Problems in measuring adherence include the lack of reliable measures, lack of a common approach to quantifying levels of adherence and lack of a single indicator of adherence. There is a tendency to treat adherence to diabetes regimens and metabolic control as interchangeable constructs; however, the literature has failed to show a clear relationship between adherence and diabetes control.[147] Metabolic control is dependent on additional factors other than adherence, such as appropriateness of the regimen, duration of the disease, and presence of other illnesses or medical conditions.[148] It is important not to assume too much about the patient's adherence from the patient's HbA1C level.

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[145] Ibid.

[146] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

[147] Ibid.

[148] Ibid.

Adherence is an important contributor to good control, but is not the same as control and cannot be evaluated by looking at just laboratory values. [149]

Another problem with assessing adherence is the lack of a common approach to quantifying levels of adherence.[150] In the literature, there are different methods of quantifying adherence. Some investigators categorize the behavior based on *never*, *sometimes, often, always*, and so on and others use absolute measures such as number of times the patients perform the activity. Finally, there is a lack of a single indicator of adherence. Ary and colleagues found that adherence to one aspect of the regimen is not highly associated with adherence to other aspects. [151] However, this should not be surprising because each aspect of the regimen requires different skills and levels of motivation.[152]

Methods of Measuring Adherence

The methods of measuring adherence in diabetes include health-status indicators, health provider ratings, behavioral observations, permanent products,

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[149] Glasgow R.E., Fisher E.D., Anderson B.J., et al. Behavioral science in diabetes. *Diabetes Care* 22(5): 832-843, 1999.

[150] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

[151] Ary D., Toobert D., Wilson W., et al. Patient perspective factors on contributing to nonadherence to diabetes regimen. *Diabetes Care* 9(2): 168-172, 1986.

[152] McNabb W.L. Adherence in diabetes: can we define it and can we measure it? *Diabetes Care* 20(2); 215-218, 1997.

and patients' self-reports.[153] Metabolic control or other indicators of health status are a poor substitute for a more direct measure of adherence. Using health status indicators, such as the HbA1C levels, to measure adherence provides insufficient information about what the patient is doing or is not doing relevant to the different aspects of diabetes care. Provider ratings of patient adherence have the same problems as health status indicators. The provider is usually aware of the patient's current level of metabolic control and this knowledge may bias the provider ratings of the patient's adherence. Observational methods are very useful and reliable in evaluating the technical skills involved in the administration of insulin or testing the glucose. Observational methods however are labor intensive, requiring the observers to be trained.

Counting permanent products such as pills or glucose strips, or weighing bottles of insulin are other methods that are not commonly used.[154] A problem with counting products is that the person could engage in behaviors that would invalidate a pill count as a measure of medication adherence by removing the pills from the bottle or taking the pills at the wrong time.

Another approach used in measuring adherence is patient self-reports. The problem with self-reports is that what patients say they do may bear little

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[153] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

[154] Ibid.

resemblance to their actual behavior because patients may be influenced by what they feel their doctors want to hear.[155] In addition, the use of total compliance score derived from specific behaviors, medication, dietary, exercise, foot care and glucose testing, can be problematic. The use of a total compliance score may fail to detect relationships between specific adherence behaviors and the health outcome variables. Other methods used in measuring adherence include diaries and the 24-hour recall interview. Although the self-report method has many limitations, it is however a practical and cost-effective approach to self-care assessment.[156]

A pharmacy claims database (manual or electronic) is another method that is used in measuring medication adherence. The calculations are usually based on refill frequency. This method measures adherence to receiving the refills and not the actual consumption by the person for whom the medication was prescribed. A limitation of the method is that the accuracy of the pharmacy claims data is dependent on the accuracy of the days' supply variable that is entered by the pharmacy staff.[157]

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[155] Ibid.

[156] Toobert D.J., Hampson S.E. and Glasgow R.E. The summary of diabetes self-care activities measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[157] Grymonpre R.E., Didur C.D., Montgomery P.R., et. al. Pill count, self-report, and pharmacy claims data to measure medication adherence in the elderly. *Annals of Pharmacotherapy* 32(7-8): 749-754, 1998.

Defining Adherence

There is no common definition of *adherence* or operationalization of the term that researchers commonly accept. The term *self-management* or *self-care behavior* has been used in the place of *adherence.* Self-management has been defined as "a set of skilled behaviors engaged in to manage one's own illness."[158] With this definition, self-management would be limited to describing self-care behaviors, not the level of adherence to a self-care regimen. Toobert and Glasgow have chosen the terms *diabetes self-care activities* to represent the absolute frequency with which self-care behaviors are performed and the level of adherence to some general "recommended" standard.[159] [In this study, the term *self-care behaviors* isused rather than *adherence* or *compliance*. The patients' self-reports of their regimens and regimen behaviors wereexamined.]

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[158] Goodall T.A. and Halford W.K. Self-management of diabetes mellitus: a critical review. *Health Psychology* 10(1): 1-8, 1991.

[159] Toobert D.J. and Glasgow R.E. Assessing diabetes self-management: the summary of diabetes self-care activities questionnaire in *Handbook of Psychology and Diabetes: A Guide to Psychological Measurement in Diabetes Research.* Bradley C. editor, Chur, Switzerland, Harwood Academics, 351- 375, 1994.

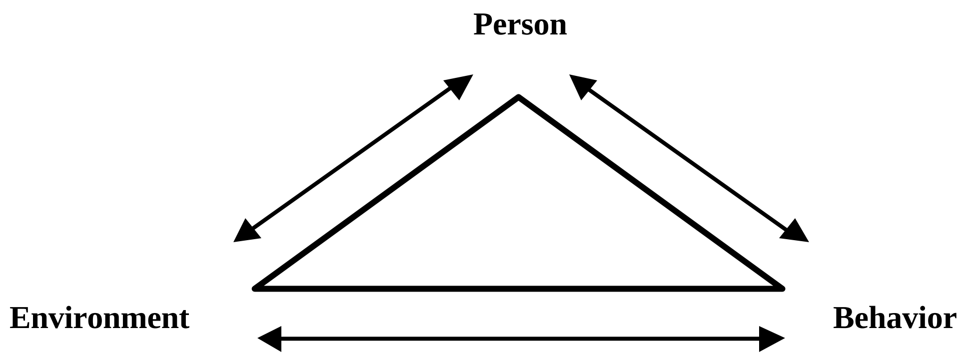
THE SOCIAL COGNITIVE THEORY

Overview of Theory

Social Cognitive Theory (SCT) addresses both the psychosocial factors influencing health behavior and the methods of promoting behavior change. The theory emphasizes that a person's behavior and cognitions affect future behavior. The Social Cognitive Theory provides a framework to examine the interactions among the three components involved in human behavior: the person, the behavior, and the environment in which the behavior takes place.[160] The characteristics of the person (including cognitions), the person's behavior, and the environment are in constant interaction and the influences operate in both directions. The continuing interaction among these three components is called *reciprocal determinism*. Any change in one component may have an impact on the others. Reciprocal determinism is considered a principle or a postulate in the SCT. Figure 1.2 depicts the reciprocal determinism of the SCT.

[160] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 153-178, 1997.

Figure 1.2 The Social Cognitive Theory



Brief History

There is a broad range of theoretical concepts that have been incorporated in the SCT. In 1941, Miller and Dollard originally introduced the Social Learning Theory to explain the imitation of behavior among animals and humans.[161] These concepts were based on classic learning principles and on the work of Hull.[162] The learning theory explains that a person is seen as a "black box" that emits responses to which reinforcements are applied by other people. The reinforcements in turn increase the likelihood of these behaviors.   Hull explained why some behaviors were more likely to occur than others by considering the

[161] Miller N.E. and Dollard J. *Social Learning and Imitation*. New Haven, Yale University Press, 1941.

[162] Hull C.L. *Principles of Behavior*. Englewood Cliffs, New Jersey, Appleton-Century-Crofts, 1943.

internal stars or drives, not cognitions. He proposed that animals and humans acquire drive and it is these drives that motivate behaviors. Thus, social learning attends to others' responses when motivated by an acquired drive.

In 1966, Rotter's research on "generalized expectancies" of "reinforcement" stemmed from the early social learning principles.[163] Rotter believed that a person learns or is conditioned on the basis of his or her experience with positive or negative reinforcement. Thus, a person develops a sense of internal or external locus of control over the events in his or her life. In 1978, Wallston and Wallston developed a scale for measuring health *locus of control*.[164] They believed their health locus of control measure was more useful in health research than a general measure because a person's sense of control often varies based on experience and actions. The locus of control research evolved around this time to provide evidence that people will improve their health outcomes if they are given control over their lives.

The operant learning theory maintained that rewards had to be directly applied in order for learning to occur. Bandura and Walters proposed that children watch other children to learn a new behavior and did not need to be

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[163] Rotter J.B. Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs* 80(1): 1-28, 1966.

[164] Wallston K.A. and Wallston B.S. Locus of control and health: a review of the literature. *Health Education Monographs* 6(2): 107-117, 1978.

rewarded directly in 1963,.[165] Ten years later, Mischel was the first to propose several cognitive constructs that formed the basis for the SCT.[166] In 1977, Bandura provided the first theoretical treatment of his concept, *self-efficacy*.[167] The next year, Bandura proposed the concept of *reciprocal determinism*, in which the environment, person, and behavior are seen to be continually interacting.[168] In 1981, Parcel and Baranowski utilized the theory in health education and described the stages in the behavioral change process at which each concept was most relevant.[169] Bandura published a comprehensive framework for understanding human social behavior and the Social Learning Theory was renamed the Social Cognitive Theory in 1986.[170] In 1995, Bandura proposed self-efficacy as the construct responsible for many aspects of social change.[171]

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[165] Bandura A. and Walters R.H. *Social Learning and Personality Development*. Austin, Hold Rinehart and Winston, 1963.

[166] Mischel W. Toward a cognitive social learning reconceptualization of personality. *Psychological Review* 80(4): 252-283, 1973.

[167] Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84(2): 191-215, 1977.

[168] Bandura A. The self system in reciprocal determinism. *American Psychologist* 33(4): 344-358, 1978.

[169] Parcel G.S. and Baranowski T. Social learning theory and health education. *Health Education* 12(3): 14-18, 1981.

[170] Bandura A. *Social Foundations of Thought and Actions: A Social Cognitive Theory*. Englewood Cliffs, Prentice Hall, 1986.

[171] Bandura A. *Self –Efficacy in Changing Societies*. New York, Cambridge University Press, 1995.

Major Social Cognitive Theory Constructs

The major constructs of the SCT include: the environment, observational learning, behavioral capability, reinforcement, outcome expectations, outcome expectancies, self-efficacy, and emotional coping responses.

The *environment* refers to the objective view of all factors that can affect a person's behavior but are physically external to the person.[172] The social environment may include family, friends, and colleagues. Characteristics of the environment may include the interaction among family members and friends. The physical environment may refer to the place or the conditions of the environment, such as the availability of certain foods or exercise equipment and the temperature of the room. *Situation* refers to the cognitive or mental representation of the environment and how this influences a person's behavior. The situation is a person's perception of the environment and may include the place, time and the person's role in the situation.

Observational learning refers to the reinforcement a person receives when he/she watches the action of another person.[173] This is also known as vicarious reward or vicarious experience. Observational learning is considered a more

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[172] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice*. Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 153-178, 1997.

[173] Ibid.

efficient approach than operant learning for learning complex behaviors. In operant learning, the person must perform a behavior before the behaviors are reinforced.

Behavioral capability refers to the knowledge and skills needed to perform a specific behavior. [174] The behavioral capability is a result of a person's training, his/her intellectual ability and learning style. Mastery learning refers to the skills training which provide the cognitive knowledge of what is to be performed, practice in the performance and mastering of the behavior, or performance of the behavior at a predefined level of acceptability.

Reinforcement is the response to a person's behavior that either increases or decreases the chance of the behavior occurring again.[175] Positive reinforcement is a response to a person's behavior that increases the chance of repeating the behavior. Negative reinforcement will increase the chance of performing the behavior but does so with a withdrawal of a negative stimulus when the behavior is performed. In the SCT, there are three types of reinforcement–– direct, vicarious and self-reinforcement. An example of direct reinforcement is operant conditioning. The person must perform a behavior that

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[174] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.

[175] Ibid.

is subsequently reinforced and continues to perform behaviors that come closer to the desired performance. Observational learning is an example of vicarious reinforcement. The person observes the behaviors and reinforcements of another person and the reinforcements that the person receives. An example of self-reinforcement is self-control. The person monitors one's own behavior and compares the behavior and its outcomes to the person's self-set goals and self-reward.

Outcome expectations are the anticipatory outcomes of a behavior.[176] The person expects certain events to occur in response to a behavior and the event will occur again based on the behavior. *Outcome expectancies* are the values that a person places on a particular outcome.

Self-efficacy refers to the individual's confidence in his/her ability to perform a behavior.[177] This includes the confidence in overcoming the barriers to performing a behavior. The measurement of this construct must be specific to the targeted behavior. *Self-control* refers to the performance of a behavior that is

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[176] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.

[177] Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84(2): 191-215, 1977.

under the control of the individual.[178] Self-efficacy has a role in self-control in that it affects a person's selection of the extent of behavioral change and in building confidence in self-regulation.

Emotional coping responses are strategies used by a person to deal with an emotional situation.[179] Several categories of coping responses have been identified. These categories include psychological defenses (denial and repression); cognitive techniques (problem restructuring); stress management; and solving problems effectively.

[178] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.
[179] Ibid.

Limitations of the Social Cognitive Theory

One problem with the SCT is that it may be too comprehensive in its formulation.[180] A limitation of the theory is that there are so many constructs that almost any phenomenon can be explained using one or another of the constructs. "When a theory explains everything, it explains nothing."[181] The theory is not falsifiable in that negative findings can always be explained by other constructs in the theory. If one is to use the SCT, one must clearly recognize where the theory applies and not make claims about the utility of the SCT that are not supported by empirical evidence.

THE FAMILY ENVIRONMENT, SOCIAL COGNITIVE VARIABLES AND DIABETES

This section will include a brief discussion of the role of the family in diabetes management and the relationship between ethnicity and family behavior. A discussion of selected major constructs of the Social Cognitive Theory (SCT) and their relationships to diabetes self-care behaviors and glycemic control also

[180] Ibid.
[181] Ibid.

will be presented. The major categories of the social cognitive variables included are environments and situations, behavioral capabilities, and self-efficacy.

The Role of the Family

Family Defined

The *family* is defined as "a group of intimates living together or in close geographic proximity with strong emotional bonds (identification, attachment, loyalty, reciprocity, solidarity) and with a history and future." This definition is taken from a combination of definitions from Gilliss and associates and Ransom and Vandervoort.[182] There are several reasons why it is important to address the family as the primary social context in the management of chronic illnesses. Most disease management behavior takes place within the family or home setting.[183] The family is the life context that has the greatest and most long-lasting effect on its members and has the most influence on the management of type 2 diabetes.[184, 185] Clinical and educational interventions not only affect the patients but also have an effect on family members, even if the family member does not

[182] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24(5): 599-607, 1998.
[183] Ibid.
[184] Campbell T.L. Family's impact on health: a critical review. *Family System Medicine* 4: 135-328, 1986.
[185] Rolland J.S. *Families, illness, and disability.* New York, Basic Books, 1994.

participate directly in the intervention.[186] The spouse/partner or other family members also can undermine the patient self-management behavior.[187] The relationships in the family environment are complex and it may be that there are certain types of social support or certain conditions in which social support is more or less important.

Ethnicity and Family Behavior

Ethnicity appears to play a strong role in family relationships. Characteristics of the family setting in which disease management takes place are significantly linked to patient self-care behaviors and these linkages vary by patient ethnicity.[188] Fisher and colleagues examined the relationship between the characteristics of families involved in the care of Hispanic and European Americans with type 2 diabetes.[189] The researchers found that characteristics of the family setting play a role in the diabetic's self-care behavior; however, the role may vary by ethnic group.

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[186] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24(5): 599-607, 1998.
[187] Ibid.
[188] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European- American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.
[189] Ibid.

It is often assumed that minority persons have more extended family ties, such as aunts, uncles, sibling, nieces, nephews, and cousins, than whites. [190] This appears to be true for the black elderly, with older black women playing a key role in this network.[191] Research has supported the notion that older African Americans are more likely to receive help from family members than are whites when in need of assistance.[192] Research has shown that Mexican American elders prefer to rely on family for support rather than on friends or formal supports.[193, 194, 195] Traditionally, elderly Mexican Americans strongly expect to receive assistance and support from their children.[196] Phillips and associates found that for the care-giving structure, more Mexican American caregivers were adult children, even though the elder had a living spouse. [197]

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[190] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[191] Ibid.

[192] Peek M.K., Coward R.T. and Peek C.W. Race, aging, and care. *Research on Aging* 22(2): 117-142, 2000.

[193] Phillips L.R., Komnenich P., Killen M., et al. The Mexican American care giving experience. *Hispanic Journal of Behavioral Science* 22(3): 296-313, 2000.

[194] Wishner W.J. and O'Brien M.D. Diabetes and the family. *Medical Clinic of North America* 62(4): 849-856, 1978.

[195] Keefe S.B. The Mexican American extended family as an emotional support system. *Human Organization* 38: Summer, 144-152, 1979.

[196] Phillips L.R., Komnenich P., Killen M., et al. The Mexican American care giving experience. *Hispanic Journal of Behavioral Science* 22(3): 296-313, 2000.

[197] Ibid.

While extended family life is a tradition in the Asian culture, many Asian-American elderly may be isolated from their family due to increasing urbanization and assimilation of Asian families.[198] Due to economic assimilation and accommodation to American values, many Asian-American elderly are left isolated and alienated from their families.[199]

The Social Cognitive Theory and Diabetes Self-Care Behaviors

Environments and Situations

The *environment* refers to factors that are physically external to the person.[200] These factors may include the barriers or obstacles to adherence such as competing demands, social pressures, scheduling, economics, and other factors.[201] The cost of medications, insulin injections, glucose monitoring,

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[198] Funnell M. M. and Merrit H.H. Diabetes mellitus and the older adult in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 759-780, 1996.

[199] Ibid.

[200] Baranowski T., Perry C., and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M., and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.

[201] Glasgow R.E. Social environmental factors in diabetes: barriers to diabetes self-care in *Handbook of Psychology and Diabetes : A Guide to Psychological Measurement in Diabetes Research.* Bradley C. editor, Chur, Switzerland, Harwood Academics, 335-349, 1994.

perceived costs of nutritious foods and availability of low-cost fitness facilities and equipment would be expected to influence self-care behaviors.[202]

The *situation* refers to the person's perception of the environment and how this influences a person's behavior. Research in adolescents has found that one's perception of the family environment has been found to influence self-care behaviors.[203] The amount of social support provided by family members has been found to influence several aspects of the diabetes self-care regimen in adults.[204,205] A review of the literature regarding the influence of social support, family environment and barriers to care on diabetes self-care regimens is provided in the next section.

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[202] Glasgow R.E. Compliance to diabetes regimens in *Patient Compliance in Medical Practice and Clinical Trials.* Cramer J.A. and Spilker B., editors, Raven Press, New York, 209-224, 1991.

[203] Hanson C.L., Henggeler S.W. and Burghen G.A. Model of associations between psychosocial variables and health outcome measures of adolescents with IDDM. *Diabetes Care* 10(6): 752-758, 1987.

[204] Wang, C.Y. and Fenske M.M. Self- care of adults with non- insulin dependent diabetes mellitus: influence of family and friends. *Diabetes Educator* 22(3): 465- 470, 1996.

[205] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

Family Environment and Social Support Studies

Characteristics or qualities of the family unit have been linked with the management of many acute and chronic diseases.[206] The characteristics of the family setting in which disease management takes place are significantly linked to the patients' self-care behaviors.[207] The influence of the family environment on diabetes self-care behaviors has been widely studied in children and adolescents with type 1 diabetes. In general, these studies have found that diabetes self-management and glycemic control is best in families with good organization, low spouse conflict, high cohesion and stability of membership, high marital satisfaction and few economic problems.[208, 209] There has been considerably less research in the area of social support from family members in adults with diabetes and even less in older adults. Overall, the studies that have investigated the relationship of the family environment to outcomes for adult diabetics have found that family and social support appear to have a positive impact on glycemic

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[206] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24(5): 599-607, 1998.

[207] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European-American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

[208] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24(5): 599-607, 1998.

[209] Glasgow R.E. Social environmental factors in diabetes: barriers to diabetes self-care in *Handbook of Psychology and Diabetes : A Guide to Psychological Measurement in Diabetes Research.* Bradley C. editor, Chur, Switzerland, Harwood Academics, 335-349, 1994.

control and/or self-management behaviors. There are a few studies that did not find any relationship between the family environment and glycemic control. The studies that are discussed in the following section are not all generalizable to the older adults with type 2 diabetes.

Wang and Fenske examined the influence of family and friends on the self-care of adults with type 2 diabetes.[210] The study found that the patient's source of support influences the self-care behaviors. Patients with support from both family and friends reported higher self-care behaviors and medication adherence than those without support (no family, friends or diabetes support group). Albright and associates found the family context was positively associated with diet, exercise and medication adherence in adults with type 2 diabetes.[211]

Eaton, Larson and Mengel used the Family Adaptability and Cohesion Evaluation Scale to explore the relationship of family process variables to the

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[210] Wang C.Y. and Fenske M.M. Self- care of adults with non- insulin dependent diabetes mellitus: influence of family and friends. *Diabetes Educator* 22(5): 465- 470, 1996.

[211] Albright T.L., Parchman M., Burge S.K., et al. Predictors of self-care behavior in adults with type 2 diabetes: an RRNesST Study. *Family Medicine* 33(5): 354-360, 2001.

management and control of adolescents and adults with type 1 diabetes. [212] Higher levels of family cohesiveness were related to lower HbA1C levels (better glycemic control). Overall, the family process variables were inversely correlated with glycemic control. The nature of the relationships between psychosocial variables and adherence and control changes significantly over the life span. Psychosocial factors are most important in the young person during the first decade of insulin dependence, when the young person is learning how to control his/her diabetes.

Cardenas and associates examined the association between levels of family functioning and control of diabetes.[213] In this study, patients were categorized by their extent of diabetes control. Good family function was found in over 90 percent of the patients in *good* control of their diabetes, in 66 percent of those in *fair control* and only in 50 percent of those in *poor* control. A limitation of the study is the use of fasting plasma glucose as an indicator of glycemic control.

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[212] Eaton W.W., Larson D., Mengel M., et al. Psychosocial and psychopathologic influences on management and control of insulin-dependent diabetes. *International Journal of* Psychiatry *in Medicine* 22(2): 105-117, 1992.

[213] Cardenas L., Vallbona C., Baker S., et al. Adult onset diabetes mellitus: glycemic control and family function. *American Journal of Medical Sciences* 293(1): 28-33, 1987.

Konen, Summerson and Dignan examined the relationship between perceived family function and glycemic control in adults with either type 1 or 2 diabetes. The results of the study found that adults with type 2 diabetes in good glycemic control (measured with HbA1C) had lower levels of family cohesion than those in poor control. On the contrary, adults with type 1 diabetes with acceptable HbA1C levels had higher levels of family cohesion than those in poor control.[214] Subjects with type 1 diabetes were predominantly in early to middle adulthood, in comparison to the patients with type 2 diabetes, who were older. The researchers speculated that high cohesion in midlife has a positive role on health behavior and glycemic control and perhaps a negative role later in life.

Wilson and associates assessed potential psychosocial correlates of self-care behaviors and glycemic control in a community sample of type 2 diabetics.[215] The diabetes-specific psychosocial measures of health beliefs and social support were the strongest predictors of regimen adherence. However, these psychosocial variables were not significant predictors of the level of glycemic control. These results suggest either that the variables affecting glycemic control are different for those affecting self-care behaviors or that they were not successful in identifying

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[214] Konen J.C., Summerson J.H. and Dignan M.B. Family function, stress, and locus of control. *Archives of Family Medicine* 2(4): 393-402, 1993.

[215] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

variables strongly related to glycemic control in the study. Nichols and colleagues examined characteristics that influence glycemic control among insulin using adults with type 2 diabetes and found that personal characteristics explain little of the variation in glycemic control in adults with type 2 diabetes using insulin.[216]

Edelstein and Linn examined the role of the family environment in the glycemic control of adult diabetic men.[217] The study examined ten aspects of family functioning. Participants were seen every six months for three years. The family scores at baseline were then used to predict metabolic control six months later using a stepwise regression analysis. Patients in better control of their diabetes perceived their families to be low in conflict and organization and oriented toward achievement. Lower conflict as well as less organization creates a more relaxed atmosphere which may encourage less anxiety and greater support associated with better metabolic control. In a high achievement environment, the family encourages and supports personal development of its members, thus increases the self-esteem of its members. The diabetic individual with high self-

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[216] Nichols G.A., Javor K. and Hillier T.A. Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 23(3): 273-277, 2000.

[217] Edelstein J. and Linn M.W. The influence of the family on control of diabetes. *Social Science & Medicine* 21(5): 541-544, 1985.

esteem would value his/her own health and take responsibility in managing his/her own health.

McCaul and colleagues examined regimen adherence among adolescents and adults with type 1 diabetes and found environmental support was related to several adherence behaviors.[218] Environmental support was associated with better adherence to insulin injections and glucose testing than to diet and exercise.

Glasgow and associates examined diabetes-specific social learning variables and self-care behaviors among adults with type 2 diabetes.[219] The researchers used the Diabetes Family Behavior Checklist II, a revised scale of family support, for performing diabetes self-care behaviors. The family support measures were the strongest and most consistent predictors for adherence, but measures of stress and other social environment measures also improved the prediction of adherence.

In summary, there have been a few studies conducted which have not found a relationship between family environment/social support and glycemic control. Murphy, Williamson, and Nease examined perceived family support in

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[218] McCaul K.D., Glasgow R.E. and Schafer L.C. Diabetes Regimen Behaviors: predicting adherence. *Medical Care* 25(9): 868-881, 1987.

[219] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

adults with diabetes.[220] The study found that the mere presence of a "health expert" for the family or some other helping family member was not necessarily related to glycemic control.

In 1998, Trief and associates examined whether family system variables of adults with diabetes were related to metabolic control or the psychosocial adaptation to the illness.[221] The study found that none of the family system measures were significant predictors of glycemic control, but these measures did relate to psychosocial adaptation. When family members were supportive in the diabetes care regimen, the individual with diabetes was more satisfied with his/her adaptation to the illness and reported less interference due to emotional problems.

Silliman and colleagues examined the extent to which family members participate in the daily management of older persons with diabetes mellitus and the participation in the diabetic's medical encounters.[222] The researchers found that the family members studied frequently assisted older diabetics with their diabetes related care and more than one-third were involved with the diabetic's

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[220] Murphy D.J., Williamson P.S. and Nease D.E. Supportive family members of diabetic adults. *Family Practice Research Journal* 14(4): 323-331, 1994.

[221] Trief P.M., Elbert K., Grant W., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

[222] Silliman R.A., Bhatti S., Khan A., et al. The care of older persons with diabetes mellitus: Families and primary care physicians. *Journal of American Geriatrics Society* 44(11): 1314-1321, 1996.

medical encounters. Family members were more likely to become involved in the day-to-day care when the older diabetics were functionally disabled.

In summary, research in the area of social support from family members in adults with diabetes have found that the family environment appears to have an influence on glycemic control and/or diabetes self-management behaviors. These studies have found that perceived support, families with good organization and high levels of cohesiveness were associated with better diabetes outcomes. [223, 224, 225, 226] However, there are several studies that found no

[223] Wang C.Y. and Fenske M.M. Self- care of adults with non- insulin dependent diabetes mellitus: influence of family and friends. *Diabetes Educator* 22(5): 465- 470, 1996.

[224] Eaton W.W., Larson D., Mengel M., et al. Psychosocial and psychopathologic influences on management and control of insulin-dependent diabetes. *International Journal of* Psychiatry *in Medicine* 22(2): 105-117, 1992.

[225] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[226] Edelstein J. and Linn M.W. The influence of the family on control of diabetes. *Social Science & Medicine* 21(5): 541-544, 1985.

relationship between family environment/social support and diabetes outcomes.[227, 228] In addition, only a few studies have been identified that have examined the role of the social and cognitive factors on self- care behaviors.[229, 230]

Barriers to Diabetes Self-Care Studies

Barriers to self-care refer to the environmental and cognitive factors that interfere with one or more aspects of diabetes self-care. The diabetes regimen is multidimensional and each component of the regimen may have its own set of barriers. Barriers to care have been measured in both type 1 and 2 diabetes.

Schafer and associates assessed perceived barriers to self-care in adolescents and adults with type 1 diabetes and found that barriers to self-care were associated with following a diet and care in measuring the insulin dose.[231] Several studies have been conducted in a mixed sample (both type 1 and 2

[227] Trief P.M., Elbert K., Grant W., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.
[228] Murphy D.J., Williamson P.S. and Nease D.E. Supportive family members of diabetic adults. *Family Practice Research Journal* 14(4): 323-331, 1994.
[229] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.
[230] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.
[231] Schafer L.C., Glasgow R.E., McGaul K.D., et al. Adherence to IDDM regimens: relationship to psychosocial variables and metabolic control. *Diabetes Care* 6(5): 493- 498, 1983.

diabetics) and found that barriers to care significantly predicted the level of self-care behavior in the regimen areas examined (diet, blood glucose monitoring and exercise).[232, 233] Jenny examined barriers to adherence in a mixed sample and found differences in the frequency of barriers across self-care areas. The greatest numbers of barriers were related to the diet and exercise components of the regimen and medication taking had the fewest barriers.[234] Glasgow and associates found similar results in their study with type 2 patients. Adherence to diet had the greatest frequency of barriers followed by exercise, blood glucose testing and medication taking.

Hess, Davis and Harrison developed a fourteen-item subscale of the Diabetes Care Profile to assess barriers to adherence.[235] They found that barriers to adherence were inversely related to reports of the extent to which subjects followed their meal plan and positively related to HbA1C (the more barriers, the higher the HbA1C value or worse control). In another study, Davis and associates

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[232] Ary D.V., Toobert D., Wilson W., et al. Patient perspective on factors contributing to non adherence to diabetes regimen. *Diabetes Care* 9(6): 168-172, 1986.

[233] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[234] Jenny J.L. Differences in adaptation to diabetes between insulin-dependent and non insulin dependent patients: Implications for patient education. *Patient Education and Counseling* 8(1): 39-50, 1986.

[235] Hess F.E., Davis W.K. and Harrison R.V. A diabetes psychosocial profile. *Diabetes Educator* 12(2): 135-140, 1986.

did not find the same relationship between barriers and HbA1C. The barriers were not associated with HbA1C values.[236]

Behavioral Capability (Knowledge)

Behavioral capability refers to the knowledge and skills required to perform a specific behavior.[237] A large number of studies have examined the relationship between knowledge levels and metabolic control. Two meta-analyses of these studies have found that patient education is associated with an increase in patient knowledge and this has a positive effect on metabolic control.[238, 239]

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[236] Davis W.K., Hess G.E., Van Harrison R., et al. Psychosocial adjustment to and control of diabetes mellitus: differences by disease type and treatment. *Health Psychology* 6(1): 1-14, 1987.

[237] Baranowski T., Perry C., and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M., and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.

[238] Padgett D., Mumford E., Hyne M., et al. Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *Journal of Clinical Epidemiology* 41(10): 1007-1030, 1988.

[239] Brown S. Studies of educational interventions and outcomes in diabetic adults: a meta-analysis revisited. *Patient Education and Counseling* 16(3): 189-215, 1990.

However, two studies have found no correlation between increased knowledge and metabolic control. [240, 241]

Nagasawa and associates conducted a meta-analysis on the correlates of diabetic patients' compliance with prescribed medications and found that the direction of knowledge on compliance varied, depending on the study characteristics.[242] When biological tests such as HbA1C were used to quantify compliance, skills were inversely associated with compliance level-the more knowledgeable the person was, the less compliant. In contrast, other methods of assessing compliance presented opposite results. Compliant behaviors increased with the amount of knowledge possessed by the person. It is important to note that knowledge and skills have been viewed as a necessary but not sufficient

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[240] Dunn S.M., Beeney L.J., Hoskins P.L., et al. Knowledge and attitude change as predictors of metabolic improvement in diabetes education. *Social Science & Medicine* 31(10): 1135-1141, 1990.

[241] Bloomgarden Z.T., Karmally W., Metzger M.J., et al. Randomized controlled trial of diabetic patient education: improved knowledge without improved metabolic status. *Diabetes Care* 10(3): 263-272. 1987.

[242] Nagasawa M., Smith M., Barnes J.H., et al. Meta-analysis of correlates of diabetes patients' compliance with prescribed medications. *Diabetes Educator* 16(3): 192-200, 1992.

condition of good diabetes self-management.[243] It is the behavioral application of knowledge, rather than general abstract knowledge about diabetes, that influences compliance.

Self Efficacy

Self-efficacy is an important predictor of health behavior change and maintenance. There is evidence to support the use of self-efficacy as a predictor in sustained behavior change across a wide scope of problem areas such as alcohol abuse, smoking and depression. [244] However, there has been limited work on self-efficacy and the management of diabetes. Kavanagh and colleagues found that self-efficacy is a significant predictor of later adherence to diabetes treatment in both type 1 and 2 diabetics.[245] McCaul and associates found that measures of self-efficacy expectations were strong predictors across almost all regimen areas for adolescents and adults.[246] Glasgow and associates examined diabetes specific social learning variables and self-care behaviors among adults with type 2

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[243] Glasgow R.E. Compliance to diabetes regimens in *Patient Compliance in Medical Practice and Clinical Trials*. Cramer J.A. and Spilker B., editors, Raven Press, New York, 209-224, 1991.

[244] Strecher V.J., DeVellis B., Becker M.J., et al. The role of self-efficacy in achieving health behavior change. *Health Education Quarterly* 13(1): 73-92, 1986.

[245] Kavanagh D. H., Gooley S. and Wilson P.H. Prediction of Adherence and control in diabetes. *Journal of Behavioral Medicine* 16(5): 509-522, 1993.

[246] McCaul K.D., Glasgow R.E. and Schafer L.C. Diabetes Regimen Behaviors: predicting adherence. *Medical Care* 25(9): 868-881, 1987.

diabetes.[247] Their study found that beliefs/expectations consistently improved the prediction of self-care beyond that attributable to demographic variables.

Padgette used a measure of diabetes self-efficacy in a sample of patients with type 2 diabetes attending an outpatient clinic in Yugoslavia and found that higher self-efficacy scores (greater self-efficacy) were associated with higher self-rated adherence.[248] The correlations between level of HbA1C and self-efficacy scores were weak. Talbot and associates found that lower self-efficacy beliefs were significantly associated with lower levels of adherence to diet and exercise.[249] In addition, lower levels of self-efficacy were related to higher levels of HbA1C, indicating less adequate glycemic control.

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[247] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[248] Padgett D.K. Correlates of self-efficacy beliefs among patients with non-insulin dependent diabetes mellitus in Zagreb, Yugoslavia. *Patient Education and Counseling* 18(2) : 139-147, 1991.

[249] Talbot F., Nowwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the multidimensional diabetes questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

SUMMARY OF THE LITERATURE REVIEW

In summary, the literature review provided an overview of diabetes mellitus in older adults which included the management and complications of the disease. The prevalence, incidence, mortality and economic burden of the illness were discussed. Adherence to the diabetes treatment regimen and the challenges to adherence in older adults were presented. The prevalence of non-adherence in diabetes varies across the different regimen areas and across the patient's lifespan and during the course of the disease.[250] The physical, psychological and environmental barriers specific to the elderly were discussed. The methodological issues related to defining and assessing adherence in diabetes were examined. The complexity of the diabetes treatment regimen and the different methods employed to assess adherence in diabetes were described.

The literature review provided an overview of the Social Cognitive Theory (SCT). The SCT provides framework to examine the relationships among the three components in human behavior: the person, the behavior, and the

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[250] Glasgow R.E. Patient Compliance in Diabetes Mellitus in *Patient Compliance in Medical Practice and Clinical Trials.* Cramer J.A. and Spilker B. editors, New York, Raven Press, 209-224, 1991.

environment in which the behavior takes place.[251] The main constructs of the SCT applied in the present study include the *environments* and *situations*, *behavioral capability*, and *self-efficacy*.

The literature review included studies that examined the role of the family environment or social support in diabetes adherence and/or glycemic control. Research in this has found that the family environment appears to have an influence on glycemic control and/or diabetes self-management behaviors. Some studies have found that perceived support, families with good organization and high levels of cohesiveness were associated with better diabetes outcomes.[252, 253, 254, 255] However, there are several studies that found no relationship between family environment/social support and diabetes

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[251] Baranowski T., Perry C., and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice*. Glanz K., Lewis F.M., and Rimer B.K. editors, San Francisco, Jossey-Bass, 1997.

[252] Wang C.Y. and Fenske M.M. Self- care of adults with non- insulin dependent diabetes mellitus: influence of family and friends. *Diabetes Educator* 22(5): 465- 470, 1996.

[253] Eaton W.W., Mengel M., Mengel L., et al. Psychosocial and psychopathologic influences on management and control of insulin-dependent diabetes. *International Journal of* Psychiatry *in Medicine* 22(2): 105-117, 1992.

[254] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[255] Edelstein J. and Linn M.W. The influence of the family on control of diabetes. *Social Science & Medicine* 21(5): 541-544, 1985.

outcomes.[256, 257] Additionally, a review of the literature in the area of the social cognitive variables such as barriers to self-care and knowledge on self- care behaviors.

[256] Trief P.M., Grant W., Elbert K., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

[257] Murphy D.J., Williamson P.S. and Nease D.E. Supportive family members of diabetic adults. *Family Practice Research Journal* 14(4): 323-331, 1994.

STATEMENT OF THE PROBLEM

There is much concern regarding type 2 diabetes in older adults. The population over age 65 is increasing and it has been predicted that by the year 2030, twenty percent of the population will be over 65 years.[258] Diabetes is a chronic condition that requires active participation from the patient in order to maintain metabolic control. The need for patients to carry out the daily self-care activities is not less important because the patients are older. Older adults do have special needs and challenges because of the physical limitations that may be imposed by the aging process and the increased likelihood of other illnesses and complications.

There is a growing recognition of the importance of the patients' social context in enabling them to effectively manage their chronic conditions.[259] The family has an all-encompassing, long-lasting effect on its members and can

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[258] U.S. Department of Health and Human Services, Administration on Aging, *A Profile of Older Americans: 2000, Washington*, DC, 2000.

[259] Auslander W. and Corn D. Environmental influences on diabetes management: family, health care system and community contexts in *Management of Diabetes Mellitus: Perspectives of Care Across the Lifespan.* 2nd ed. Haire-Joshu D. editor, St. Louis, Mosby, 513-526, 1996.

have a significant impact on the management of type 2 diabetes.[260] What is the role of the family environment on the level of diabetes self-care behaviors?

In addition to the family environment, psychological factors play an important role in self-care behaviors.[261] However, little is known about which factors are associated with improved levels of self-care behaviors in older patients. Much of this research has been conducted in type 1 diabetics. There is a need to identify the mechanisms and linkages among the psychosocial predictors for a better understanding of diabetes self-care behaviors.

[260] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24 (5): 599-607, 1998.

[261] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

RATIONALE FOR THE STUDY

The main purpose of this study is to examine the relationships among the family environment, the other social cognitive factors and diabetes self-care behaviors in older adults with type 2 diabetes. The family influences are strong in older people and may influence the management of type 2 diabetes.[262] It is important to examine how the family environment relates to the level of diabetes self-care behaviors.

A review of the literature found that most of the research examining the role of the family environment has been conducted in children and adolescents. In general, these studies have found that diabetes self-management and glycemic control is best in families with good organization, low spouse conflict, high cohesion and stability of membership, high marital satisfaction and few economic problems.[263, 264] There has been considerably less research in the area of social support from family members in adults with diabetes and even less in older adults. In general, results of studies that have investigated the relationship of the family

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[262] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24(5): 599-607, 1998.
[263] Ibid.
[264] Glasgow R.E. Social environmental factors in diabetes: barriers to diabetes self-care in *Handbook of Psychology and Diabetes : A Guide to Psychological Measurement in Diabetes Research.* Bradley C. editor, Chur, Switzerland, Harwood Academics, 335-349, 1994.

environment to outcomes for adult diabetics suggest that family and social support appears to have a positive impact on glycemic control and/or diabetes self-management behaviors. Several studies have found that perceived support, and families with good organization and high levels of cohesiveness were related to better diabetes outcomes.[265, 266] On the other hand, two studies found no relationship between family environment/social support and diabetes outcomes.[267, 268]

In addition, there have only been a few studies identified that have examined the role of the social and cognitive factors on self- care behaviors.[269, 270] More research needs to be conducted in older adults with type 2 diabetics. By

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[265] Wang C.Y. and Fenske M.M. Self- care of adults with non- insulin dependent diabetes mellitus: influence of family and friends. *Diabetes Educator* 22(5): 465- 470, 1996.

[266] Edelstein J. and Linn M.W. The influence of the family on control of diabetes, *Social Science & Medicine* 21(5): 541-544, 1985.

[267] Murphy D.J., Williamson P.S., Nease D.E. Supportive family members of diabetic adults. *Family Practice Research Journal* 14(4): 323-331, 1994.

[268] Trief P.M., Grant W., Elbert K., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

[269] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[270] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

having a better understanding of the factors that relate to self-care behaviors, interventions can be developed to improve outcomes.

SIGNIFICANCE OF THE STUDY

Adherence to the diabetes regimen is multidimensional with many factors interacting to determine the levels of adherence to the regimen. With a better understanding of the social and cognitive factors that contribute to diabetes self-care behaviors, interventions can be designed to improve diabetes outcomes.

By examining knowledge, self-efficacy and barriers to diabetes self-care in older adults, one can develop interventions that address these specific areas. For example, specific problems with diabetes self-care behavior can be identified by examining the individual's confidence in his/her ability to perform specific regimen behaviors. Educational interventions could be developed based on these social cognitive constructs such as interventions that specifically address mastery experiences to improve self-efficacy.

Furthermore, it is important to examine the relationship between family function and level of diabetes self-care behaviors in older adults. The patient's family is an important factor related to health care behaviors.[271] The results of the study could help design interventions that enhance family support and have a positive impact on regimen adherence. The study should identify areas which family members can provide more support and have better impact on the specific aspect of the regimen. A family member who is supportive in one aspect of the regimen may not necessarily be supportive of other aspects.

By having a better understanding of the family systems on diabetes management, pharmacists and other health professionals can develop professional interventions to improve diabetes outcomes. The social support needs of diabetic patients require health professionals to develop new kinds of partnerships in order to improve self-care behaviors. Pharmacists can form partnerships with diabetic patients and their relevant family members or friends. The health care team, including pharmacists, must better understand the factors that influence regimen adherence in older diabetics.

Pharmacists are in a unique position to assess older adults with diabetes and to recognize problems and refer their patients to other resources in the healthcare system so patients can be given the psychological, social and economic support required to control their diabetes. Health care professionals need to better

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[271] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European-American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

understand the needs of the elderly and their family environment, as well as the social cognitive variables and their influence on self-care behaviors.

THEORETICAL FRAMEWORK

The Proposed Model

To better understand the factors which influence self-care behaviors and glycemic control in diabetes, it is important to employ a model that depicts the complex and multidimensional aspects of the diabetes self-care regimen. The Social Cognitive Theory (SCT) was selected because the theory addresses both the psychosocial dynamics influencing diabetes self-care behaviors and the methods of promoting behavioral change. The SCT emphasizes that a person's behavior and cognitions will affect future behavior. [272] Human behavior is explained in terms of a reciprocal model in which the behavior, the personal factors including cognitions, and the environmental influences all interact with one another. The major constructs of the SCT selected for this study include the

[272] Baranowski T., Perry C. and Parcel G. How individuals, environment and health behavior interact: social cognitive theory in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 153-178, 1997.

environment and situation, behavioral capability and self-efficacy. These constructs were selected because the most consistent variables associated with diabetes self-care behaviors include self-efficacy, perceptions of the social and environmental influences and barriers to diabetes self-care activities.[273]

Theoretically, the relationships between the person's characteristics, environment, and behavior are all reciprocal. However, the pathways in the proposed model for this study are unidirectional as supported by the findings from the literature. The main objective of the study is to examine how factors (personal and environmental) affect diabetes self-care behavior. Figure 1.3 depicts the proposed theoretical model for this study. The derived model depicts the relationships among the SCT constructs: environment/situation (perceived diabetes-specific support, perceived family function, barriers to self-care); behavioral capability (knowledge); and self-efficacy on diabetes self-care behaviors.

[273] Glasgow R.E. Behavioral research on diabetes at the Oregon Institute. *Annals of Behavioral Medicine* 17(1): 32-40, 1995.

Figure 1.3 Social Cognitive Theory and Diabetes Self-Care Behaviors

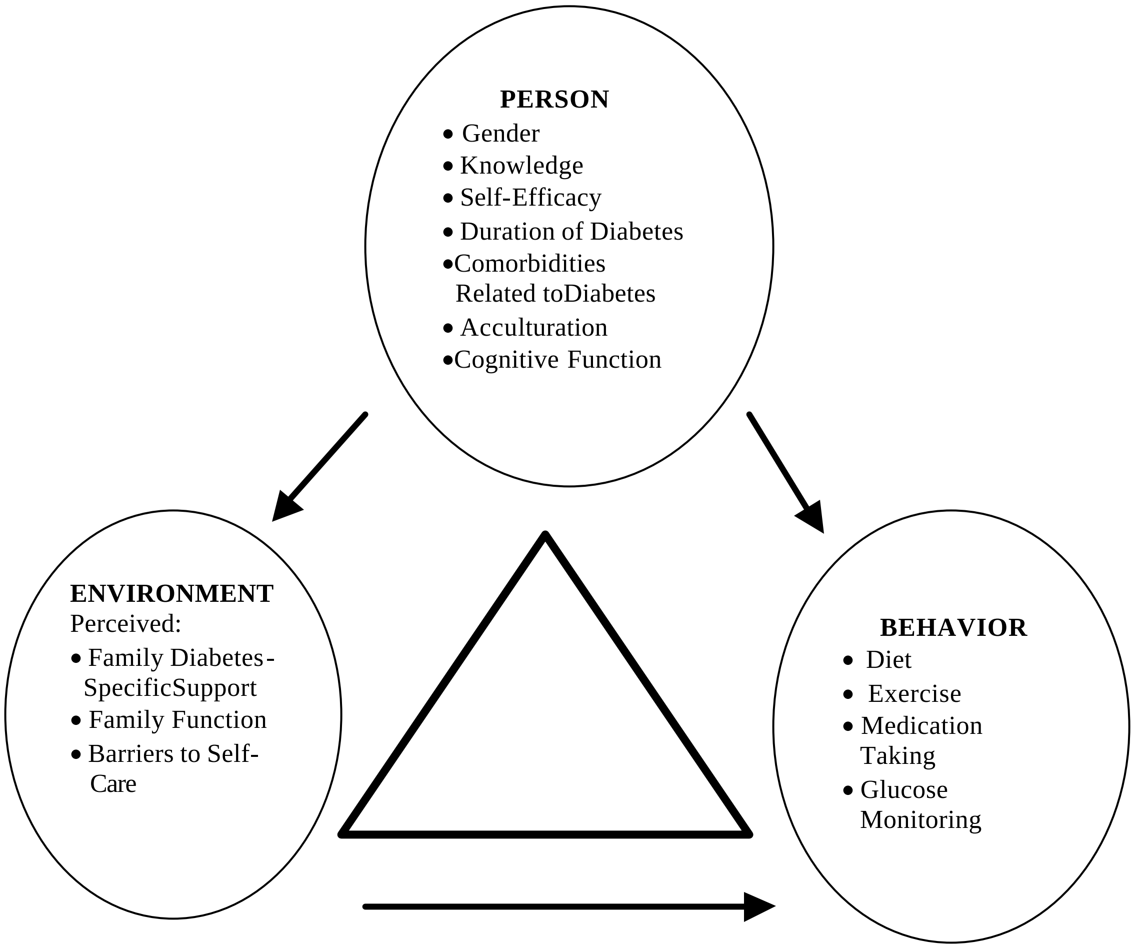
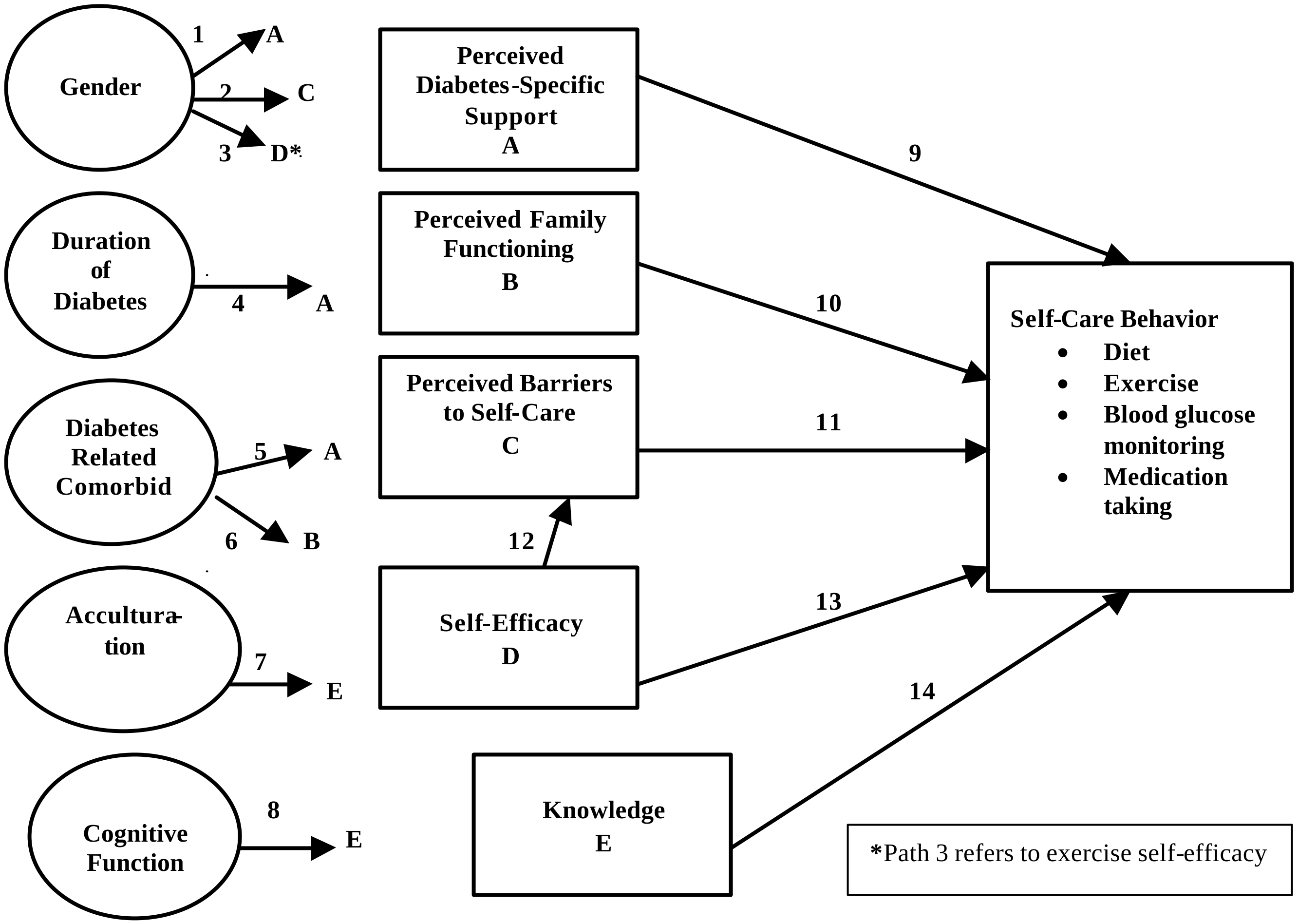


Figure 1.4 depicts the proposed model for this study with the direct and indirect relationships between environment, social cognitive variables, demographic variables (acculturation and gender) and health variables (duration of disease, diabetes-related comorbidities and cognitive function) on self-care behaviors.

Figure 1.4 Proposed Model of Family Environment, Other Social Cognitive Variables, and Diabetes Self-Care Behaviors



Pathways of the Proposed Model

The proposed model in Figure 1.4 depicts the relationships between the psychological factors, social environmental factors, and personal characteristics that relate to levels of diabetes self-care behavior. Additional paths may be drawn for some of the factors but the pathways in the model represent the primary influence(s) of the factor. These paths were determined to be primary influences based on the review of the literature. The psychological variables in this study include knowledge and self-efficacy. Social environmental factors include perceived diabetes-specific support, perceived family function, and perceived barriers to diabetes self-care. The psychological and social environmental variables have effects on the levels of diabetes self-care behaviors.[274, 275] The personal characteristics in the model also include demographic and health background variables.

There are four different regimen areas under the self-care behaviors in Figure 1.4. The areas represent the different dimensions to diabetes self-

[274] Glasgow R.E. Compliance to diabetes regimens in *Patient Compliance in Medical Practice and Clinical Trials.* Cramer J.A. and Spilker B., editors, Raven Press, New York, 209-224, 1991.

[275] Gilden J.L., Hendryx M., Casia C., et al. The effectiveness of diabetes education programs of older patients and their spouses. *Journal of the American Geriatric Society* 37(11): 1023-1030, 1989.

management and the factors that affect each of the areas may differ.[276,277] However, at the present time, there is not enough research to evaluate this issue adequately. The variables in the proposed model and their hypothesized relationships are discussed in more detail in the following section. The relationships discussed in the following section apply to all four behaviors unless otherwise noted.

Demographic Variables

In general, the demographic variables have not been found to be significantly related to the degree of adherence in adults with type 2 diabetes.[278, 279] Gender is one demographic variable that is related to the other variables in the model. The following section is a brief discussion of some of the demographic variables (gender, marital status, ethnicity and acculturation) and their relationships with the social cognitive variables and health behavior.

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[276] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[277] Ary D.V., Toobert D., Wilson W., et al. Patient perspective on factors contributing to non adherence to diabetes regimen. *Diabetes Care* 9(2): 168-172, 1986.

[278] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[279] Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the multidimensional diabetes questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

Gender

Gender differences have been found to be related to disease management.[280] Talbot and associates found that in a sample of type 2 diabetics, women reported lower levels of social support and lower levels of positive reinforcing behaviors.[281] Connell found that women reported lower levels of perceived social support. [282] Kaplan and Hartwell found that social support size and satisfaction have different functions for diabetic men than for diabetic women.[283] Women have reported greater frequency of barriers to self-care than males.[284] Males have been found to have higher scores on self-efficacy for exercise than females.[285] The hypotheses involving gender include the following: 1.) Women will report lower levels of perceived diabetes family

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[280] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European- American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

[281] Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the multidimensional diabetes questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

[282] Connell C.M. Psychosocial contexts of diabetes and older adulthood: reciprocal effects. *Diabetes Educator* 17(5): 364-371, 1991.

[283] Kaplan R.M. and Hartwell S.L. Differential effects of social support and social network on physiological and social outcomes in men and women with type 2 diabetes mellitus. *Health Psychology* 6 (5): 387-398, 1987.

[284] Glasgow R.E., Hampson S. E., Strycker L.A., et al. Personal- model beliefs and social-environmental barriers related to self-management *Diabetes Care* 20(4): 556-561, 1997.

[285] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

support than men; 2.) Males will report higher self-efficacy scores for exercise than females; and 3.) Women will report more barriers to self-care than men.

Marital Status

Adults with type 2 diabetes reported the spouse as the primary source of support and most helpful with diabetes.[286] Marital status has been linked with the prevalence and the severity of disease.[287] Married or coupled adults are less likely to become ill and are more likely to have a shorter recovery period than unmarried or uncoupled adults.[288] However, Connell and associates found that diabetics who were married had perceived greater availability of general support but reported less diabetes-specific support.[289] One cannot assume that being married reflects a supportive context for self-management of disease. Based on these findings, marital status may not have an effect on perceived family support or function.

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[286] Jenny J.L. Differences in adaptation to diabetes between insulin dependent and non-insulin dependent patients: implications for patient education. *Patient Education and Counseling* 8(1): 39-50, 1986.

[287] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24 (5): 599-607, 1998.

[288] Berkman L.F. and Syme S.L. Social networks, host resistance, and mortality: a nine year follow-up of Alameda County residents. *American Journal of Epidemiology* 109(2): 186-204, 1979.

[289] Connell C.M., Davis W.K., Gallant M.P., et al. Impact of social support, social cognitive variables and perceived threat on depression among adults with diabetes. *Health Psychology* 13(3): 263-273, 1994.

Ethnicity

Ethnicity appears to play a strong role in family relationships. The characteristics of the family setting in which disease management takes place are significantly linked to patient self-care behaviors and these linkages vary by patient ethnicity.[290] For Mexican Americans, extended family is considered a primary support group.[291] Fisher et al. found that domains of family life were related to disease management, but the results varied by ethnic group.[292] There were differences between European Americans and Hispanics in the domains of family coherence (family's belief that the world is meaningful and comprehensible), family emotion management, family cohesiveness and family sex role traditionalism (traditional sex roles within the family). However, no studies were identified which found significant relationships between ethnicity and the variables of the model.

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[290] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European- American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

[291] Tamez E.G. and Vacalis T.D. Health beliefs, the significant others and compliance with therapeutic regimens among adults Mexican American diabetics. *Health Education* 20(6): 24-31, 1989.

[292] Fisher L., Chesla C.A., Skaff M.M., et al. The family and disease management in Hispanic and European- American patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

Acculturation

Acculturation refers to "changes in values and behaviors made by individuals of an ethnic group as a result of continuous interaction with people of a different ethnic group."[293] Acculturation is a process of attitudinal and behavioral change undergone by individuals who reside in multicultural societies such as the United States, Canada and Spain, or who come in contact with a new culture due to colonization or other important political changes.[294] People learn certain behaviors of the dominant culture, such as the language and food preferences and the value placed on health.[295]

It is important to measure acculturation because it not only identifies differences among individuals, but also because it has been reported to be related to other important variables. Acculturation has been shown to be

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[293] Cantero P.J., Richardson J.L., Baezconde-Garbanati L. et al. The association between acculturation and health practices among middle-aged and elderly Latinas. *Ethnicity and Disease* 9(2): 166-180, 1999.

[294] Marin G. Issues in the measurement of acculturation among Hispanics in *Psychological Testing of Hispanics.* Geisinger K.F. editor, Washington DC, American Psychological Association, 235-251,1992.

[295] Marin G., Sabogal F., Van Oss Marin B., et al. Development of a short acculturation scale for Hispanics. *Hispanic Journal of Behavioral Sciences* 9(2): 183-205, 1987.

associated with health behavior.[296, 297] Cantero and associates examined the relationship between acculturation and health care practices (smoking and alcohol consumption and exercise) among Latinas. The researchers found that as acculturation (language) increased, so did the levels of exercise. In addition, as acculturation increased, women were more likely to be current smokers and heavy drinkers.[298] Vega et al. examined the relationship between acculturation and alcohol consumption and found that a positive relationship existed between acculturation and alcohol consumption among young and middle aged adults.[299] Other researchers have examined the relationship between acculturation and body mass index and obesity.[300, 301] Studies conducted among a sample of Mexican Americans in the San Antonio Heart Study found that as

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[296] Cantero P.J., Richardson J.L., Baezconde-Garbanati L., et al. The association between acculturation and health practices among middle-aged and elderly Latinas. *Ethnicity and Disease* 9 (2): 166-180, 1999.

[297] Vega W.A. and Amaro H. Latino outlook: good health, uncertain prognosis. *Annual Review of Public Health* 15: 39-67, 1994.

[298] Cantero P.J., Richardson J.L., Baezconde-Garbanati L., et al. The association between acculturation and health practices among middle-aged and elderly Latinas. *Ethnicity and Disease* 9 (2): 166-180, 1999.

[299] Vega W.A. and Amaro H. Latino outlook: good health, uncertain prognosis. *Annual Review of Public Health* 15: 39-67, 1994.

[300] Stern M.P., Rosenthal M. and Haffner S.M. Sex differences in the effects of sociocultural status on diabetes and cardiovascular risk factors in Mexican Americans: The San Antonio Heart Study. *American Journal of Epidemiology* 120(6): 834-851, 1984.

[301] Hazuda H.P., Haffner S.M., Stern M.P., et al. Effects of acculturation and socioeconomic status on obesity and diabetes in Mexican Americans: The San Antonio Heart Study. *American Journal of Epidemiology* 128(6): 1289-1301, 1988.

acculturation and socioeconomic status increased, body mass index linearly decreased among middle aged Mexican American women.[302]

Acculturation exerts its effects through its association with language skills, employment, and education.[303] Language use is one dimension of acculturation and has been found to be an important behavioral indicator of acculturation. Measurements of language use and preference have appeared to produce reliable and valid instruments to evaluate a person's level of acculturation.[304] Olmedo and Padilla found that items in their acculturation scale that best predicted ethnic group membership were those items relating to language.[305]

Garcia and associates administered a diabetes knowledge questionnaire and a language-based acculturation scale to Mexican American adults with type 2 diabetes.[306] The researchers found that although the questionnaire was administered in the participants' preferred language (English, Spanish or both),

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[302] Ibid.

[303] Bassford T.L. Health status of Hispanic elders. *Clinics in Geriatric Medicine* 11(1): 25-38, 1995.

[304] Marin G. Issues in the measurement of acculturation among Hispanics in *Psychological Testing of Hispanics.* Geisinger K.F. editor, Washington DC, American Psychological Association, 235-251,1992.

[305] Olmedo G.M. and Padilla A.M. Empirical and construct validation of a measure of acculturation for Mexican Americans. *Journal of Social Psychology* 105: 179-187, 1978.

[306] Garcia A., Villagomez E., Brown S., et al. The Starr County Diabetes Education Study: development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care* 24(1): 16-21, 2001.

those who scored higher on the language-based acculturation scale also scored higher on the knowledge questionnaire. Acculturation is hypothesized to have a positive effect on diabetes knowledge and indirectly affect self-care behaviors.

Health Background Variables

Duration of Diabetes

Research has suggested that there is a curvilinear relationship between duration of diabetes and the level of self-care behavior in patients with type 1 diabetes. The relationship is moderated by age.[307] Eaton and associates found that there was a negative relationship between duration of diabetes and adherence to diabetes regimen in the young unmarried group with type 1 diabetes. However, the direction of the correlation is the opposite in the married group. As one ages from fourteen through twenty-five, the period is associated with a decline in adherence. After that, additional years are associated with improved adherence.

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[307] Eaton W.W., Mengel M., Mengel L., et al. Psychosocial and psychopathologic influences on management and control of insulin-dependent diabetes. *International Journal of Psychiatry in Medicine* 22 (2): 105-117, 1992.

In persons with type 2 diabetes, Glasgow and associates found no association between duration of diabetes and levels of self-care behaviors.[308] In adolescents, duration of diabetes and age were negatively associated with family functioning.[309] Connell and associates found that adult diabetics who had the disease longer, perceived a greater amount of general support.[310] Duration of diabetes is hypothesized to have a positive effect on perceived diabetes-specific support.

Diabetes-Related Comorbidities

Comorbidities refer to the number of chronic diseases or long-term complications. For this study, comorbidities will be limited to those related to diabetes. The United Kingdom Prospective Diabetes Study has shown that better glycemic control can reduce microvascular complications resulting from

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[308] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[309] Hanson C.L., Henggeler S.W., Harris M.A., et al. Family system variables and the health status of adolescents with insulin-dependent diabetes mellitus. *Health Psychology* 8(2): 239-253, 1989.

[310] Connell C.M., Davis W.K., Gallant M.P., et al. Impact of social support, social cognitive variables and perceived threat on depression among adults with diabetes. *Health Psychology* 13(3): 263-273, 1994.

diabetes in type 2 diabetes.[311] The presence of chronic illness in the family affects the health and well-being of other family members and can reduce the family's ability to respond to one another.[312] Older adults with a greater number of health problems reported the least amount of social support.[313] The patients' comorbidities have been found to be significantly associated with diabetes-related care received from the family member. It is hypothesized that the more diabetes-related comorbidities an individual has, the lower the level of perceived diabetes-specific support and the lower the level of perceived family functioning.

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[311] U.K. Prospective Diabetes Study Group: Intensive blood glucose control with sulfonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *Lancet* 352(9131): 837-853, 1998.

[312] Lieberman M.A. and Fisher L. The impact of chronic illness on the health and well-being of family members. *Gerontologist* 35(1): 94-102, 1995.

[313] Jenny J.L. Differences in adaptation to diabetes between insulin dependent and non-insulin dependent patients: implications for patient education. *Patient Education and Counseling* 8(1): 39-50, 1986.

Depression

Several studies have reported that comorbid depressive symptoms are especially prevalent among adults with diabetes.[314, 315, 316] Additionally, older adults appear to be more susceptible to comorbid depression and diabetes.[317, 318] Depressive symptoms and poorer well being have been found to be associated with poor glucose control and inadequate treatment adherence.[319] In this study, depression will be controlled for and will be treated as a diabetes-related comorbidity.

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[314] Peyrot M. and Rubin R.R. Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 20(4): 585-590, 1997.

[315] Konen J.C., Curtis L.G. and Summerson J.H. Symptoms and complications of adult diabetic patients in a family practice. *Archives of Family Medicine* 5(3): 135-145, 1996.

[316] Gavard J.A., Loustman P.J. and Clouse R.E. Prevalence of depression in adults with diabetes: an epidemiological evaluation. *Diabetes Care* 16(8): 1167-1178, 1993.

[317] Black S. Increased health burden associated with comorbid depression in older diabetic Mexican Americans: results from the Hispanic Established Population for the Epidemiologic Study for the elderly survey. *Diabetes Care* 22(1): 56-64, 1999.

[318] Amato L., Paolisso G., Caccitore F., et al. Non-insulin dependent diabetes mellitus is associated with a greater prevalence of depression in the elderly. *Diabetic Metabolism* 22(5): 314-318, 1997.

[319] Van der Doees F.E., De Neeling J.N., Snoel F.J., et al. Symptoms and well-being in relation to glycemic control in type II diabetes. *Diabetes Care* 19(3): 204-210, 1996.

Cognitive Function

It is estimated that approximately five to 10 percent of adults over age 65 are affected by a decline in cognitive function.[320] A number of studies conducted over the past 30 years have suggested that patients with type 2 diabetes exhibit moderate degrees of cognitive dysfunction, particularly with respect to verbal memory.[321, 322, 323] It is hypothesized that cognitive function indirectly affects diabetes self-care behaviors. There is a direct positive relationship between cognitive function and diabetes knowledge. It is hypothesized that as cognitive function declines, the scores on the diabetes knowledge instrument will decline.

Perceived Diabetes-Specific Support

This construct refers to the amount of support received from family members and non-family members for the performance of self-care activities. Several studies have found that the amount of support provided by the family

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[320] Tun P.A., Nathan D.M., Perlmuter L.C. Cognitive and affective disorders in elderly diabetics. *Clinical Geriatric Medicine* 6: 731-746, 1990.
[321] Strachan M.W.J., Deary I.J., Ewing F.E., et al. Is Type II diabetes associated with an increased risk of cognitive function? A critical review of published studies. *Diabetes Care* 20(3): 438-455, 1997.
[322] Stewart R. and Liolitsa D. Type 2 diabetes mellitus, cognitive impairment and dementia. *Diabetic Medicine* 16(2): 93-112, 1999.
[323] Tun P.A., Nathan D.M., Perlmuter L.C. Cognitive and affective disorders in elderly diabetics. *Clinical Geriatric Medicine* 6: 731-746, 1990.

has positively influenced adherence in several aspects of the diabetes regimen. Wilson and colleagues found diabetes-specific measures of social support were the most consistent and strongest predictors of self-care behavior across the different regimens.[324] Glasgow and associates found that environmental support was a strong predictor of exercise but much less important in predicting glucose testing.[325] Perceived diabetes-specific support is hypothesized to have a positive effect on levels of self-care behavior.

Perceived Family Function

As mentioned earlier in this chapter, the patient's family is an important factor in determining appropriate health care behaviors. Studies of the association between family function and control of diabetes have been conducted primarily in adolescents and children and overall there is a positive correlation between the two variables.[326] Cardenas and associates found that family function differs in patients according to their level of diabetes control (as

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[324] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

[325] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[326] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24 (5): 599-607, 1998.

measured by fasting plasma glucose).[327] Patients with better diabetes control reported better family function. The five basic components of family function that appear to represent common themes in the social science literature dealing with families are adaptation, partnership, growth, affection and resolve.[328] The family is a nurturing unit that promotes emotional and physical growth and maturation of all members. The family's role in health is to provide a nurturing environment that demonstrates integrity of the five components.

Adaptation is the utilization of intra- and extra-familial resources for problem solving when family equilibrium is stressed during a crises. *Growth* is the physical and emotional maturation and self-fulfillment that is achieved by family members through mutual support and guidance. *Affection* is the caring or loving relationship that exists among family members. *Resolve* is the commitment to devote time to other members of the family for physical and emotional nurturing. It usually involves a decision to share wealth and space. *Partnership* is the sharing of decision-making and nurturing responsibilities by family members. It is hypothesized that family function has a positive effect on

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[327] Cardenas L., Vallbona C., Baker S., et al. Adult onset diabetes mellitus: glycemic control and family function. *American Journal of Medical Sciences* 293(1): 28-33, 1987.

[328] Smilkstein G. The Family APGAR: A proposal for a family function test and its use by physicians. *Journal of Family Practice* 6(6): 1231-1239, 1978.

self-care behaviors (the better the family function, the better the level of self-care behaviors).

Perceived Barriers to Self-Care

Studies have demonstrated the influence of perceived barriers on diabetes self-care behaviors.[329, 330, 331, 332] Overall, these studies have shown that the frequency of barriers varies across self-care areas. Adherence to diet has the greatest frequency of barriers and is usually followed by exercise. The medication-taking barriers have been reported to have the lowest frequency. Generally, studies have shown that barriers to self-care have an inverse relationship with the extent to which subjects follow their diabetic regimen. Most of the studies mentioned have been conducted in younger adults with the exception of the study by Connell and associates.[333]

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[329] Ary D.V., Toobert D., Wilson W., et al. Patient perspective on factors contributing to non adherence to diabetes regimen. *Diabetes Care* 9(2): 168-172, 1986.

[330] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[331] McCaul K.D., Glasgow R.E., and Schafer L.C. Diabetes regimen behaviors: predicting adherence. *Medical Care* 25(9): 868-881, 1987.

[332] Connell C.M., Storandt J. and Lichty W. Impact of health belief and diabetes-specific psychosocial context variables on self-care behavior, metabolic control, and depression of older adults with diabetes. *Behavior, Health, and Aging* 1(3): 183-196, 1990.

[333] Ibid.

Glasgow and associates found that greater total barrier scores were significantly associated with the following factors: being female and Caucasian, having managed care insurance or no insurance, having type 1 diabetes and being more highly educated.[334] It does seem counter-intuitive that being more educated was associated with higher perceived barriers. Perhaps being more educated makes one more aware of the self-management regimen for the disease and to recognize the potential barriers to self-care. On the other hand, those that are less educated may not be aware of the self-management regimen and are not aware of the barriers. The frequency of barriers to self-care are hypothesized to have an inverse relationship with self-care behaviors. In addition, barriers to self-care are hypothesized to moderate the relationship between self-efficacy and self-care behaviors. This is discussed in more detail on the following page.

Knowledge

Research has demonstrated that knowledge about diet, medications, exercise and blood glucose monitoring and treatment of diabetes is necessary to effectively manage diabetes. Several meta-analyses of studies assessing the relationship between patient education and diabetes outcomes have found that

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[334] Glasgow R.E., Hampson S. E., Strycker L.A., et al. Personal-model beliefs and social-environmental barriers related to self-management. *Diabetes Care* 20(4): 556-561, 1997.

patient education is associated with an increase in patient knowledge and this has a positive effect on adherence and metabolic control.[335, 336] Also, research has demonstrated that a bicultural educational intervention lead to improved patient knowledge and self-care behaviors in older Hispanic adults.

Gilden and associates examined the effectiveness of an educational intervention in older adults and their spouses and found that older patients with participating spouses showed greater improvement in knowledge and in metabolic control compared to those patients without spouses.[337] It is hypothesized that knowledge has a positive effect on levels of self-care.

Self-Efficacy

Self-efficacy refers to the individual's confidence in his/her ability to perform the self-care behaviors (for example, testing blood glucose or taking medication or administering insulin as directed). This construct includes the confidence in having the skills to perform the behavior and in being able to

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[335] Padgett D., Mumford E., Hyne M., et al. Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *Journal of Clinical Epidemiology* 41(10): 1007-1030, 1988.

[336] Brown S. Studies of educational interventions and outcomes in diabetic adults: a meta-analysis revisited. *Patient Education and Counseling* 16(2): 189-215,1990.

[337] Gilden J.L., Hendryx M., Casia C., et al. The effectiveness of diabetes education programs of older patients and their spouses. *Journal of the American Geriatric Society* 37(11): 1023-1030, 1989.

overcome any barriers to performing the behavior.[338] Self-efficacy is an important predictor of health behavior change and maintenance.[339] Self-efficacy has been found to be a significant predictor of adherence to diabetes treatment in both type 1 and 2 diabetics.[340, 341, 342] Self-efficacy is inversely related to perceived barriers to self-care behaviors. The greater the self-efficacy one has, the less the perceived frequency of barriers to self-care.

Among persons with type 2 diabetes, there has not been a relationship found between age and self-efficacy.[343, 344] McCaul and associates examined the psychosocial predictors of regimen adherence among adolescents and adults with type 1 diabetes and found no association between age and self-efficacy.

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[338] Baranowski T. Families and health actions in *Handbook of Health Behavior Research I: Personal and Social Determinants.* Gochman D.S., editor, New York, Plenum Press, 179-206, 1997.

[339] Strecher V.J., DeVellis B., Becker M.J., et al. The role of self-efficacy in achieving health behavior change. *Health Education Quarterly* 13(1): 73-92, 1986.

[340] Kavanagh D. H., Gooley S. and Wilson P.H. Prediction of adherence and control in diabetes. *Journal of Behavioral Medicine* 16(5): 509-522, 1993.

[341] McCaul K.D., Glasgow R.E., and Schafer L.C. Diabetes regimen behaviors: predicting adherence. *Medical Care* 25(9): 868-881, 1987.

[342] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[343] Ibid.

[344] Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the Multidimensional Diabetes Questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

Padget examined the correlates of self-efficacy beliefs in type 2 diabetes and found that duration of diabetes and diabetes-related comorbidities were not significantly associated with self-efficacy beliefs.[345] Glasgow and associates also found no association between health variables and self-efficacy beliefs.[346] With respect to gender, males have been found to have higher scores on self-efficacy for exercise than females.[347] It is hypothesized that self-efficacy has a direct effect on level of self-care behaviors and an indirect relationship via barriers to self-care. Self-efficacy is hypothesized to have a negative relationship with perceived barriers. The lower the self-efficacy, the greater the perceived barriers to self-care.

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[345] Padgett D.K. Correlates of self-efficacy beliefs among patients with non-insulin dependent diabetes mellitus in Zagreb, Yugoslavia. *Patient Education and Counseling* 18(2): 139-147, 1991.

[346] Glasgow R.E. Toobert D.J. Riddle M, et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[347] Ibid.

PURPOSE, OBJECTIVES AND HYPOTHESES

Purpose and Objectives

The overall purpose of the study is to test a model that depicts the relationships between the social environmental factors, psychological factors, duration of illness, comorbidities, acculturation and gender on diabetes self-care behaviors among older adults with type 2 diabetes. In this dissertation, the results for two self-care behaviors will be presented–– medication taking and diet.

The specific objectives of the study are:

1.) to determine the level of perceived family support and family functioning in older adults with type 2 diabetes;

2.) to evaluate the level of diabetes self-care activities; and

3.) to analyze the relationships among the family environment and other psychosocial variables and levels of self-care behaviors.

The study will test the following paths:

1.) direct paths between gender and perceived diabetes specific support, perceived barriers to self-care, and exercise self-efficacy;

2.) direct path between duration of diabetes and perceived diabetes specific support;

3.) direct paths between diabetes-related comorbidities and family environment variables (perceived diabetes specific support and family function);

4.) direct path between acculturation and knowledge;

5.) direct path between cognitive function and knowledge;

6.) direct path between self-efficacy and levels of self-care behaviors (with the exception of exercise);

7.) indirect paths between gender and levels of self-care behaviors via perceived diabetes-specific support and perceived barriers to self-care;

8.) indirect path between gender and levels of exercise behavior via self-efficacy;

9.) indirect paths between diabetes-related comorbidities and levels of self-care behaviors via perceived diabetes specific support and family function;

10.) indirect path between acculturation and levels of self-care behaviors via knowledge;

11.) indirect path between cognitive function and levels of self-care behaviors via knowledge; and

12.) indirect path between self-efficacy and levels of self-care behaviors via perceived barriers to self-care.

Analysis of Self-Care Regimen

The proposed model depicted in Figure 1.4 represents the four main aspects of the diabetes self-care regimen. Previous research has consistently indicated that the dimensions of diabetes self-care are relatively independent. A separate analysis will be conducted for each regimen area.[348] Thus, there are four proposed models with each model depicting a different regimen area. Figures 1.5 through 1.8 represent the proposed models for the medication taking, the dietary aspect of the regimen, exercise and blood glucose monitoring respectively.

[348] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

Hypotheses

Only the set of hypotheses for the medication taking and diet models are present in this section. The model for *medication taking behavior* is described by the following set of hypotheses, which correspond to the numbered paths in Figure 1.5.

H1. Women will report lower levels of perceived diabetes family support than men.

H2. Women will report greater frequency of barriers to medication taking behavior than men.

H3. Duration of diabetes is positively related to perceived diabetes-specific support.

H4. The number of diabetes-related comorbidities is inversely related to the perceived level of diabetes specific support (The more comorbidities an individual has, the lower the level of perceived diabetes specific support.)

H5. The number of diabetes-related comorbidities is inversely related to the perceived family function. (The more comorbidities an individual has the more that individual will perceived their family as being dysfunctional.)

H6. Acculturation is positively related to knowledge. The more acculturated, the higher the scores on the knowledge instrument.

H7. Cognitive function is positively related to knowledge. The better the cognitive function, the higher the scores on the knowledge instrument.

H8. Perceived diabetes specific family support is positively related to levels of medication taking behavior.

H9. Perceived family functioning (more functional) is positively related to levels of medication taking behavior.

H10. The frequency of perceived barriers to self-care is inversely related to levels of medication taking behavior.

H11. Self-efficacy in medication taking is inversely related to the frequency of perceived barriers to self-care.

H12. Self-efficacy in medication taking is positively related to levels of medication taking behavior.

H13. Knowledge is positively related to levels of medication taking behavior.

The model for *dietary behavior* is described by the following set of hypotheses, which correspond to the numbered paths in Figure 1.6.

H1. Women will report lower levels of perceived diabetes family support than men.

H2. Women will report greater frequency of barriers to dietary behavior than men.

H3. Duration of diabetes is positively related to perceived diabetes specific support.

H4. The number of diabetes-related comorbidities is inversely related to the perceived level of diabetes specific support (The more comorbidities an individual has, the lower the level of perceived diabetes specific support.)

H5. The number of diabetes-related comorbidities is inversely related to the perceived family function. (The more comorbidities an individual has, the more that individual will perceived their family as being dysfunctional.)

H6. Acculturation is positively related to knowledge. The more acculturated, the higher the scores on the knowledge instrument.

H7. Cognitive function is positively related to knowledge. The better the cognitive function, the higher the scores on the knowledge instrument.

H8. Perceived diabetes specific family support is positively related to levels of dietary behavior.

H9. Perceived family functioning (more functional) is positively related to levels of dietary behavior.

H10. The frequency of perceived barriers to self-care is inversely related to level of dietary behavior.

H11. Self-efficacy in diet regimen is inversely related to the frequency of perceived barriers to diet.

H12. Self-efficacy in diet regimen is positively related to levels of dietary behavior.

H13. Knowledge is positively related to levels of dietary behavior.

Figure 1.5 Proposed Model of Family Environment, Other Social Cognitive Variables, and Medication Taking Behavior

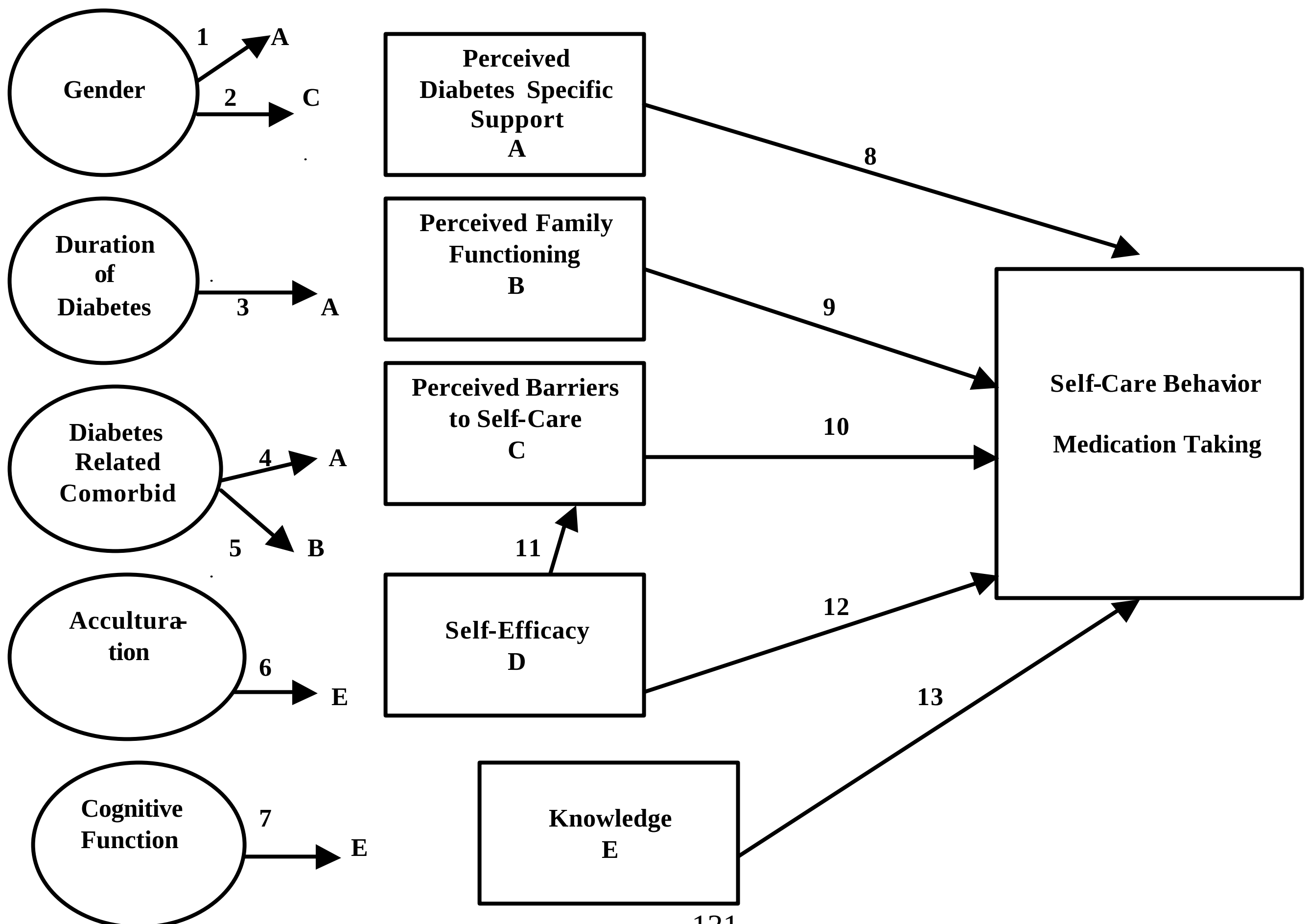


Figure 1.6 Proposed Model of Family Environment, Other Social Cognitive Variables and Diet Self-Care Behavior

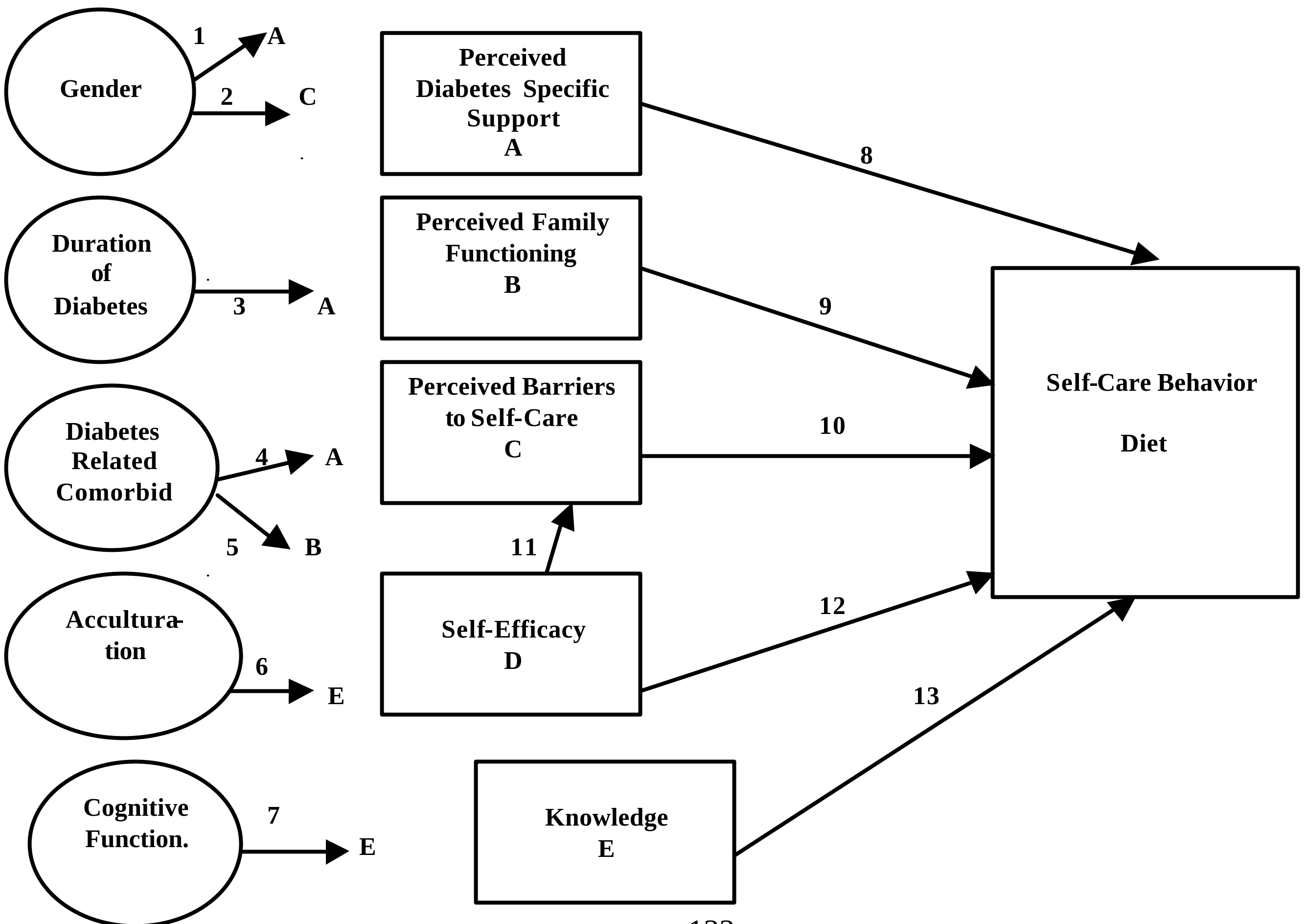


Figure 1.7 Proposed Model of Family Environment, Other Social Cognitive Variables and Exercise Self-Care Behavior

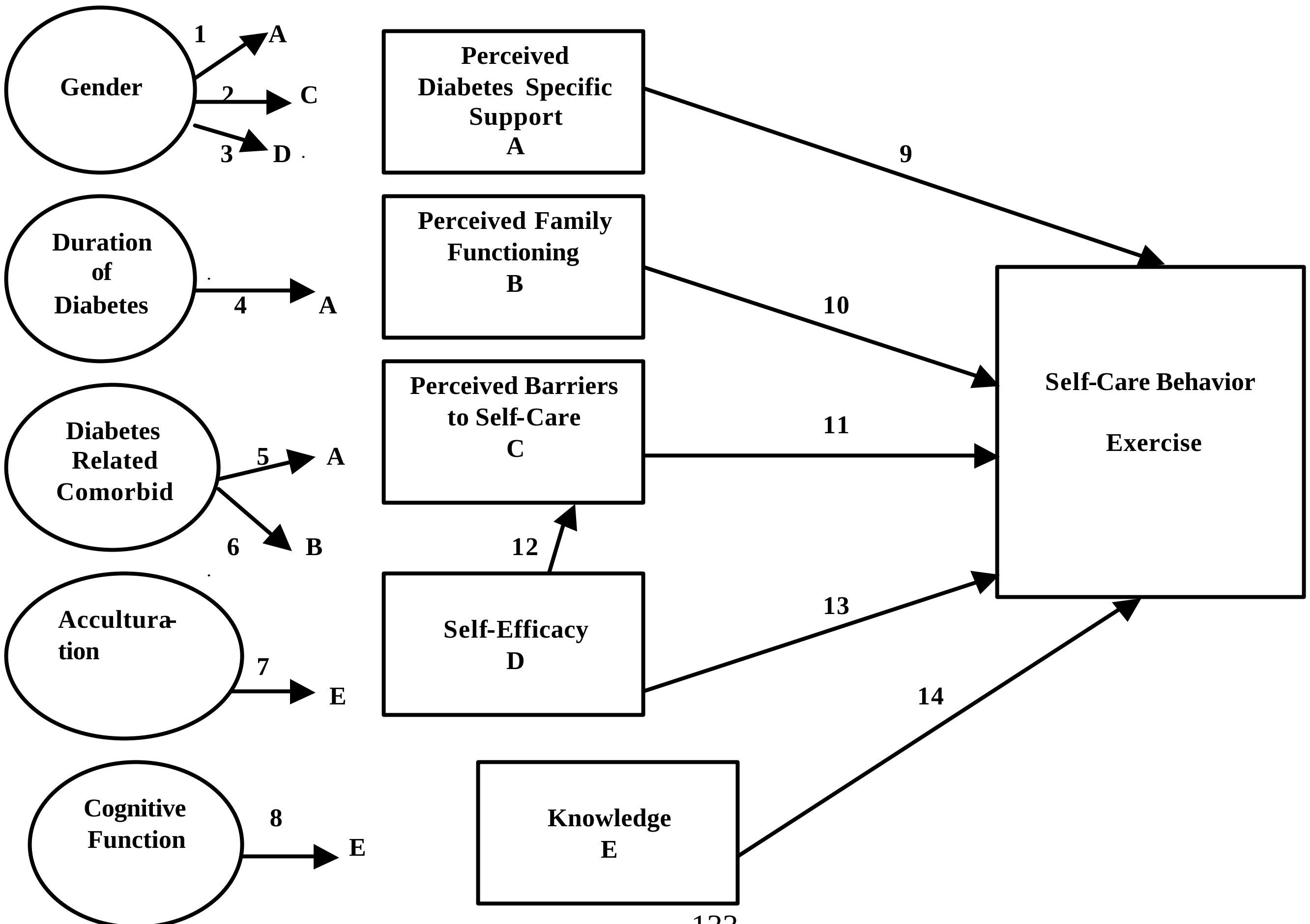
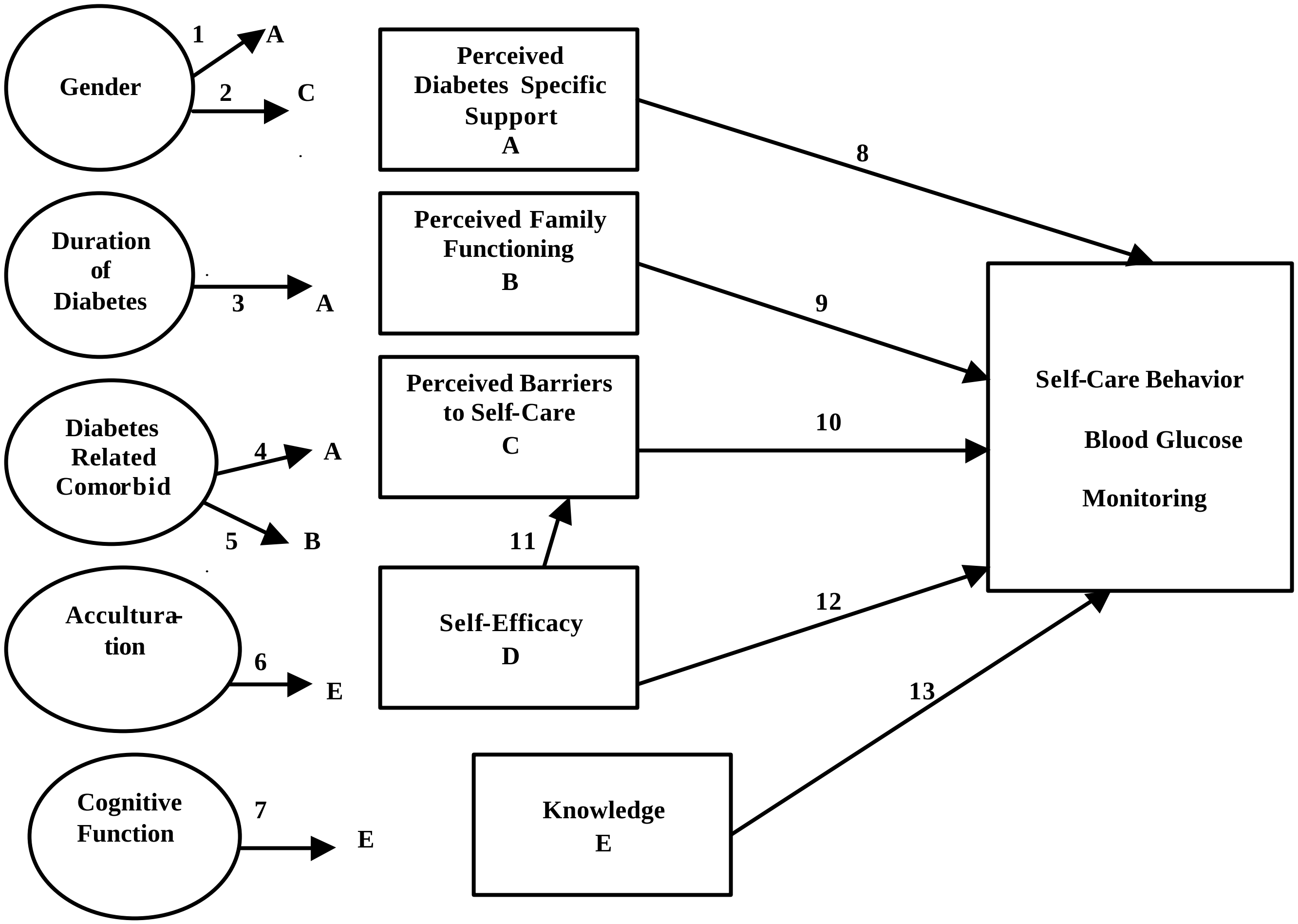


Figure 1.8 Proposed Model of Family Environment, Other Social Cognitive Variables and Self-Monitoring of Blood Glucose



CHAPTER 2

METHODOLOGY

INTRODUCTION

The purpose of this study is to achieve a better understanding of how the family environment and other social cognitive variables influence an individual's diabetes self-care behaviors. A non-experimental survey design was utilized. This chapter will be divided into eight major sections. These sections include the following: sampling design, instrument development, description of measures, procedures, pilot test, non-participant bias, data analysis, and limitations. A brief discussion of path analysis is included in the data analysis section.

The nature of the study was exploratory; therefore, a non-experimental, descriptive study design was utilized to meet the objectives of the study. Of the different methods used in survey research, a face-to-face interview (researcher administered survey) was selected. Other methods such as telephone survey, self-administered and mail survey were considered. The face-to-face interview was selected based on the recommendations from other researchers experienced in working with a similar patient population. In addition, the survey was relatively lengthy and the target population was older adults. A disadvantage of the mail or self-administered survey is that in this patient population, over 50 percent have less than a high school education and literacy may be an issue. This population would probably respond best to the face-to-face method of surveying.

THE SAMPLING DESIGN

Study Population

The site for this study was located in San Antonio, Texas. This city was chosen because a small local study is appropriate due to the exploratory nature of the research and budget constraints required a population that was readily accessible. The population from which the sample was drawn was the clinic population at the University Health System's Outpatient Health Center (Downtown). A convenience sample of patients receiving care from the primary care clinics (adults and geriatrics) were used for the study.

Demographics of the Outpatient Diabetic Population

Approximately 70 percent of the diabetic patients at the primary care clinics (adult and geriatric) is female, 80 percent is Hispanic, approximately 50 percent has less than a high school education, 36 percent does not have health insurance and the average age is 56 years.

Inclusion Criteria

The inclusion criteria included the following:

1. adults 55 years of age or older;
2. diagnosed with diabetes (type 2) for at least one year;
3. prescribed diabetes medication (oral or insulin);
4. living in a family environment; and
5. able to provide informed consent.

Living in a family environment is defined as the following:

living with a spouse/significant other;
living with spouse/significant other and children;
living with children; or
living with family or friends.

Exclusion Criteria

The exclusion criteria included the following:

1. treated for major psychiatric problems within the previous 6 months;
2. scoring 15 or higher on the Patient Health Questionnaire depression screen;
3. started on insulin therapy during the six month period preceding the study;
4. have major complications that may affect performance of diabetes self-management activities such as cognitive impairment (scoring below cut score for CLOX test), end-stage renal disease, and blindness; or
5. institution or nursing care is required.

Major psychiatric problems included psychoses (schizophrenia) and affective disorders (mania) and major depression.

Institutional Review Board (IRB)

Applications for expedited review of this project were sent to the Institutional Review Boards (IRBs) at The University of Texas at Austin and The University of Texas Health Science Center in San Antonio because the study involved human subjects. Expedited approvals from both IRBs were obtained. Copies of informed consents for the pilot study and final study can be found in Appendix A. The Spanish version is included in Appendix A as well.

Sample Size

In conducting a statistical analysis, two hypotheses are being tested: the null hypothesis and the alternate hypothesis. The null hypothesis assumes the variable of interest has no effect and the alternate hypothesis states the variable of interest does have an effect. An appropriate sample size is needed in order to test the alternate hypothesis.[349]

For any given test of a null hypothesis, there are five factors that need to be considered: (1) the alpha level (the probability of rejecting the null hypothesis when it is true); (2) the effect size (the magnitude of the effect in the

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[349] Kraemer H. and Theimann S. *How Many Subjects? Statistical Power Analysis in Research.* Beverly Hills, Sage Publications Inc., 63, 1987.

population of the variable of interest); (3) the sample size (n) (the number of subjects to be sample; (4) the power of the test (1- ß) (the probability of rejecting the null hypothesis when it is false); and (5) the type of statistical test to be used. Path analysis was used to examine the relationships between the set of independent variables and the dependent variables. Path analysis is based on simple regression techniques. The principal statistical tests that were used in this study are correlation and regression. Path analysis is discussed in more detail later in this chapter.

There are different methods used for determining the effect size of the population. One method involves a review of the literature to determine the range of effect sizes that have been reported. Then the effect size is set within this range. Correlation and regression have been mathematically demonstrated to have the same power.[350, 351] Correlation and regression have equal critical effect sizes and thus, equal necessary sample sizes. A multiple regression and correlation formula (MRC) were used to calculate sample size.

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[350] Pedhazur E.J. *Multiple Regression in Behavioral Research.* New York, CBS College Publishing, 1982.

[351] Kraemer H. and Theimann S. *How Many Subjects? Statistical Power Analysis in Research.* Beverly Hills, Sage Publications Inc., 1987.

Cohen considers the following:

Small effect size	R^2 = 0.02 (accounts for 2 % of the Y variance)
Moderate effect size	R^2 = 0.13 (accounts for 13% of the Y variance)
Large effect size	R^2 = 0.30 (accounts for 30% of the Y variance)[352]

Cohen provides a formula for determining the sample size, given *lambda*, the non-centrality parameter (of the non-central F distribution). [353] *Lambda* is a function of the effect size index and the numerator and denominator degrees of freedom.

The formula for sample size is the following:

$$N = \frac{lambda \quad (1 - R^2_{y.b})}{R^2_{y.b}}$$

Where N = total sample size
lambda = non centrality parameter of the non central F distribution
$R^2_{y.b}$ = proportion of variance in dependent variable (Y) accounted for by B

The value for *lambda* obtained from a table, where *lambda* is a function of u (number of independent variables, v (degrees of freedom for the denominator of the F ratio), alpha and the power.[354] According to Cohen, the *lambda* values for the four values of v for any given level of desired power do not vary greatly.[355]

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[352] Cohen J. *Statistical Power Analysis for the Behavioral Sciences.* New Jersey, Lawrence Erlbaum Associates, Hillsdale, 412-413, 1988.
[353] Ibid, 445.
[354] Ibid, 453.
[355] Ibid, 445.

Using v = 120 will yield an N of sufficient accuracy. From the *lambda* table, for an alpha = 0.05, u =10, v = 120, and power = 0.80, the *lambda* value is 17.4.

Effect Size Determination

To determine the effect size, one needs to review the literature to determine the range of effect sizes or correlation coefficients reported in the relevant studies and then select an effect size within the range. The range of effect sizes used to calculate the sample size in this study was taken from those studies that are most similar to this study. Studies that examine the psychosocial variables and their effects on diabetes self-care in adults with type 2 diabetes were examined. A review of the literature revealed that the effect sizes (multiple correlation coefficient R^2) from these previous studies ranges from 0.04 to 0.58. A brief description of the studies that reported R^2 is summarized in Table 2.1. A conservative effect size of 0.10 was selected for this study.

Using the following equation:

$$N = \frac{lambda\ (1 - R^2_{y.b})}{R^2_{y.b}}$$

Where *lambda* = 17.4

$R^2_{y.b} = 0.10$

$$N = \frac{17.4\ (1 - 0.10)}{0.10}$$

$N = 157$

The general rule of thumb for the ratio of subjects to predictors is at least 10:1.[356] Using this general rule of thumb, the sample size needed is 100 subjects. The goal was to recruit approximately 160 subjects.

[356] Maxwell S.E. Sample size and multiple regression analysis. *Psychological Methods* 5(4): 434-458, 2000.

Table 2.1 Description of Previous Studies Used to Determine Effect Size

Study/Description	Self-care Behavior	R^2
Wilson et al. assessed potential psychosocial correlates of self-care behaviors and of glycemic control in a community sample of adults with type 2 diabetes.[357] (Social Learning Theory Variables)	medication taking glucose testing diet exercise	0.43 0.58 0.51 0.50
Glasgow et al. assessed the relationship between diabetes specific social learning factors and diabetes self- care among persons with type 2 diabetes.[358] (Social Learning Theory Variables)	medication taking glucose testing diet exercise	n/a 0.44 0.26 0.49
Glasgow et al. examined personal model beliefs and the social environment barriers related to diabetes self management among type 1 and 2 diabetics.[359] (Barriers to Self- Care)	overall barriers medication taking glucose testing diet exercise	0.45 n/a 0.41 0.46 0.33
Fisher et al. determined the relationship between the characteristics of families involved in diseased management and the self-care practices of Hispanic and European-American patients with type 2 diabetes.[360]	European-Americans exercise diet observations Hispanic exercise diet observations	 0.11 0.04 0.18 0.13

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[357] Wilson W., Ary D.V., Biglan A., et al. Psychosocial predictors of self-care behaviors (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* 9(6): 614-622, 1986.

[358] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes-specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

[359] Glasgow R.E., Hampson S.E., Strycker L.A., et al. Personal model beliefs and social- environmental barriers related to diabetes self-management. *Diabetes Care* 20(4): 556-561, 1997.

[360] Fisher L., Chesla C.A., Skaf M.M., et al. The family and disease management in Hispanic and European-American Patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

Sampling Method

A convenience sample of consenting patients from the primary care clinics who met the above inclusion criteria was used for the study. A description of the procedures used in administering the survey is provided in a later section of this chapter.

NON-PARTICIPANT BIAS

Due to the methodology employed, it was not possible to examine non-participant bias to determine if the participants are representative of the sample population. Demographic data is not available on the older adults with diabetes in the clinic. The data that is available is for the adult population with diabetes and includes those younger than 55 years of age. The sample will be compared to the demographic data for persons with diabetes in Bexar County.

THE SURVEY INSTRUMENT

According to Salant and Dillman, advance letters should be used whenever possible in face-to-face surveys.[361] However, with this population, current addresses are not always available. A signed introductory letter from the researchers was available and was given to all potential respondents. The letter explained the purpose of the study.

Introductory Letter

The first paragraph of the introductory letter explained the theme of the survey. The letter explained how the results of the study can help health care professionals better understand the factors that affect diabetes self-care behavior and to develop programs to better improve the levels of self-care behaviors.

The letter had a non-judgmental tone in order to encourage the potential participant to be comfortable in being truthful. In addition, the patients were

[361] Salant P. and Dillman D. *How To Conduct Your Own Survey*. New York, John Wiley and Sons, Inc., 137-174, 1994.

informed that their participation in the study is voluntary and would not impact the care that they receive at the clinic. If they chose not to participate, this would not alter the care received from their physician(s). Because the survey was administered at the clinic where they receive their medical care, the patients were promised confidentiality.

The last paragraph of the letter explained the incentive for participating in the study. Each participant selected a book on diabetes as a token of appreciation for his or her participation. The two books available included 101 Medication Tips for People with Diabetes (English) and Diabetes from A to Z (Spanish). A copy of the English and Spanish versions of the letter can be found in Appendix B.

Measures

The majority of the items on the survey were chosen largely from existing instruments. The Diabetes Family Behavior Checklist II (DFBC II),[362] Family APGAR,[363] Barriers to Self-Care,[364] Diabetes Knowledge Questionnaire

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[362] Schafer L.C., McGaul K.D. and Glasgow R.E. Supportive and non-supportive family behaviors: relationship to adherence and metabolic control in persons with type 1 diabetes. *Diabetes Care* 9(2): 179-185, 1986.
[363] Smilkstein G. The Family APGAR: A proposal for a family function test and its use by physicians. *The Journal of Family Practice* 15(2): 303-311, 1982.
[364] Glasgow R.E. Social-environmental factors in diabetes: barriers to diabetes self-care in *Handbook of Psychology and Diabetes*. Bradley C. editor, Chur Switzerland, Harwood Academics, 335-349, 1994.

(DKQ-24), [365] Patient Health Questionnaire (PHQ-9),[366] an acculturation scale developed by Deyo et al.,[367] a clock drawing test (CLOX)[368] and the Summary of Diabetes Self-Care Activities (SDSCA)[369] were used. Self-efficacy measures were adapted from an existing instrument and the researchers developed a medication taking behavior scale. Additional items included to assess non-family diabetes-specific support were adapted from the Diabetes Care Profile (DCP).[370] Data on health variables (comorbidities), duration of diabetes, and HbA1C were collected from the clinical records. A description of each of these instruments is provided in the next section. A copy of the instrument is provided in Appendix C.

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[365] Garcia A., Villagomez E.T., Brown S.A., et al. The Starr County Diabetes Education Study: development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care* 24(1): 16-21, 2001.

[366] Kroenke K., Spitzer R.L. and Williams J.B. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16 (9): 606-613, 2001.

[367] Deyo R.A., Diehl A.K., Hazuda H., et al. A simple language-based acculturation scale for Mexican Americans: validation and application to health care research.
American Journal of Public Health 75(1): 51-55, 1985.

[368] Royall D.R., Cordes J.A. and Polk M. CLOX: an executive clock drawing task. Journal of Neurology, Neurosurgery and Psychiatry 64: 588-594, 1998.

[369] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[370] Fitzgerald J.T., Davis W.K., Connell C.M., et al. Development and validation of the Diabetes Care Profile. *Evaluation and the Health Professions* 19(2): 208-230, 1996.

The Spanish version of the instrument was developed by translating the English version of the instrument into Spanish and back translated into English. Any discrepancies were corrected using the consensus of three bilingual experts. The Diabetes Knowledge Questionnaire (DKQ) is available in both English and Spanish. A copy of the Spanish version of the instrument is provided in Appendix D.

DESCRIPTION OF MEASURES

Family Measures

Perceived Family Support (Diabetes-Specific)

Perceived Family Support is the perceived support from specific family members for performing diabetes-related behaviors. This variable was assessed through the Diabetes Family Behavior Checklist II (DFBC). The instrument was developed by Schafer et al. to assess actions of family members toward the person with type 2 diabetes in the following areas: medication taking, glucose testing, exercise and diet. [371] The instrument contains 16 items that measures supportive and non-supportive family behaviors specific to diabetes. There are nine positive

[371] Schafer L.C., McGaul K.D. and Glasgow R.E. Supportive and non-supportive family behaviors: relationship to adherence and metabolic control in persons with type 1 diabetes. *Diabetes Care* 9(2): 179-185, 1986.

items that measure supportive behavior and seven negative items that measure non-supportive behavior.

This instrument can be scored in several ways. One method involves calculating the positive and negative summary scores.[372] The second method involves calculating a score for each of the regimen areas. In the first method, a positive summary score can be calculated by adding the totals of the positive items and the same with the negative items. A high positive summary score indicates a strong perception of positive interactions with the specific family member rated regarding the performance of diabetes-related behaviors. In contrast, a high negative summary score indicates a strong perception of negative interactions with the specific family members rated regarding the performance of diabetes-related behaviors. The positive items are 4, 6, 8, 11, 12, 13, 15, 16 and 18. The negative items are 5, 7, 9, 10, 14, 17, and 19.

The component scores can be calculated by adding all the positive items in each of the areas of interest (diet, exercise, glucose testing or medication) and then totaling and subtracting the ratings of the negative items in the respective area of interest. A high component score indicates a strong perception of positive interactions with the rated family members. For example, the diet scale has two positive items (4 and 15) and two negative items (9 and 19). If a person's

[372] Ibid.

responses on both positive items were "at least once a day," the total positive score is ten. If the responses for the negative items were "once a month" and "never," the total negative score is three. To calculate the diet score, three is subtracted from ten to get a score of seven. The maximum scores for each component are listed in Table 2.2.

Table 2.2 Maximum Component Scores for DFBC II

Diabetes Management Component	Maximum Attainable Score
Diet	8
Exercise	9
Blood Glucose Testing	3
Medication Taking	4

Glasgow et al. reported an internal consistency (Cronbach's alpha) of 0.71 for the positive summary score and 0.64 for the negative summary score in a sample of 127 adults with type 2 diabetes.[373] Pearson product moment correlations revealed a moderate degree of test-retest stability. The stability of the scores over a six-month period for the regimen-specific scores were moderate with correlations ranging from 0.55 to 0.76. The diet and exercise scales had

[373] Glasgow R.E. and Toobert D.J. Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.

good stability (r = 0.59 for diet and 0.76 for exercise). The glucose testing (r = 0.22) and medication taking (r = 0.05) were less stable. The component scores of family support were consistently stronger predictors of regimen adherence in the respective diabetes management area. For example, the items regarding family support for medication taking were more predictive of the individual's adherence to the medication regimen than either the overall positive or negative summary scores. The instrument has items which ask the participant to rate the family member as to how often they "praise you for following your diet," "suggest things that might help you take your diabetes medication on time," "nag you about testing your glucose level," and "criticize you for not exercising regularly." The response format was a five-point scale from one to five. (1 = never and 5 = at least once a day).

Calculating the component scores was the method selected for scoring the DFBC. This method was selected because the component scores of family support have been found to be consistently stronger predictors of regimen adherence in their respective area than the overall positive and negative summary scores.[374] The scores for the positive and negative items for each component were totaled. The total negative score for each component was subtracted from the

[374] Glasgow R.E. and Toobert D.J. Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.

total positive score for that component. Higher scores indicate a strong perception of positive interaction with the rated family member regarding performance of specific diabetes management tasks.

Non-Family Support

In addition to measuring perceived family support for diabetes, it is important to measure perceived non-family support as well. There were six items included in the instrument that asks about perceived support received from friends regarding their diabetes. These items were adapted from the Diabetes Care Profile (DCP).[375] The original question in the DCP is worded to include “family and friends.” The items were changed to include “friends” only. Examples of the items included in this section are “My friends accept me and my diabetes” and “My friends encourage or reassure me about my diabetes.” The response format was a Likert scale from 1 to 5, from *strongly disagree* to *strongly agree*. Fitzgerald et al. reported reliabilities in the range of 0.69 to 0.73 in a community sample of 440 individuals.[376] The sample consisted of participants with type 1 and type 2 diabetes on insulin and type 2 not using insulin.

[375] Fitzgerald J.T., Davis W.K., Connell C.M., et al. Development and validation of the Diabetes Care Profile. *Evaluation and the Health Professions* 19(2): 208-230, 1996.
[376] Ibid.

To score the items of non-family support, the reverse score for items b, d and f were used. Then the sum of the total scores was calculated and divided by the number of non-missing items. Higher scores indicate better-perceived support.

The scores on the two measures, diabetes-specific support from family and non-family support, cannot be combined to form a composite score because two different dimensions are being measured. A separate analysis was conducted for each measure—diabetes-specific support from family and non-family support. It is also not desirable to create another variable for the non-family support in the model, since the two items may be correlated.

Perceived Family Function

Family function was measured using the Family APGAR Scale.[377] The scale was developed as a tool to measure a family member's perception of five dimensions of family function.

[377] Smilkstein G. The Family APGAR: a proposal for a family function test and its se by physicians. *Journal of FamilyPractice* 6(6): 1231-1239, 1978.

Family APGAR

The Family APGAR is a brief questionnaire designed to test five areas of the family function.[378] The acronym APGAR refers to the following components:

Adaptability- Utilization of intra- and extra-familial resources;
Partnership- Sharing of decision making;
Growth- Emotional maturation through mutual support;
Affection- Caring or loving relationship; and
Resolve- Commitment to devote time to each other.

Scores on the Family APGAR measure satisfaction with family life and provide an overall view of family function. This instrument has been used in several studies examining family function and the relationship to glycemic control in adults with type 2 diabetes.[379, 380] This instrument can be used with either a three- or five-choice response format. For research purposes, it is recommended that the five-choice response format be used because this improves the instrument's reliability[381] (Cronbach's alpha increased from 0.80 to 0.86). Each question has five possible responses: "always" (4 points); "almost always"

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[378] Ibid

[379] Cardenas L., Vallbona C., Baker S., et al. Adult onset diabetes mellitus: glycemic control and family function. *American Journal of the Medical Sciences* 293(1): 28-33, 1987.

[380] Konen J.C., Summerson J.H. and Dignan M.B. Family function, stress, and locus of control: relationships to glycemia in adults with diabetes mellitus. *Archives of Family Medicine* 2(4): 393-402, 1993.

[381] Smilkstein G., Ashworth C. and Montano D. Validity and reliability of the Family APGAR as a test of family function. *Journal of Family Practice* 15(2): 303-311, 1982.

(3 points); "some of the time" (2 points); "hardly ever" (1 point); and "never" (0 points). The participants answer questions dealing with the level of satisfaction with each one of the above five aspects of family life as they apply to each member of the family. For example, the participants were asked if they are satisfied with the way their spouse talks over things with you...? Then they were asked to rate other family members such as daughter, son, etc… All of the scores obtained for each family member were added and averaged to arrive at a composite family score. The higher scores indicate a more functional family. The range of scores for the Family APGAR is 0 to 20.

The internal consistency for the tool with a five-choice response format has been reported to be 0.86 (Cronbach's alpha).[382] Validity has been addressed through known-group comparisons in which a community sample scored significantly higher than a psychiatric outpatient group. The instrument has been correlated with the Pless-Satterwhite (1973) measure of family function and with clinicians' rating of family function (r = 0.80 and 0.64, respectively).[383] The

[382] Smilkstein G. The family APGAR: a proposal for a family function test and its use by physicians. *Journal of Family Practice* 6(6): 1231-1239, 1978.

[383] Pless I. and Sattwewhite B. A measure of family functioning and its application. *Social Science and Medicine* 7(8): 613-621, 1973.

Family APGAR has been shown to successfully discriminate between normal families in clinical and non-clinical settings.[384]

Perceived Barriers to Diabetes Self-Care

Barriers to self-care were measured with the 31-item Barriers to Self-Care Scale developed by Glasgow and associates.[385] The scale measures the frequency of both environmental and cognitive factors that interfere with diabetes self-care. The scale assesses the barriers to glucose testing, regular exercise, healthy low-fat eating and diabetes medication taking. There are seven items per regimen area and three general barrier items, such as traveling and unexpected events. The scale has been validated on adults with type 2 diabetes. The internal consistency for the overall barriers score and regimen subscores are depicted in Table 2.3. [386, 387]

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[384] Smilkstein G. The family APGAR: a proposal for a family function test and its use by physicians. *Journal of Family Practice* 6(6): 1231-1239, 1978.

[385] Glasgow R.E. Social-environmental factors in diabetes: Barriers to diabetes self-care in *Handbook of Psychology and Diabetes.* Bradley C. editor, Chur, Switzerland, Harwood Academics, 335-349, 1994.

[386] Ibid.

[387] Glasgow R.E., Hampson S.E., Strycker L.A., et al. Personal model beliefs and social-environmental barriers related to diabetes self management. *Diabetes Care* 20(4): 556-561, 1997.

Table 2.3 Psychometric Properties of Barriers to Self-Care Scale

Score	Internal Consistency Cronbach's Alpha
Overall Score	(0.84 to 0.92)
Dietary Subscore	(0.55 to 0.92)
Exercise Subscore	(0.59 to 0.66)
Glucose Testing Subscore	(0.39 to 0.61)
Medication Subscore	(0.40 to 0.56)

The respondents were asked to rate how frequently they experience various barriers to self-care using a six-point frequency of occurrence scale from one (never) to six (daily). Some examples of items from the instrument include the following:

1. I am not at home when it is time to take my diabetes medication (oral medication or insulin).
2. I think about how much time it takes to test my glucose level.
3. I am around other people who are eating or drinking things I shouldn't.

The scale produces an overall barriers score and four subscales for barriers To the specific areas of diabetes management. Each of the subscale scores was used in their respective analysis. The four regimen-specific subscales were scored by averaging the responses across the relevant items. The dietary subscale consists of items 4, 6, 9, 15, 17, 27 and 31. The exercise subscale consists of items 3, 5, 7, 13, 16, 20 and 30. The glucose testing subscale consists of items 1, 10, 14, 19, 23, 24 and 29. The medication subscale consists of items 2, 8, 12, 18, 22, 25 and 28. Higher scores indicate a higher frequency of the barriers. Three general barrier items were not used in the analyses. These items included the following: "I am extremely busy; " "I have visitors staying with me;" and " I don't feel well."

Diabetes Knowledge

Knowledge of diabetes and its management was assessed with the 24-item Diabetes Knowledge Questionnaire (DKQ). The DKQ scale is a shortened version derived from the original 60-item DKQ instrument.[388] The instrument has items pertaining to diabetes self-management and its complications. The potential response choices for the DKQ are "Yes," "No" and "Don't Know." The original DKQ was developed for the average educational level for Starr County, which was sixth grade, and many of the items were written in simple language. The DKQ 24 item scale has a reported coefficient alpha of 0.78.[389]

[388] Garcia A., Villagomez E.T., Brown S.A., et al. The Starr County Diabetes Education Study: development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care* 24 (1): 16-21, 2001.
[389] Ibid.

Items were scored as correct or incorrect and the correct items were summed to obtain a total score. The scores range from 0 to 24. Higher scores indicate better knowledge of diabetes, its complications and treatment.

Self-Efficacy

Self-efficacy is the perceived ability to carry out a variety of self-management behaviors that control blood glucose levels.[390] Participants were asked to rate how confident they were in their ability to perform behaviors specific to the diabetes self-care activities. The self-efficacy scale was adapted from the Multidimensional Diabetes Questionnaire (MDQ) developed by Talbot and associates. [391] The internal consistency for the self-efficacy scale was reported to be 0.89.

The rating scales of self-efficacy instruments vary in the literature from five-, seven- and ten-point scales to 100-point scales. In the MDQ instrument, the participants are asked to rate from 0 (not at all confident) to 100 (very confident) in their ability to perform diabetes self-care behaviors. The items are phrased

[390] Baranowski, T., Perry C.L. and Parcel G.S. How individuals., environments, and health behavior interact: social cognitive theory, in *Health Behavior and Health Education: Theory, Research and Practice*. Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 164, 1997.

[391] Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the Multidimensional Diabetes Questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

"How confident are you in your ability to follow your diet?   …… test your blood sugar? …..exercise regularly?   The rating scale (0 to 100) may be difficult for the participants to understand. The wording of the items and the response scale were changed. A five-point Likert scale from "strongly agree" to "strongly disagree" was used. The wording of the questions was modified to:

> "I am confident in my ability to follow my diet."
> "I am confident in my ability to test my blood sugar at the recommended frequency."

Health Variables

<u>Duration of Diabetes</u>

Duration of diabetes was operationalized as the time since the individual has been diagnosed with diabetes. It is calculated by subtracting the year first diagnosed from the current year. Duration of diabetes was rounded to the nearest year.

<u>Comorbidities – Diabetes-Related</u>

The comorbidities related to diabetes included the microvascular and macrovascular disorders. Microvascular disorders included retinopathy, nephropathy, neuropathy, and foot problems. Macrovascular disorders included cardiovascular disease, cerebral vascular disease, and peripheral vascular disease.

Depression

The Patient Health Questionnaire (PHQ-9) is a brief new measure of depression severity.[392] The instrument consists of items related to the actual nine criteria upon which the diagnosis of DSM-IV depressive disorders is based. Major depression is diagnosed if five or more of the nine depressive symptom criteria have been present at least "more than half the days" in the past two weeks and one of the symptoms is depressed mood or anhedonia. Other depression is diagnosed if there are two to four depressive symptoms present at least "more than half the days" in the past two weeks and one of the symptoms is depressed mood or anhedonia.

As a severity measure, the PHQ-9 score can range from 0 to 27. Each of the nine items is scored from 0 (not at all) to 3 (nearly every day).

The level of depression severity and PHQ-9 scores are:

Minimal	1-4
Mild	5-9
Moderate	10-14
Moderately severe	15-19
Severe	20-27

A cut-off score of 15 or greater was used for the inclusion criteria.

[392] Kroenke K., Spitzer R.L. and Williams J.B. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16 (9): 606-613, 2001.

Sensitivity and Specificity

The sensitivity of the instrument ranges from 68 % to 95% depending on the depression score.[393] The higher the score, the less sensitive the instrument. The specificity ranges from 84% to 95% depending on the score. The higher the depression score, the higher the specificity. Table 2.4 shows the sensitivity, specificity and likelihood ratios based on the score.

Table 2.4 Sensitivity and Specificity of PHQ-9 Measure

PHQ-9 Score	Sensitivity %	Specificity %	Likelihood Ratio
≥9	95	84	6.0
≥10	88	88	7.1
≥11	83	89	7.8
≥12	83	92	10.2
≥13	78	93	11.1
≥14	73	94	12.0
≥15	68	95	13.6

The likelihood ratio means that a person with major depression is 6 times more likely than a person without major depression to have a PHQ-9 score of 9 or greater and 13.6 times more likely to have a score of 15 or greater.

[393] Kroenke K., Spitzer R.L. and Williams J.B. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16 (9): 606-613, 2001.

Glycemic Control (HbA1C)

HbA1C is affected by factors such as the effectiveness of the regimen and status of the disorder. The HbA1C value was taken from the day of the clinic visit at which the patient is recruited. If no HbA1C was done on the day the patient is recruited, the most recent HbA1C value was used (within a one year period from date of enrolling in study). Other studies have used the HbA1C value from the day the survey was administered to the patient, average of the last year of HbA1Cs, or the most current HbA1C value within a one-year period..[394, 395, 396] This variable was used to check the construct validity of the self-reported levels of diabetes self-care activities.

Cognitive Function

Clock drawing has been used as a screening tool for cognitive impairment in the elderly.[397] The clock drawing test (CDTs) is a rapid and cost-effective

[394] Fisher L., Chesla C.A., Skaf M.M., et al. The family and disease management in Hispanic and European-American Patients with type 2 diabetes. *Diabetes Care* 23(3): 267-272, 2000.

[395] Konen J.C., Summerson J.H., and Dignan M.B. Family function, stress, and locus of control. *Archives of Family Medicine* 2(4): 393-402, 1993.

[396] Trief P.M., Grant W., Elbert K., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

[397] Tuokko H. and Hadjistavropoulos T. *An assessment guide to geriatric neuropsychology.* Mahwah, N.J. Erlbaum Associates, 38-41, 1998.

method of screening for cognitive impairment.[398, 399] The CDTs have been found to discriminate healthy from demented elderly patients. [400] Although there are various administration methods for the clock drawing tasks, subjects are often presented with a predawn circle and asked to draw a clock face and place the hands on the clock. Most scoring procedures for clock drawing are based on the rank ordering of the severity of errors and there are various systems for classifying the errors. [401, 402, 403, 404] The CDTs have been found to correlate

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[398] Sunderland T., Hill J.L. and Mellow A.M., Clock drawing in Alzheimer's Disease: a novel measure of dementia severity. *Journal of the American Geriatric Society* 37(8): 725-729, 1989.

[399] Wolf-Klein G.P., Silverstone F.A., Levy A.P., et al. Screening for Alzheimer's disease by Clock Drawing. *Journal of the American Geriatric Society* 37(8): 730-734, 1989.

[400] Tuokko H., Hadjistavropoulos T., Miller J.A., et al. The clock test: a sensitive measure to differentiate normal elderly from those with Alzheimer's disease. *Journal of the American Geriatric Society* 40(6): 579-584, 1992.

[401] Huntzinger J.A., Rosse R.B., Schwartz B.L, et al. Clock drawing in the screening assessment of cognitive impairment in an ambulatory care setting: a preliminary report. *General Hospital Psychiatry* 14: 142-144, 1992.

[402] Sunderland T., Hill J.L., and Mellow A..M. Clock drawing in Alzheimer's Disease: a novel measure of dementia severity. *Journal of the American* Geriatric Society 37(8): 725-729, 1989.

[403] Watson Y.I., Arfken C.L. and Birge S.J. Clock completion: an objective screening test for dementia. *Journal of the American Geriatric Society* 41(11): 1235-1240, 1993.

[404] Mendez M.F., Ala T. and Underwood K.L. Development of scoring criteria for the clock drawing task in Alzheimer's Disease. *Journal of the American Geriatric Society* 40(11): 1095-1099, 1992.

significantly with traditional cognitive measures.[405, 406] Additionally, CDTs have not been found to be influenced significantly by cultural or language factors.[407]

The concept of "executive control" has the potential to greatly improve the CDT interpretation. Executive control functions (ECFs) are cognitive processes that coordinate simple ideas and actions into complex goal-directed behaviors.[408] Examples of ECFs include goal selection, motor planning and sequencing and the self-monitoring of one's current action plan. The CLOX is a brief measure of executive control function that is based on a clock-drawing task.[409] The CLOX is divided into two parts to help discriminate the executive control of clock drawing from clock drawing itself. CLOX 1 is an unprompted task that is sensitive to executive control. The participant is asked to draw a clock on the back of the form that says 1:45 and then is instructed to set the hands and numbers on the face

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[405] Ibid.

[406] Sunderland T., Hill J.L. and Mellow A.M. Clock drawing in Alzheimer's Disease: a novel measure of dementia severity. *Journal of the American* Geriatric Society 37(8): 725-729, 1989.

[407] Shulman K.I., Pushkar G.D., Cohen C.A., et al. Clock drawing and dementia in the community: a longitudinal study. *International Journal of Geriatric Psychiatry* 8: 487-496, 1993.

[408] Royall D.R., Mulroy A.R. and Chiodo L.K. Clock drawing is sensitive to executive control: a comparison of six methods. *Journal of Gerontology* 54B (5): 328-333, 1999.

[409] Royall D.R., Cordes J.A. and Polk M. CLOX: an executive clock drawing task. Journal of Neurology, Neurosurgery and Psychiatry 64: 588-594, 1998.

so a child could read them. The participant's performance is rated on a 15-point scale according to the CLOX directions. Lower scores indicate impairment. CLOX 2 rates the participant's performance in a copy condition and is less dependent on executive skills. The examiner allows the participant to observe him/her draw a clock in the circle provided on the scoring sheet. The examiner places the 12, 6, 3, and 9 first, makes the hands into arrows and sets the hands to "1:45". The participant is asked to copy the examiner's clock and this clock is scored as the "CLOX 2." Cut points of 10/15 (CLOX 1) and 12/15 (CLOX 2) represent the 5th percentile for young adult controls.

The participant must score above the cut points for both the CLOX 1 and CLOX 2 to be included in the study. Only the scores from the CLOX 1 were used in the analysis. Two examiners (researcher and research assistant) determined a consensus score for the clock-drawing test. Royall and associates found that the CLOX has been internally consistent (Cronbach's alpha = 0.82) and a high degree of between rater reliability was found (CLOX 1 r = 0.94, CLOX 2 r = 0.93).[410]

[410] Ibid.

Demographic Variables

The survey contained items to determine age, gender, ethnicity, education level, income level, and levels of acculturation. Age was calculated by subtracting the date of birth from the date of participating in the study. The categories for ethnicity were white (non-Hispanic), black, Hispanic, Native American, Asian or Pacific Islander; and *other*. Education level was assessed based on the number of years of schooling, if less than high school, and then based on the degree earned if greater than a high school education. Income level was assessed on total monthly family income before taxes. This information was used to compare this population to those in other studies and to the demographics of the diabetic population at the adult and geriatric primary care clinics used for this study.

Acculturation-Language Scale

The scale developed by Deyo and associates is a simple scale for quantifying English use among Mexican Americans.[411] The scale consists of four brief questions regarding language. Language has been found to be a very

[411] Deyo R.A., Diehl A.K., Hazuda H., et al A simple language-based acculturation scale for Mexican Americans: validation and application to health care research. *American Journal of Public Health* 75(1): 51-55, 1985.

important behavioral indicator of acculturation.[412] Acculturation scales that cover other domains are usually lengthy (about 20 items). The scale to be used in this study was a brief scale focusing on the language dimension of acculturation. The language scale appears to be reliable and valid. Scale scores were found to have significant associations with major demographic characteristics which were considered to be correlated with acculturation.[413] Each patient was given a total score by assigning one point for each response favoring English and 0 points for each response favoring Spanish. The patient has a score ranging from 0 to 4, with higher scores reflecting higher levels of acculturation.

DEPENDENT VARIABLES

Diabetes Self-Care Behaviors

The Summary of Diabetes Self-Care Activities (SDSCA) questionnaire is a self-report measure of the frequency of completing different regimen activities over the preceding seven days.[414] The instrument was developed to provide a

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[412] Olmedo G.M. and Padilla A.M. Empirical and construct validation of a measure of acculturation for Mexican Americans. *Journal of Social Psychology 105*: 179-187, 1978.

[413] Deyo R.A., Diehl A.K., Hazuda H., et al A simple language-based acculturation scale for Mexican Americans: validation and application to health care research. *American Journal of Public Health* 75(1): 51-55, 1985.

[414] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

brief measure of self-care for several different regimen areas (diet, exercise, and blood glucose monitoring) that would be practical for use in most clinical or research settings. The rationale for using a seven-day recall period is that self-care behaviors are expected to vary over time, and one wants a stable estimate. Therefore, asking participants to recall details over a longer period of time may result in increased inaccuracies.[415]

The Use of Self-Reports

Patient self-report is a very practical and cost-effective method to self-care assessment; however, it is often seen as unreliable.[416] Other methods of self-care assessment include direct observations of skills such as blood glucose testing and monitoring. Pill counts and activity monitors are other direct methods that are labor intensive and subject to reactivity.[417] Patients' self-reports can be subject to

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[415] Toobert D.J. and Glasgow R.E. Assessing diabetes self-management: the summary of diabetes self-care activities questionnairein *Handbook of Psychology and Diabetes*, Bradley C. editor, Chur, Switzerland, Harwood Academic, 351-375, 1994.

[416] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[417] Johnson S.B. Methodological issues in diabetes research. *Diabetes Care* 15(11): 1658-1667, 1992.

social desirability bias but can be made more reliable by asking specific, nonjudgmental questions in the interview or survey.[418]

The SDSCA is probably the most widely used self-report instrument for measuring diabetes self-management in adults. It has been used in almost 4,000 adults including a survey of more than 2,000 diabetics across the United States.[419] The subscales of the SDSCA instrument have a small number of significant correlations among the subscales and the participants' characteristics, such as insulin status, gender, number of comorbid conditions and duration of diabetes. This demonstrates that SDSCA can be generalized to different diabetes subpopulations.

The revised SDSCA scales consist of a core set of 11 items that have been used in previous studies and has an expanded list of 14 additional items. The revised version differs from the original SDSCA in that it consists of the best items and the scoring is simplified. The revised version has items assessing foot care and smoking status. These items were not included in this study and were not assessed. Although foot care is an important aspect of the diabetes regimen,

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[418] Freund A., Johnson S.B., Silverstein J., et al. Assessing daily management of childhood diabetes using 24-hour recall interviews: reliability and stability. *Health Psychology* 10(3): 200-208, 1991.

[419] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self management: self-reported recommendations and patterns in a large population. *Diabetes Care* 20(4): 568-576, 1997.

the study was limited to the other four regimen areas because of the time constraints. Cigarette smoking was not assessed because it is not usually considered a part of the diabetes regimen. However, it does increase the risk of cardiovascular disease among persons with diabetes.[420]

The revised version does not include items on medication taking because of the strong ceiling effects and a lack of variability among the respondents. Overall, the SDSCA has adequate internal and test-retest reliability and evidence of validity. Toobert and associates reviewed the reliability and validity and normative data from seven different studies using the SDSCA measure.[421] The test-retest correlations were moderate (mean = 0.40). The internal consistency of the scales was assessed by the average inter-item correlations and was found to be acceptable (mean = 0.47). The validity estimates for the diet and exercise scale were based on multiple methods of self-report such as food records and self-monitoring. A brief description of the items in each of the different regimen areas is provided below.

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[420] Haire-Joshu D., Glasgow R.E., and Tibbs T.J. Smoking and diabetes. *Diabetes Care* 22: 1887-1898, 1999.

[421] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

Diet

To obtain an accurate assessment of eating patterns, it is necessary to measure the components of diet separately. The diet subscale consists of *general* and *specific* diet items. There are two general items that ask how many of the last seven days has the individual followed a healthful eating plan as well as their own eating plan. There are three *specific* diet items that ask about eating fruits and vegetables, high fat foods, and spacing carbohydrates evenly through the day.

Exercise

The instrument has two questions which assess the level of exercise over the last seven days. There is a question which asks about how many of the last seven days the individual participated in at least 30 minutes of physical activity. The second question asks about how many of the last seven days did the individual participate in a specific exercise session.

Blood Sugar Testing

There are two questions which assess the level of blood sugar testing. One question asks about how many of the last seven days did the individual test his/her blood sugar. The other question asks about how many of the last seven days did the individual test his/her blood sugar the number of times recommended by the health care provider.

Medication Taking

In the SDSCA, there are two items that assess the level of diabetes medication taking behavior. The authors recommend NOT using the medication scales due to high ceiling effects and low variability among the patients. Medication taking behavior measures were developed for this study.

The medication taking behavior items were adapted from the Brief Medication Questionnaire (BMQ).[422] The items in the BMQ pertain to *all* medications and the questions ask about how each of the medications was taken in the past week. In the BMQ, there are two items that ask about the drug efficacy and its bothersome effects. The items were changed to include only diabetes medications (oral and insulin). The first item of the scale asks the patient to list his/her diabetes medication(s) and the directions on how they were instructed to take the medication(s). For each medication listed, three questions were asked about the medication taking behavior over the past seven days. The questions included the following: 1.) "How many times did you miss a dose because you forgot or purposely did not take?" 2.) "How many times did you add an extra dose?" and 3.) "How many times did you reduce or cut down the dose?"

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[422] Svarstad B.L, Chewning B.A., Sleath B.L. et al. The brief medication questionnaire: a tool for screening patient adherence and barriers to adherence. *Patient Education and Counseling* 37(2): 113-124, 1999.

It is noted that some patients have been advised to adjust their insulin dose accordingly and some of the questions may not apply. For example, the questions regarding “an extra dose taken” or “reducing the dose” may not apply. In these cases, these patients were not scored as non-compliant.

Scoring of Medication Taking Behavior

The level of medication taking behavior was measured by calculating the compliance rate. Noncompliance is defined as not taking the drug as directed or prescribed. It includes omission of a scheduled dose, taking extra doses, or reducing the dose.

Compliance Rate

A compliance rate for each participant was calculated as follows:

$$\frac{\text{Total \# of doses during the past 7 days that medication(s) were taken as prescribed}}{\text{Total \# of doses that were prescribed during past 7 days}} \times 100\%$$

The total number of doses includes all the diabetes medications that the patient was prescribed. For example, if the patient was prescribed one tablet orally daily and insulin injections twice per day, the total number of doses prescribed during the past 7 days is 21 doses. If the patient skipped 2 insulin injections during the past 7 days and took the oral medication as directed, the total number of doses during the past 7 days that medications were taken as prescribed (numerator) is

19. The medication compliance rate is 90 percent. There are four items which relate to medication taking behavior.

Scoring of SDSCA

Scores were calculated for each of the three regimen areas–– diet, exercise, and blood-glucose testing. The number of days per week on a scale from 0 to 7 was used. A detailed description of the scoring is provided below.

Diet

The score for the *diet subscale* consists of two scores –– one for the *general* diet scale and the other for the *specific* diet scale. For the *general* diet scale, the mean number of days for items 1 and 2 was used. For the *specific* diet scale, the mean number of days for items 3, 4 and 5 was used. For the item on high fat (item 4) reverse scoring was used (0 = 7, 1 = 6, 2 = 5, 3 = 4, 5 = 3, 6 = 2, and 7 = 1).

Exercise

The mean number of days for the two items (6 and 7) was used.

Blood Glucose Monitoring

The mean number of days for the two items (8 and 12) was used.

Summary Characteristics of Instruments and Scales

Table 2.5 provides a description of characteristics of the instruments and the scales used in developing the instrument. The table includes the reported internal consistency or other psychometric properties, scoring range and interpretation of the scores.

Table 2.5 Summary Characteristics of Instruments and Scales

Instruments and Subscales	Internal Consistency (Cronbach's Alpha)	Scoring Range	Interpretation
Diabetes Family Support Behavior Checklist DFBC II (20 items)	Positive Summary (0.71) Negative Summary (0.64)	Maximum Component Scores: Diet (8) Exercise (9) Glucose Testing (3) Medication (4)	Maximum attainable score dependent on each component High score indicates strong perception of positive interactions.
Non-Family Support Scale Adapted from DCP instrument (6 items)*	(0.69-0.73) for original DCP scale	Likert Scale 5 response choice Strongly Disagree to Strongly Agree	Higher scores indicate better perceived non family support
Family APGAR (5 items)	0.86	0 to 20 (five-choice format) 0 to10 (3 choice format)	Higher scores indicate higher functional family Highly functional 8-10 Moderately dysfunctional 5-7 Severely dysfunctional 0-4
Barriers to Self-Care (31 items)	See Table 2.3	1 to 7	Higher scores indicate greater frequency of barriers

*Indicates scale has been changed

Table 2.5 Summary Characteristics of Instruments (Continued)

Instruments and Subscales	Internal Consistency (Cronbach's Alpha)	Scoring Range	Interpretation
Diabetes Knowledge Questionnaire (24 items)	0.78	0 to 24	Higher scores indicate greater diabetes-related knowledge
Self- Efficacy- Scale Adapted from MDQ instrument (7 items)	(0.89) for total scale	Likert Scale 5 response choice Strongly Disagree to Strongly Agree	Higher scores indicate higher levels of self-efficacy
Summary of Diabetes Self-Care Activities Diet (5 items) Exercise (2) Blood glucose Testing (2) Medication Taking Behavior (4 items for each medication)	Internal consistency of 11 core items = average inter item correlation mean = 0.47 * Developed by researchers	Mean number of days of past SEVEN days followed recommendations Compliance rate based on total number of doses taken as prescribed over 7 day period	Number of days followed self-care behavior recommendations Higher numbers indicate more likely to take medication as recommended.
CLOX- Clock drawing test	0.82	0 to 15	Cut points of 10/15 (CLOX 1) and 12/15 (CLOX 2) represent the 5th percentile for young adult controls.

Table 2.5 Summary Characteristics of Instruments (Continued)

Instruments and Subscales	Internal Consistency (Cronbach's Alpha)	Scoring Range	Interpretation
Patient Health Questionnaire PHQ-9	0.86-0.89	0 to 27	Higher scores indicate greater severity of Depression >= 15 severe depression
Acculturation (4 items)	Guttman coefficient of reproducibility: 0.97 scalability: 0.89-0.90	0 to 4	Higher score indicates greater language acculturation

* Internal consistency of revised scale is not available yet.

PROCEDURES

The researcher or trained bilingual interviewer briefly explained the purpose of the study to patients during their clinic visit and screened for eligibility for the study. These patients were approached in the reception area of the clinic, where they were waiting to be escorted to the exam room for their visit. Those who met the inclusion criteria were given more information (introductory letter) about the purpose of the study and were asked to participate in the study. All interested patients were asked to sign an informed consent form. If the patients agreed to participate in the study, the survey was administered by the researcher or trained interviewer in the language of the participant's preference (English or Spanish). The survey was administered while the participant was in the clinic or arrangements were made for another time. The "Basics of Proper Interviewing" from Salant and Dillman was used to train all interviewers.[423] In addition, changes were made to the instructions for the various measures to accommodate the interview method of administration. For example, in the Diabetes Family Behavior Checklist, the instructions stated to "just put down what happens." The instructions were changed to "just let me know what happens."

The participant's clinical record was used to confirm certain eligibility criteria (i.e., age, diagnosis of type 2 diabetes greater than one year; starting insulin therapy, and major psychiatric problems). The participants were assured of the confidentiality of their responses. The patients were told that participation is completely voluntary and refusal to participate would not have any effect on the treatment received from the clinic or the physician. As mentioned previously, each participant was given a book on diabetes (either in English or Spanish) as a token of appreciation for participating in the study.

[423] Salant P. and Dillman D. *How To Conduct Your Own Survey*, New York, John Wiley and Sons, Inc., 137-174, 1994.

Because there were different response formats used in the survey, the response formats for the Likert scale items were placed on a laminated sheet and were shown to the participants. Only the responses for the Likert scale items were placed on the laminated sheets, because the response choices varied on these items and it may be difficult to remember what the response choices are on the five or seven-point scales. The participants were reminded that they can select any number on the scale. Copies of the laminated response formats in English and Spanish are included in Appendix E. The original font size for the laminated response format was 24-point font, which is smaller than the examples in the appendix.

PILOT TEST

The instrument was pilot tested on a small sample of older diabetic patients (approximately 12 individuals) similar to the sample population. The instrument was pretested to determine if there were any major problems with the instrument such as the wording of the questions and instructions. Using Cronbach's alpha, the reliability of the scales in the survey were tested after the pilot test. Changes were not made based on the results of the reliability scales.

ADDENDUM TO METHODOLOGY

Revisions were made to the instrument after the protocol was submitted for IRB approval. Changes were made to two measures in the instrument- the screens for depression and cognitive impairment. The Short Depression Screen (SDS)[424] was replaced with the Patient Health Questionnaire (PHQ-9)[425]. The PHQ-9 is a recently modified brief instrument that may be a more reliable and sensitive screen for depression in older adults than the Short Depression Screen (SDS).

The other revision made was to the cognitive measure. The Departmental Review Committee recommended not using a subsection of the Mini Mental State Exam[426] but to use another screen for cognitive impairment such as the clock-drawing task. A description of both instruments has been provided in this chapter under the description of the measures.

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[424] Burnam M.A., Wells KB., Leake B., et al. Development of a brief screening instrument for detecting depressive disorders. *Medical Care* 26(8): 775-789, 1988.

[425] Kroenke K., Spitzer R.L. and Williams J.B. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16 (9): 606-613, 2001.

[426] Folstein M.F., Folstein S.E. and McHugh P.R. "Mini Mental State" A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 12(3): 189-198, 1975.

In chapter 1, it was proposed that data on all four self-care areas would be collected; however, only two self-care behaviors (medication taking and diet) would be presented in this dissertation. There was a ceiling effect with the medication taking behavior and the path analysis of this self-care behavior was not possible. This is discussed in more detail in the results chapter. The diet and exercise models were presented in the dissertation.

DATA ANALYSIS

This section describes the statistical analysis of the sample data. All computer data analyses were conducted using SPSS version 10.0 and AMOS version 4.0.[427, 428] An alpha level of 0.05 was used for all statistical significance tests. Data analysis included the following:

1. Appropriate descriptive statistics such as frequency distributions, means and standard deviation for selected variables in order to provide a description of the sample data;

2. Preliminary analysis of co-linearity among predictor variables to determine if variables are intercorrelated;

3. Analysis of variables to determine if they have normal distributions and constant error variances (homoscedasticity);

4. Reliability analysis on all scales; and

5. Tests of the model using path analysis.

The following section provides a brief description of path analysis.

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[427] SPSS Version 10, SPSS Inc, Chicago, Illinois, 1999.
[428] Analysis of Moment Structure (AMOS 4.0), SPSS Inc, Chicago, Illinois, 1995.

PATH ANALYSIS

Description

Path analysis is a method for studying patterns of causation among a set of variables.[429] Sewall Wright developed path analysis as a method for studying the direct and indirect effects of variables hypothesized as causes of variables treated as effects.[430] Path analysis is not a method for discovering causes but a method applied to a causal model formulated by the researcher on the basis of knowledge and theoretical considerations. The path diagram is useful for displaying graphically the pattern of causal relations among a set of variables. Path diagrams depict theorized, directional relationships among a set of variables. Path analysis is an analysis of the paths or lines in a model that represent the influence of one variable on another.

In this study, hypotheses were driven by the paths based on the Social Cognitive Theory and the findings from the literature. Path analysis was used to evaluate the relationships between the variables in the derived model. The use of path analysis allowed an evaluation of how the variables in the model behave to predict diabetes self-care behaviors. The independent variables have both direct

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[429] Asher H.B. *Causal Modeling,* Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8 -9, 1983.

[430] Pedhazur E.J. *Multiple Regression in Behavioral Research.* New York, CBS College Publishing, 577-635, 1982.

and indirect effects.[431] By examining the paths, path analysis provides information about the consistency between the data and a theorized path model. If the data does not fit the theorized model, this suggests that the model may warrant revision. Yet, if the data does fit the model, such data only indicates that the model was not disconfirmed.

Exogenous and Endogenous Variables

In the causal model, a distinction is made between *exogenous* and *endogenous* variables.[432] An *exogenous* variable is a variable whose variability is assumed to be determined by causes outside the causal model. An e*ndogenous* variable (dependent variable) is one that is being influenced by other variables in the model. The factors influencing the *exogenous* variable are not under consideration in the model. There will be no attempt made to explain the variability of an *exogenous* variable or its relations with other exogenous variables. On the other hand, the *endogenous* variable is one whose variation is explained by the *exogenous* or *endogenous* variables in the system. In path analysis, regression analysis is conducted for every *endogenous* variable in the model. The correlation between the *exogenous* variables is depicted by a curved

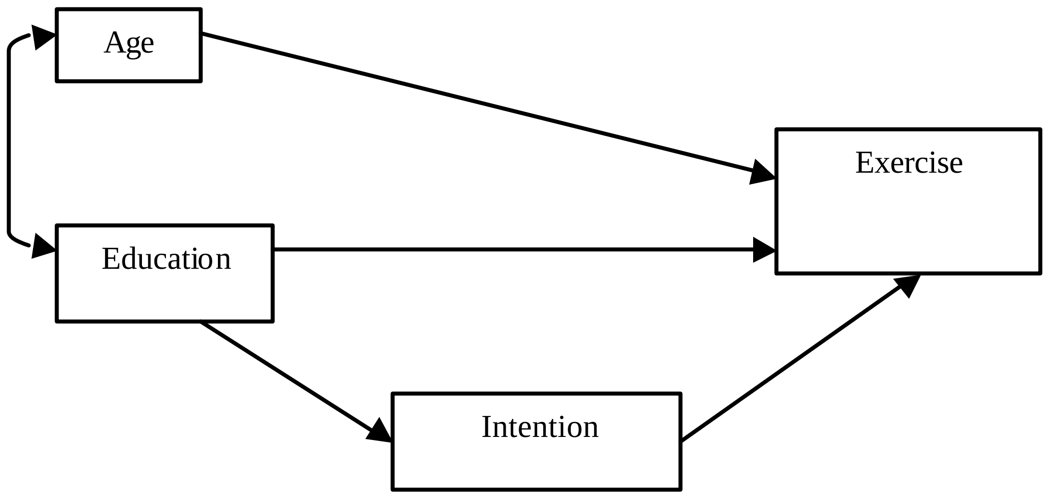
[431] Norris A.E. Path Analysis in Statistical *Methods for Health Care Research*, Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

[432] Pedhazur E.J. *Multiple Regression in Behavioral Research.* New York, CBS College Publishing, 577-635, 1982.

line with arrowheads at both ends. This indicates that there is no conception that one variable is the cause of the other.

To provide an example of the types of variables in path analysis, Figure 2.1 depicts a model of the effect of education on exercise. In this example, the exogenous variables are age and education. These variables are diagrammed as being independent of any influence by other variables in the model. The curved line between age and education depicts the correlations between the two variables. The endogenous variables are intention and exercise. Intention and exercise are being influenced by other variables in the model. Exercise is influenced by age, education and intention. Intention is influenced by education. In this path model, two regression analyses are needed. In one analysis, exercise is the dependent variable and the independent variables are age, education and intention. In the second analysis, intention is the dependent variable with education as the predictor variable.

Figure 2.1 Model of Education and Exercise



Advantages of Path Analysis

Path analysis is used to examine the relationships between a set of independent variables and a dependent variable. Path analysis is based on simple regression techniques, but by looking at these relationships, it takes the researcher a step beyond the traditional regression analysis. [433] It goes beyond testing whether a set of independent variable predicts a phenomenon to examining the relationships among the variables. It is argued that path analysis provides a richer

[433] Norris A.E. Path Analysis in *Statistical Methods for Health Care Research.* Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

understanding of the phenomena.[434] One of the advantages of path analysis is that it enables one to measure the direct and indirect effects one variable has on another. [435] Path analysis also allows one to decompose the correlation between any two variables into a sum of simple and compound paths where some of these compound paths represent substantive meaningful indirect effects and others perhaps not. The total association is the direct effect plus the indirect effect. Another advantage is that one can compare the magnitude of the direct and indirect effect and provide support for the theorized causal mechanisms.

Type of Data Needed

Path analysis requires the same type of data as linear multiple regression. The dependent variable is continuous and normally distributed.[436]

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[434] Asher H.B. *Causal Modeling,* Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8-9, 1983.
[435] Ibid.
[436] Norris A.E. Path Analysis in Statistical *Methods for Health Care Research.* Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

Theoretical Assumptions

1. There must be an observed and measurable relationship between X and Y. X and Y must be correlated.

2. X should precede Y in time.

3. X and Y should have a non-spurious relationship. (This means the relationship between X and Y will not disappear when the effects of other variables are controlled for. [437])

Statistical Assumptions

The statistical assumptions are the same as in multiple regression and include normal distribution, homoscedasticity and linear relationships.[438]

Additional unique assumptions are as follows:

1. When two independent variables are correlated with one another and diagrammed as having no other variables influencing them – their relationship cannot be analyzed. The magnitude of this relationship is represented by correlation coefficient.

2. The flow of causation is unidirectional.

3. Variables are measured on an interval scale. Asher argues that this assumption can be relaxed with ordinal variables.[439]

4. The exogenous variables are measured without error.[440]

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[437] Ibid.

[438] Norris A.E. Path Analysis in *Statistical Methods for Health Care Research.* Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

[439] Asher H.B. *Causal Modeling,* Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8-9, 1983.

[440] Kline R. Data Preparation and Screening in *Principles and Practice of Structural Equation Modeling,* New York, Guilford Press, 67-91, 1998.

Method of Path Analysis

Path analysis is an application of regression and correlation that uses standardized variables. The residual is expressed as a standardized variable, thus allowing it to be compared more easily to the regressors.[441] In path analysis, multiple regression is used over and over again to estimate a whole system of interrelated variables. For organizing the calculations, a model is drawn with the regression coefficients shown as arrows.

In path analysis, straight, one-headed arrows indicate a presumed causal relationship between two variables.[442] Cause in path analysis is defined as the assumption that a change in the source variable (the variable from which an arrow begins) will cause a change in another variable (usually the dependent variable, the variable to which the arrow flows or terminates) with all other variables held constant. An indirect effect is represented when there is no direct arrow from one variable to another variable, but arrows go through other variables before they terminate at the dependent variable. In addition to direct and indirect paths, there is a residual variable path associated with each dependent variable. The residual

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[441] Wonnacott T.H. and Wonnacott R.J. *Regression: A Second Course in Statistics.* Malabar, Florida, Krieger Publishing Company, 194-204, 1986.

[442] Norris A.E. Path Analysis in Statistical *Methods for Health Care Research.* Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

path represents unmeasured, unexplained variance in the independent variable (or source variables). It is assumed that residual variables are uncorrelated with other residuals and the independent variables.

Path Solutions

Each arrow in a path diagram represents a path to be solved and each path is the sum of the product of the correlations between the variables attached by the arrows (also known as compound paths). The solution to each path is the path coefficient. Path coefficients may be solved by either correlation matrices or by ordinary least squares regression. The proposed study used ordinary least squares regression to solve for the path coefficients.

Path coefficients (P ei) represent the magnitude of the influence of one variable on another in a path model. The subscripts used in the notation for path coefficients are ordered such that the letter or abbreviation representing the variable being influenced is always listed first and the one for the variable doing the influencing is listed second. Standardized beta regression coefficients are usually used which allows for comparison of the magnitude of one path in the model with other paths. One can determine which independent variable has the greatest direct effect on the dependent variable.[443]

There will be as many regression equations as there are endogenous (dependent) variables specified in the model. After the path coefficients have been solved, there may be some insignificant path coefficients. In order to specify the output model (i.e., the model with all paths solved), the insignificant paths were dropped if the standardized coefficients fell below a set a priori limit, as has been done by other researchers.[444] For the proposed research, the alpha level = 0.05.

Direct and Indirect Effects

One important advantage of path analysis over traditional regression analysis is that it allows one to determine the direct effect and indirect effects of an independent variable.[445] Knowing the total effect of an independent variable allows one to decide which independent variables may be targeted in an

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[443] Asher H.B. *Causal Modeling*, Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8-9, 1983.

[444] Norris A.E. Path Analysis in Statistical *Methods for Health Care Research.* Munro B.H. editor, Philadelphia, Lippincott Williams and Wilkins, 355-377, 2001.

[445] Asher H.B. *Causal Modeling*, Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8-9, 1983.

intervention. The total effect or total correlation is the sum of the direct effects, indirect effects and the joint effect or spuriousness.[446] The total effect of a variable is the zero-order correlation coefficient between the variable and a dependent variable. The value for the direct effect is the path coefficient illustrating the effect of one variable directly on a dependent variable. The value of the indirect effect is the product of the path coefficients of the variables involved. Joint effect or spuriousness (false effect) is caused by the correlation among the exogenous or endogenous variable, or both and is not accounted for in the model. To calculate the joint effect, sum of the values for the direct and indirect effects is subtracted from the value for the total effect.

[446] Pedhazur E.J. *Multiple Regression in Behavioral Research.* New York, CBS College Publishing, 577-635, 1982.

Path Model

The path model is a recursive model in which each of the single headed arrows represents hypothesized relationships between exogenous and endogenous variables or between endogenous variables. Figures 2.2 and 2.3 depict the path models for family environment and other social cognitive variables on diet and exercise self-care, respectively. Data was collected for all four diabetes self-care behaviors but only the diet and exercise model is presented in this dissertation. The rationale for doing so is discussed in the following chapter. The relationships between the exogenous variables in the model are depicted by double-headed curved arrows.

In the *diet* model, the exogenous variables are the following:

Z_1 = Gender

Z_2 = Duration of diabetes

Z_3 = Diabetes-related comorbidities

Z_4 = Acculturation

Z_5 = Cognitive function

Z_6 = Self-efficacy

The endogenous variables in their standardized forms are:

Z_7= Family diabetes support

Z_8 = Family function

Z_9 = Barriers to self-care

Z_{10} =Knowledge

Z_{11} = Diet self-care

The participant's gender is included in the model as a dummy coded variable. Gender was coded as female =1 and male =0.

In the *exercise* model, the exogenous variables are the following:

Z_1 = Gender

Z_2 = Duration of diabetes

Z_3 = Diabetes-related comorbidities

Z_4 = Acculturation

Z_5 = Cognitive function

The endogenous variables in their standardized forms are:

Z_6 = Self-efficacy

Z_7= Family diabetes support

Z_8 = Family function

Z_9 = Barriers to self-care

Z_{10} =Knowledge

Z_{11} = Exercise self-care

Figure 2.2 Path Model of Family Environment, Other Social Cognitive Variables and Dietary Behavior

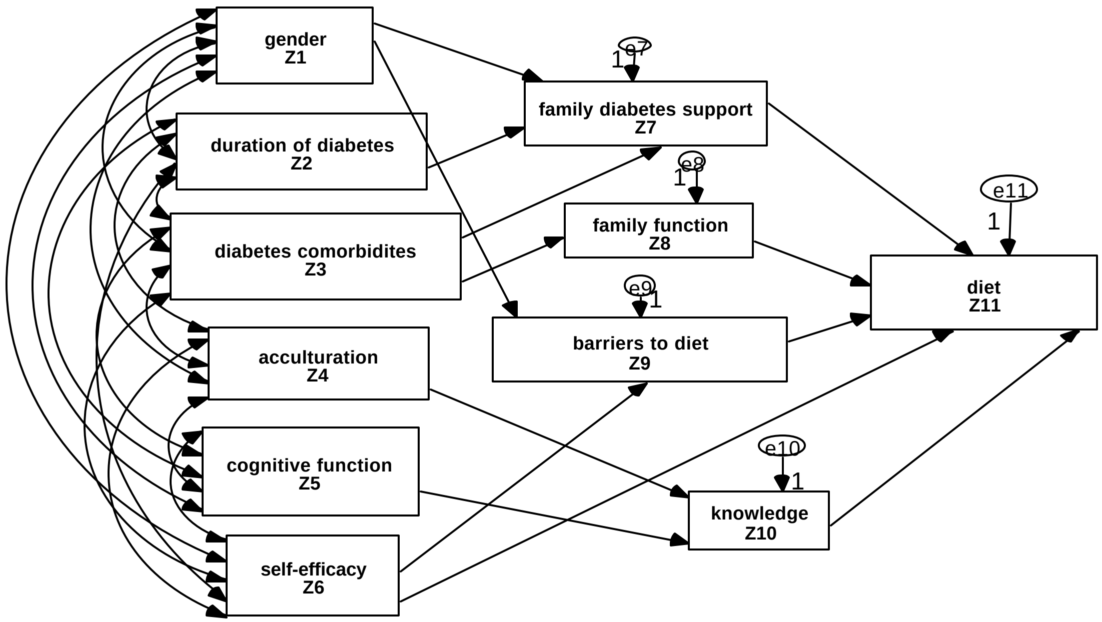
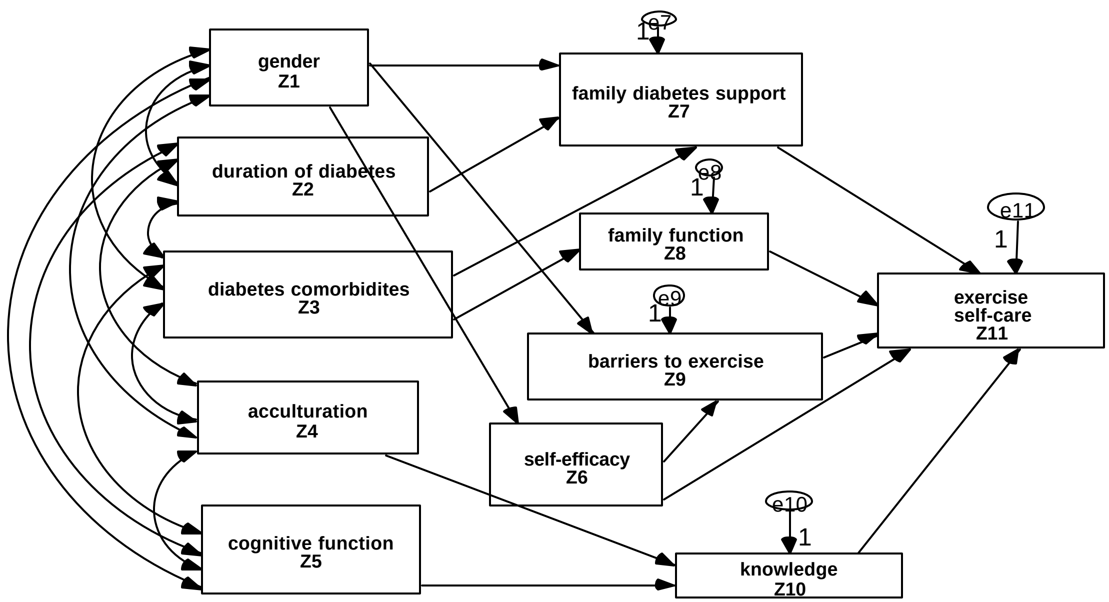


Figure 2.3 Path Model of Family Environment, Other Social Cognitive Variables and Exercise Behavior



The standardized regression equation is written as:

$$Z_0 = P_{01} Z_1 + P_{02} Z_2 + \ldots\ldots + P_{0k} Z_k + P_{0e}\, e$$

where Z_i are the standardized regressors, *e* is the standardized residual and Z_0 is the standardized response. The coefficients P_{0i} are called path coefficients.

The standardized forms of the five structural equations that describe the *diet* model are as follows:

e= disturbance error or residual term

The standardized regressor variables are defined on the previous pages.

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

In the model, the path coefficient $P_{10\,9}$ is the standardized partial regression coefficient for the relationship between knowledge (Z_{10}) and perceived barriers to self-care (Z_9). The model is recursive; therefore, ordinary least squares procedures can be used to calculate standardized partial regression coefficients (path coefficients) for each of the independent variables.

The standardized forms of the six structural equations that described the *exercise* model are listed below.

$$Z_6 = P_6 Z_1 + e_6$$

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

Summary of Processes in Path Analysis

In summary, the steps taken for the proposed path analysis included the following:

1. Created a table of correlations among variables in the regression; These coefficients describe the relationship between each of the variables when the effects of the other variables are not controlled.

2. Identified the regression analyses needed to calculate path coefficients and test the paths in the model; Usually the number of endogenous variables indicates the number of regression analyses needed.

3. Ran the regression analysis and determined the path coefficients – used betas or standardized coefficients for the diagram;

4. Deleted insignificant paths, modified the model, and repeated the regression analysis; and

5. Calculated the direct, indirect, and joint effect or spuriousness of the independent variables.

LIMITATIONS OF PATH ANALYSIS

Some of the limitations of the data analysis include the following:

1. there may be confounding variables that were not included in the model;
2. reliability of the measures; and
3. cross sectional data.

First, it is important to consider if any of the relationships in the model may be spurious. Are there any potential confounding variables that should have been included? The second limitation is that errors may exist in the measurement of the variables. The measurement error is assumed to be zero. Another limitation of path analysis is that it does not allow one to evaluate the correctness of the direction because the data is cross sectional.

MISSING DATA

Individual cases that contain missing data points that are pertinent to the various statistical analyses used in the study were dropped from the respective analyses.

CHAPTER 3

RESULTS

INTRODUCTION

The presentation of the study results is divided into six major sections: discussion of the pilot study and revisions made to the study based on the pilot study, response rate, descriptive statistics of the sample data, regression analyses of two path models (diet and exercise), tests of the hypotheses, and tests of model fit using a modeling program, Analysis of Moment Structures (AMOS 4.0).[447] In the methodology, it was proposed that the results of the medication and the diet models be presented in this dissertation. However, due to the ceiling effects of the participants reporting compliance to their diabetes medication regimen, the analysis of medication adherence will not be presented. There is more discussion of the medication model later in this chapter. Two models are presented in this dissertation– the diet and exercise models.

[447] Analysis of Moment Structure (AMOS 4.0), SPSS Inc, Chicago, Illinois, 1995.

PILOT STUDY

The pilot sample consisted of 12 patients with type 2 diabetes who were receiving care from the University Health System – Downtown clinic during the period from February 15, 2002 to March 1, 2002. A total of 14 patients were approached to participate in the pilot study; however, two patients declined. The reasons given were “do not have the time” and “do not feel like participating.” The objectives of the pilot study were to make sure the wording of the items was clear and there were not any problems with administration of the survey in the clinic.

Demographics

The mean age of the pilot sample was 64.92 years (S.D. = 7.32). Of the 12 participants in the pilot study, eleven were Hispanic (91.7%) and eight were female (66.7%). A total of 58.3% of the sample was married (n=7) and 50% lived with their spouse or significant other. Fifty percent of the sample obtained a high school education or equivalent and 72.7% (n=8) of the sample reported a family income of under $1500 per month.

The mean number of diabetes-related comorbidities was 2.0 (S.D. = 1.7) and the mean duration of diabetes was 16.6 years (S.D. = 13.1). The mean HbA1C was 7.45% (S.D. = 1.44). The HbA1C values were the most current values found in the participant's medical record and were within the twelve months preceding the interview.

Family Support

Diabetes Family Behavior Checklist II

Exercise and Self-Monitoring of Blood Glucose Items

In the pilot study, several participants stated that some items in the Diabetes Family Behavior Checklist II did not apply to them. For example, one item asks about how often the family member criticizes them for not recording the results of their glucose tests. This item may not apply in cases where the participants do not self-monitor their blood sugar because they were not able to obtain a glucometer and/or the supplies for testing. The family member did not criticize them because they were aware they were not testing their blood sugars.

Another example is the question that asks how often the family member exercises with the individual. If the family member is not able to exercise due to physical limitations, a "not applicable" response may be more appropriate than a "never."

Revisions to Study

Based on the results of the pilot study, revisions were made to three areas of the study. Revisions were made to the recruitment process, the inclusion criteria and the instrument. These revisions were submitted and approved by the Departmental Review Committee and both Institutional Review Boards.

Recruitment of Participants

It was originally proposed that the researcher or Spanish-speaking trained interviewer would explain the purpose of the study to patients while they were waiting in the reception area of the clinic. At this time, the researcher or trained interviewer would screen patients for eligibility. In the study, the nursing staff assisted with the screening of the patients. While the nursing staff obtained the patient's vital signs, they would screen for type 2 diabetes and the age criteria. If the patient met these two criteria, the researcher would further screen the patient. The assistance of the nursing staff enabled the recruitment process to be more efficient.

Inclusion Criteria-Cognitive Function Screen

The CLOX (clock drawing) instrument was used to screen for cognitive impairment and to insure the accurate recall. The scores on the CLOX were used for the inclusion criteria for the study. In the pilot study, approximately half the participants (45.5%) did not score high enough on the CLOX to meet the inclusion criteria. However, the participants were able to answer items on the survey in a consistent manner and did not have any history of cognitive impairment in their clinical records. It appears that the CLOX instrument is sensitive to higher order executive cognitive functioning and may not be an appropriate instrument for accurate recall. The CLOX scores were not used for the inclusion criteria in the study. However, the CLOX was still administered but the medical history obtained from the clinical chart was used to check for conditions such as dementia and Alzheimer's.

Instrument

Revisions were made to improve the flow of the instrument and to improve the clarity of the items. Revisions included the following:

a. The section of the Diabetes Self-Care Activities that ask about recommendations from the health care provider on diet, exercise, and blood glucose monitoring was moved up to the beginning of the survey. This improved the flow of the instrument.

b. In the pilot study, several participants stated that some of the glucose monitoring and exercise items did not apply to them. A "not applicable" response choice was added to the glucose testing and exercise items.

c. Item 3 of the survey that asks, "In what year were you first diagnosed with diabetes?" was changed to "How long have you had diabetes?" Most patients responded with number of years rather than the actual year.

d. In the pilot study, many patients did not understand the term "carbohydrate" and this term was used in two items in the survey. In the Diabetes Self-Care Activities section, the item that ask about "follow a complex carbohydrate plan" will include examples for complex carbohydrates- such as fruits, vegetables and cereals.

   In the "diet" section of the Diabetes Self-Care Activities, the item that asks "On how many of the last seven days did you space carbohydrates evenly through the day?" was revised to include examples- "On how many of the last seven days did you space carbohydrates (for example starches such as potatoes, breads, and tortillas) throughout the day?"

e. For item 2 that asks about household status, the "other" category was added to the response format. Several participants reported that they live with their children AND parents or with their spouse AND parents.

f. From the knowledge section:
   Many patients do not understand the term "effective."
   Item 2 in this section asks if the main cause of diabetes is the "lack of effective insulin." This item was reworded to "the main cause of diabetes is not having enough insulin that is working as well as it should."

STUDY POPULATION

The study sample consisted of 160 patients with type 2 diabetes who were receiving care from the University Health System – Downtown clinic during the three-month period from March 4, 2002 through May 16, 2002. The sample was drawn from the Family Practice clinics (adult and geriatric) of the University Health System. A total of 170 patients were interviewed for the study and 160 patients met the inclusion criteria for the study. Ten patients met the initial inclusion criteria and after they completed the survey it was discovered that they did not meet all the criteria for the study (scored 15 or greater on the depression screen, Patient Health Questionnaire or had diagnosis of dementia or some other cognitive disorder).

Table 3.1 presents the demographic information for the population of the clinic from which the sample was drawn for this study. Table 3.2 presents the demographic information from a national sample of patients receiving care from family practitioners. From the tables, it can be seen that the sample for this study is different than the national sample. The clinic population for this study is predominantly Hispanic and the majority is uninsured. In the national sample, almost seven percent is Hispanic and over 50 percent have private insurance. The clinic population is similar to the national sample with respect to age and gender.

Table 3.1 Demographic Characteristics of Clinic Population

Characteristics	Clinic Sample (%)
Age	
(0 to 12)	12.0
(13 to18)	9.6
(19 to 34)	23.6
(35 to 64)	48.4
(65 and older)	6.4
Total	100.0
Gender	
Females	56.6
Males	43.4
Total	100.0
Race/Ethnicity	
Hispanics	78.9
White	13.4
Black	5.7
Asian	0.3
Indian	0.1
Other	1.4
Unknown	0.2
Total	100.0
Source of Payment	
Uninsured	70.0
Medicare	15.0
Medicaid	10.0
Private Insurance	5.0
Total	100.0

Table 3.2 Demographic Characteristics of National Sample

Characteristics	Clinic Sample (%)
Age (years)	
(0 to 3)	3.9
(3 to 17)	12.3
(18 to 24)	6.4
(25 to 44)	28.7
(45 to 64)	28.0
(65 to 74)	10.3
(75 and over)	10.4
Total	100.0
Gender	
Females	57.2
Males	42.8
Total	100.0
Race	
White	87.1
Black	8.9
Asian/Pacific Islander	3.9
Multiple Races	0.2
Total	100.1[a]
Ethnicity	
Hispanics	6.7
Not Hispanic	71.5
Not Reported	21.8
Total	100.0

Table 3.2 Demographic Characteristics of National Sample (continued)

Characteristics	Clinic Sample (%)
Source of Payment	
Private Insurance	56.8
Medicare	17.2
Medicaid	8.5
Self-pay	7.1
No Charge	0.2
Other	5.5
Unknown	4.6
Total	99.9 [a]

[a] Total does not equal 100 due to rounding error.
Source: 2001 Facts About Family Practice: Adapted from U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
Available at http:www.aafp.org/x789.xml Accessed October 19, 2002.

RESPONSE RATE

Non Respondents

A total of sixteen patients who met the initial inclusion criteria (age, duration of diabetes greater than one year, taking diabetes medication and living with a family) were asked to participate in the study but declined to do so. Thirteen of the patients were female and three were male. The reasons given were as follows: didn't have the time to complete the survey (needed to return to work, had another doctor's appointment, needed to get to their ride), didn't feel up to answering the questions, or didn't offer a reason.

The initial response rate was calculated by taking the total number of patients who participated in the study divided by the total number of patients who met the initial inclusion criteria.

$$\text{Initial response rate} = \frac{170}{170 + 16} \times 100 = 91.4\ \%$$

The final response rate was calculated by taking the total number of patients who participated and met the inclusion criteria divided by the total number of patients who met the initial inclusion criteria.

$$\text{Final response rate} = \frac{160}{170 + 16} \times 100 = 86.0\ \%$$

Other Issues with Survey Process

For patients who were accompanied by family members or friends, the family member(s) or friend(s) was asked to leave for the first part of the survey that asks about family support and satisfaction. Most family members left so the participant could complete the survey. However, ten patients who completed the survey were accompanied by family member(s) or friend(s) who stayed during the entire interview process.

Six patients completed the survey via the telephone. These patients started with the survey in the clinic (signed the consent form and completed the clock drawing task) but were unable to complete the survey due to the lack of time. The patients provided their telephone numbers and permission to contact them at a later time to complete the survey.

Spanish Version of Instrument

Among the 160 patients surveyed, a total of 138 (86.2%) surveys were administered in English and 22 (13.8%) were administered in Spanish.

DESCRIPTION OF INSTRUMENT

The instrument consisted of a 20-page survey with 156 items and was administered by the researcher or researcher assistant. The survey items included nominal, ordinal, and interval data. The formats of the items were mainly closed-ended. There were seven questions that had the response choice “other —please specify.”

SAMPLE DESCRIPTION

RESPONDENT DEMOGRAPHICS

Demographic information collected from study participants included age, gender, marital status, household status, race/ethnicity, education, income, and language preferences. The distributions of the sample for the demographic variables are discussed below and the data are shown in Tables 3.3 through 3.10.

Age

Study participants were asked if they were 55 years of age or older and the clinical record was used to confirm the age. The date of birth was subtracted from the date of the survey. The average age of the study sample was 63.9 years (S.D. = 6.7). A total of 108 participants (67.5%) were between the ages of 55 to 65 years old and 52 (32.5%) were over 66 years old.

Gender

A total of 66.9 percent of the sample was female (n= 107). Table 3.3 shows the distribution of the sample by gender.

Table 3.3 Distribution of Sample by Gender

Gender	N	Percent
Females	107	66.9
Males	53	33.1
Total	160	100.0

Race or Ethnic Background

The study sample was predominantly Hispanic (86.3%), followed by white (7%), black (4.4%), and others (2.5%) which included Asian Americans and native Americans. Table 3.4 shows the distribution of the sample by race/ethnicity.

Table 3.4 Distribution of Sample by Race/Ethnicity

Ethnicity	N	Percent
Hispanic	138	86.3
Caucasian or White	11	6.9
African American or Black	7	4.4
Other [a]	4	2.5
Total	160	100.1

[a]Other category include “Asian American” (n =2) and “Native American” (n =2)
[b] Total does not equal 100 percent due to rounding error.

Marital and Household Status

A total of 53.8 percent of the participants were married, 22.5 percent were widowed, 18.1 percent were divorced, and the rest (5.6%) were separated or never married. Table 3.5 shows the distribution of the sample by marital status. A total of 36.9 percent of the sample lived with their spouse or significant other, 33.8 percent lived with their children, 16.3 percent lived with spouse or significant other and children, 10.6 percent lived with relatives or friends, and 2.5 percent were in the "other" category which included living with their parents. Table 3.6 shows the distribution of the sample by household status.

Table 3.5 Distribution of Sample by Marital Status

Marital Status	N	Percent
Married	86	53.8
Widowed	36	22.5
Divorced	29	18.1
Never Married	5	3.1
Separated	4	2.5
Total	160	100.0

Table 3.6 Distribution of Sample by Household Status

Household Status	N	Percent
Lives with spouse or significant other	59	36.9
Lives with children	54	33.8
Lives with spouse or significant other and children	26	16.3
Lives with relatives and friends	17	10.6
Other[a]	4	2.5
Total	160	100.1[b]

[a] Other category includes living with parent(s).
[b] Total does not equal 100 percent due to rounding error.

Educational Level

The educational level of the study participants was divided into five categories. Table 3.7 shows the categories and the distribution of the sample by level of education. A total of 44.7 percent (n=71) of the sample had less than an eighth grade education. Only 35.2 percent (n =56) graduated from high school or received the General Equivalency Diploma (GED).

Table 3.7 Distribution of Sample by Educational Level

Educational Level	N	Percent
Grade School or Less (0-8)	71	44.7
Some High School (9-11)	32	20.1
High School Graduate or GED[a] (12)	37	23.3
Some College or Junior College	15	9.4
Bachelor's Degree (4 or 5 year degree)	4	2.5
Total	159[b]	100.0

[a] GED- General Equivalency Diploma
[b] One participant did not provide a response.

Acculturation

The language-based acculturation scale developed by Deyo and associates was used in this study.[448] The scale consists of four brief questions regarding language. Each patient was given a total score by assigning one point for each response favoring English and 0 points for each response favoring Spanish. The participant has a total score ranging from 0 to 4, with higher scores reflecting higher levels of acculturation. The mean acculturation score was 2.05

[448] Deyo R.A., Diehl A.K., Hazuda H., et al. A simple language-based acculturation scale for Mexican Americans: validation and application to health care research. *American Journal of Public Health* 75(1): 51-55, 1985.

(S.D. =1.16). See Table 3.8 for the distribution of the sample by language-based acculturation scores. Table 3.9 shows the distribution of the scores by responses to each of the four items on the acculturation scale.

Table 3.8 Distribution of Sample by Acculturation Scores

Total Score	Number of Subjects	Percent
0	8	5.0
1	52	32.7
2	46	28.9
3	28	17.6
4	25	15.7
Total	159[a]	99.9[b]

[a] The acculturation scale was not applicable to one person whose first language was Indian.
[b] Total does not equal 100 percent due to rounding error.

Table 3.9 Frequency and Proportion of Acculturation Items: Language Preference at Clinic, Language Spoken in Home, First Language as Child, and Read Any English

Acculturation Scale Item	N	Percent
Language Preference at Clinic		
English	62	39.0
Spanish	27	17.0
Both Equally	70	44.0
Total	159[a]	100.0
Language Spoken in Home		
English	38	23.9
Spanish	64	40.3
Both Equally	57	35.8
Total	159[a]	100.0
First Language as Child		
English	27	17.1
Spanish	131	82.9
Total	158[b]	100.0
Read Any English		
Yes, anything	105	66.0
Some	18	11.3
Very little	23	14.5
None	13	8.2
Total	159[a]	100.0

[a] One participant was not applicable.
[b] One participant was not applicable and the other did not provide a response.

Income

Participants were asked about their total monthly income from all sources before taxes and to include earnings from all other members in the family. Over half of the sample (55.6%) reported a total monthly income $1000 or less. See Table 3.10 for the distribution of the sample by monthly income.

Table 3.10 Distribution of Sample by Monthly Income

Income Category	N	Percent
Less than $500	26	18.1
$501 to $1000	54	37.5
$1001 to $1500	47	32.6
$1501 to $2000	9	6.3
$2001 to $2500	2	1.4
$2501 to $4000	2	1.4
$4001 to $5000	2	1.4
$5000 to $6000	2	1.4
Total	144[a]	100.1[b]

[s] Sixteen people did not provide responses to this item.
[b] Total does not equal 100 percent due to rounding error.

Employment Status

Participants were asked about their employment status. A total of 56.0 percent reported they were not employed. Table 3.11 shows the distribution of the sample by employment status.

Table 3.11 Distribution of Sample by Employment Status

Employment Status	N	Percent
Employed Full- or Part-time	25	15.7
Unemployed	89	56.0
Retired	45	28.3
Total	159[a]	100.0

[a] One person did not provide a response to this item.

RELIABILITY OF SCALES

The validity and reliability of the original instrument cannot be assumed to be retained when modifications have been made to the questionnaire or when it is used in a different population. The psychometric properties of any modified scales should be reexamined and assessed.[449] The internal consistencies of most of the scales were tested using Cronbach's alpha for the pilot study and for the final survey instrument, with the exception of the Summary of Diabetes Self-Care Activities scale (SDSCA).[450] The authors of the SDSCA scale used mean inter-item correlations to assess the relationships among items within a scale. Inter-item correlations were used rather than the Cronbach's alpha because the alpha is influenced by the number of items as well as the relationships among the items. The reliability tests of the scales resulted in no change to the instrument item.

Table 3.12 presents the results of the reliability tests. The reported internal consistencies found in the literature for the scales are provided for comparison. Overall, the scales were consistent with the reliabilities that have been published in other studies. A few scales had some weak internal consistency measures and these include the overall barriers score –pilot and final survey; the

[449] Bradley C. Adapting scales and procedures: the limits of reliability and validity in *Handbook of Psychology and Diabetes*. Bradley C. editor, Chur, Switzerland, Harwood Academics, 379- 388, 1994.

[450] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

knowledge instrument- final survey; and the Summary of Diabetes Self-Care- final survey and the depression scale (Patient Health Questionnaire- final scale).

The overall barriers to self-care scale had weak alphas in both the pilot and the final study. However, the alphas for each of the four regimens were consistent with what has been reported in other studies.[451, 452] The reliability for the medication barrier scale was the lowest with alpha levels of 0.43 and 0.41 for the pilot and final survey, respectively. The reliabilities for the other three areas- diet, exercise and glucose monitoring were 0.52, 0.58 and 0.56, respectively.

Several of the scales had Cronbach's alphas that were lower in the final survey than in the pilot. The knowledge instrument had an alpha level of 0.64 for the final instrument which was lower than the alpha in the pilot study. The wording on several items on the knowledge scale was changed to improve the understanding of the item.

The inter-item correlations for the specific diet items of the Summary of Diabetes Self-Care scale was low (r = 0.17). The inter-item correlations of other subscales were relatively high (r =0.85 - 0.97). The items used in the Summary of Diabetes Self-Care scale are items from the revised scale and the internal

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[451] Glasgow R.E. Social-environmental factors in diabetes: Barriers to diabetes self care in *Handbook of Psychology and Diabetes.* Bradley C. editor, Chur Switzerland, Harwood Academics, 335-349, 1994.

[452] Glasgow R.E., Hampson S.E., Strycker L.A., et al. Person model beliefs and social-environmental barriers related to diabetes self management. *Diabetes Care* 20(4): 556-561, 1997.

consistency of the revised scale is not available yet.[453] However, other studies have reported low inter-item correlation with the original specific diet scale.[454]

The Cronbach's alpha for the depression measure (Patient Health Questionnaire) was lower for the final instrument (0.65) than the pilot study (0.81). Deleting any of the items on the instrument would not have improved the alpha level.

It is important to note that the internal consistencies reported for some of the measures may be for a mail survey or self-administered survey. The method of administration may influence the internal consistency of the scale.[455]

Two examiners rated the CLOX1 and CLOX 2 and then determined the consensus score for the clock-drawing tests. The CLOX has been found to have a high degree of between rater reliability (CLOX 1 $r = 0.94$, CLOX 2 $r = 0.93$).[456] In this study, the intraclass correlation coefficients for CLOX 1 and CLOX 2 were $r = 0.99$ and $r = 0.95$, respectively. Item number 5, which ask about the order of placing the numbers of the CLOX scale was not included in the analysis.

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[453] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self- Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[454] Ibid.

[455] Bradley C. Adapting scales and procedures: the limits of reliability and validity in *Handbook of Psychology and Diabetes*. Bradley C. editor, Chur, Switzerland, Harwood Academics, 379- 388, 1994.

[456] Royall D.R., Cordes J.A. and Polk M. CLOX: an executive clock drawing task. *Journal of Neurology, Neurosurgery and Psychiatry* 64: 588-594, 1998.

Table 3.12 Reliability Estimates of Scales in Survey: Cronbach's Alphas and Comparison of Reliability for Pilot and Final Instrument[a]

Scale	Number of Items	Cronbach's Alpha Reported in Literature	Pilot Study Standardized Item Alpha	N Pilot	Final Instrument Standardized Item Alpha	N Final
Diabetes Family Support Behavior Checklist	9 (+)	Positive Summary 0.71	Positive Summary 0.76	10	Positive Summary 0.74 (8 items)[b]	159
(DFBC-II)	7(-)	Negative Summary 0.64	Negative Summary 0.59	10	Negative Summary 0.66	157
Non-Family Support Scale	6	(0.69-0.73)	0.41[b]	12	0.76[b]	149
Family APGAR	5	0.86	0.95	12	0.93	157
Barriers to Self-Care						
Overall Score	31	(0.84 to 0.92)	0.77	12	0.75	157
Diet	7	(0.55 to 0.92)	0.67	12	0.52	159
Exercise	7	(0.59 to 0.66)	0.67	11	0.58	159
Glucose Testing	7	(0.39 to 0.61)	0.71	10	0.56	160
Medication	7	(0.40 to 0.56)	0.43	12	0.41	159

Table 3.12 Reliability Estimates of Scales in Survey: Cronbach's Alphas and Comparison of Reliability for Pilot and Final Instrument[a] (continued)

Scale	Number of Items	Cronbach's Alpha Reported in Literature	Pilot Study Standardized Item Alpha	N Pilot	Final Instrument Standardized Item Alpha	N Final
Diabetes Knowledge Questionnaire	24	0.78	0.75	12	0.64[b]	159
Self- Efficacy Scale	7	0.89 total scale	0.77* total scale diet only –0.77 2 diet items[b]	12	0.76* total scale diet only 0.76 2 diet items[b]	151
Revised Summary of Diabetes Self-Care Activities[a]	9	0.47[c] (total scale) inter-item correlation	general diet 0.98 specific diet 0.20 exercise 0.87 glucose 0.90	12	general diet 0.95 specific diet 0.17 exercise 0.85 glucose 0.97	158
Patient Health Questionnaire PHQ-9	9	0.86-0.89	0.81	11	0.65	160

[a] Cronbach's alpha reported on all scales except Revised Summary of Diabetes Self-Care (inter-item correlations)
[b] Indicates scale has been modified
[c] Internal consistency of 11 core items on original scale.

HEALTH VARIABLES

The health variables provided a description of the participants' overall state of health and diabetes. The health variables included duration of diabetes (time since diagnosis), number of diabetes- related comorbidities, and other comorbidities, and most recent HbA1C value available in clinical chart (within twelve months preceding the interview). Other health measures included the cognitive and the depression scores.

Duration of Diabetes

The mean duration of diabetes was 12.94 years (S.D.= 9.37). Table 3.13 shows the distribution of duration of diabetes in years. Duration of diabetes is defined as time since initial diagnosis.

Table 3.13 Distribution of Sample by Duration of Diabetes

Duration in Years	N	Percent
Less than 5	45	28.1
6-10	36	22.5
11-20	56	35.0
21 or greater	23	14.4
Total	160	100.0

Diabetes-Related Comorbidities

The patient's medical chart provided information on the number of diabetes-related medical complications. These complications included: eye problems/retinopathy, kidney disease, foot problems – infections, ulcerations, amputations, heart disease, stroke and neuropathy/numbness. The mean number of diabetes-related comorbidities was 1.94 (S.D. =1.14) and the mean number of "other" comorbidities (non diabetes-related) was 1.3 (S.D.= 1.2). The mean number of total comorbidities (sum of diabetes-related comorbidities and non diabetes-related comorbidities) was 3.3 (S.D. = 1.7). The distribution of the sample by type and number of diabetes-related comorbidities are shown in Tables 3.14 and 3.15. The distributions of the sample by type and number of "other" comorbidities are shown in Tables 3.16 and 3.17.

Table 3.14 Distribution of Sample by Diabetes-Related Comorbidities

Comorbidity	Number with Comorbidities	Percent [a]
Cardiovascular Disease		
cerebrovascular	11	6.9
coronary artery disease	24	15.0
peripheral vascular disease	5	3.1
Foot problems- infections and ulcers	20	12.5
Kidney Disease –		
nephropathy/renal failure	11	6.9
Neuropathy-		
peripheral neuropathy	15	9.4
gastroparesis	4	2.5
bladder dysfunction	6	3.8
sexual dysfunction	6	3.8
Ophthalmic Disease		
retinopathy	10	6.3
Other		
hyperlipidemia	77	48.1
hypertension	119	74.4

[a] Percentage was calculated based on a sample of 159 charts reviewed. One chart was not available for review.

Table 3.15 Distribution of Sample by Number of Diabetes-Related Comorbidities

Number of Comorbidities	N	Percent
0	9	5.7
1	52	32.7
2	57	35.8
3	26	16.4
4	12	7.5
5	2	1.3
6 or more	1	0.6
Total	159[a]	100.0

[a] One chart was not available.

Table 3.16 Distribution of Sample by Non Diabetes-Related Comorbidities

Other Chronic Conditions	Number with Comorbidities	Percent[a]
Anemia	9	5.6
Arthritis and Rheumatologic Diseases		
Arthritis	11	6.9
Osteoarthritis	9	5.6
Degenerative Joint Disease	11	6.9
Gout	3	1.9
Systemic Lupus Erythematosus	3	1.9
Endocrine Disorders		
Hypothyroidism	15	9.4
Gastroenterologic Diseases		
Diverticulitis	5	3.1
GERD (gastro esophageal reflux disease)	14	8.8
Peptic Ulcer Disease	4	2.5
Other gastrointestinal disorders[b]	6	3.8
Epilepsy (Seizures)	4	1.9
Hepatic Diseases		
Cirrhosis	4	2.5
Hepatitis C	6	3.8
Portal Hypertension	1	0.6
Malignant Diseases: Cancer		
Breast	4	2.5
Testicular	1	0.6

[a] Percentage was calculated based on a sample of 159 charts reviewed. One chart was not available for review.

[b] Other disorders include duodenal ulcer, dyspepsia, gastritis, irritable bowel syndrome, and pancreatitis.

Table 3.16 Distribution of Sample by Non Diabetes-Related Comorbidities (continued)

Other Chronic Conditions	Number with Comorbidities	Percent[a]
Pulmonary Diseases		
Asthma	3	1.9
COPD	7	4.4
Psychological Problems/Diseases		
Depression	23	14.4
Anxiety	5	3.1
Panic Disorder	1	0.6
Other Conditions		
Benign prostatic hypertrophy	3	1.9
Fibromyalgia	4	2.5
Migraines, spinal stenosis, chronic pain, cardiomegaly, obesity, psoriasis, hypercalcemia	13	8.1

[a] Percentage was calculated based on a sample of 159 charts reviewed. One chart was not available for review.

Table 3.17 Distribution of Sample by Number of Non Diabetes-Related Comorbidities

Number of Comorbidities	N	Percent
0	44	27.7
1	49	30.8
2	45	28.3
3	12	7.5
4	6	3.8
5	1	0.6
6 or more	2	1.3
Total	159[a]	100.0

[a] One chart was not available.

Metabolic Control

Metabolic control was assessed by the patient's hemoglobin A1c (HbA1C) value. The most current HbA1C values were retrieved from the patients' medical charts. Of the 160 patients in the sample, HbA1C values were available on 152 patients. Of the 152 patients, 145 had HbA1C values that were within a twelve-month period preceding the interview. The mean time in months since the most recent HbA1C reported in these 145 patients was 3.07 months (S.D. = 1.85). The time was calculated as the difference in time between the date the HbA1C lab was drawn and the date of the survey. The range for the time of most current HbA1C was from 0 to 12 months. The mean HbA1C was 8.15 percent (S.D. = 3.01%). Table 3.18 depicts the distribution of HbA1C levels by treatment goal categories. The categories for the HbA1C levels are based on treatment goals for nonpregnant individuals as recommended by the American Diabetes Association.[457] Patients with comorbid conditions, the very young and the older adults may warrant different treatment goals. HbA1C values that are greater than 8 percent are usually not acceptable in most patients and is an indication for a significant change in treatment plan.

Seven of the 152 patients had HbA1C values available in their clinical records that were over 12 months old. The range in months was from 12.6 to 22.8 months. The mean HbA1C value for these seven patients was 7.97 percent (S.D. = 2.15%).

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[457] American Diabetes Association. Standards of medical care for patients with Diabetes Mellitus. *Diabetes Care* 25(1): s33-s49, 2002.

Table 3.18 Distribution of Sample by HbA1C Levels and American Diabetes Association Classification for Treatment Goals

HbA1C (%) Level	Treatment Goals[a]	N	Percent of Patients
Less than or equal to 6.0	Normal	10	6.9
6.1 thru 7.0	Goal	33	22.8
7.1 to 8.0	Acceptable	37	25.5
8.1 or greater	Additional Action Suggested	65	44.8
Total		145[b]	100.0

[a]Treatment goals for non-pregnant individuals. Patients with comorbid conditions, very young and old may warrant different goals.
[b] Patients with HbA1C values in records within twelve months preceding the interview.

Cognitive Function

Cognitive function was assessed with the CLOX (clock drawing task). In the CLOX, participants were asked to draw a clock and set the time (scored as CLOX 1) and then asked to copy a clock (scored for CLOX 2). The mean score on the CLOX 1 was 10.41 (S.D. 2.93). The range of scores was from 0 to 15. The mean score on CLOX 2 was 12.58 (S.D. 1.75) and the range of scores was from 7 to 15. Cut points of 10/15 (CLOX 1) and 12/15 (CLOX 2) represent the 5th percentile for young adult controls.[458]

A total of 26.9 percent (n = 39) of the sample scored a "nine" or below on the CLOX 1 and 21.0 percent (n = 30) scored an "eleven" or below for the CLOX 2. The patients that scored below the cut score for the CLOX 1 did not have a history or diagnosis of cognitive impairment or dementia in their chart and were able to provide consistent responses throughout the survey. Table 3.19 shows the frequency and proportion of patients categorized by the CLOX scores grouping.

A total of fifteen patients did not participate in the clock-drawing task. Some of the reasons given are listed below.

1.) did not have their glasses with them and were not able to see well enough to draw (n = 5);
2.) had their eyes dilated and cannot see well enough to draw (n=3);
3.) did not feel up to drawing a clock (n = 4); and
4.) were not informed of having to draw a clock (n=3).

[The informed consent stated that there would be questions checking their concentration and memory but does not specifically mention the clock drawing task.]

458 Royall D.R., Cordes J.A. and Polk M. CLOX: an executive clock drawing task. *Journal of Neurology, Neurosurgery and Psychiatry* 64: 588-594, 1998.

There were two patients who completed the CLOX 1 task but refused to draw another clock for the CLOX 2.

Table 3.19 Frequency and Proportion of Patients Categorized by CLOX Score Grouping for CLOX 1 and CLOX 2 Scores

CLOX Score	N	Percent
CLOX 1		
Less than or equal to 5	13	9.0
6 thru 9	26	17.9
10 thru 12	70	48.3
13 thru 15	36	24.8
Total	145[a]	100.0
CLOX 2		
Less than or equal to 9	9	6.3
10 thru 11	21	14.7
12 thru 13	67	46.9
14 thru 15	46	32.2
Total	143[b]	100.1

[a] Fifteen patients did not participate in the CLOX 1.
[b] Seventeen patients did not participate in the CLOX 2.

Depression

The Patient Health Questionnaire (PHQ-9) was used to screen for depression.[459] As a severity measure, the PHQ-9 scores can range from 0 to 27. Each of the nine items is scored from 0 (not at all) to 3 (nearly every day). The mean score was 5.36 (S.D. = 3.91). Participants who scored above 15 did not meet the inclusion criteria for the study. The mean score for this sample is in the range for "mild" depression. Table 3.20 contains the distribution and descriptive statistics for the items on the nine-item depression scale. Table 3.21 shows the frequency and proportion of sample by score and level of depression for the PHQ-9 scale.

[459] Kroenke K., Spitzer R.L. and Williams J.B. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16(9): 606- 613, 2001.

Table 3.20 Distribution, Mean and Standard Deviation of Item Scores for the Patient Health Questionnaire (PHQ-9) and Total Scale Score

Scale Item	**Not At All 0 n**	**Several Days 1 n**	**More than Half the Days 2 n**	**Nearly Every Day 3 n**	**Total n**	**Mean [S.D.]**
Over the last 2 weeks, how often have you been bothered by any of the following problems?						
1. Little interest or pleasure in doing things	88	41	13	18	160	0.76
(%)	(55.0)	(25.6)	(8.1)	(11.3)	(100.0)	[1.01]
2. Feeling down, depressed, or hopeless	83	41	16	20	160	0.83
(%)	(51.9)	(25.6)	(10.0)	(12.5)	(100.0)	[1.05]
3. Trouble falling or staying asleep, or sleeping too much	87	42	14	17	160	0.76
(%)	(54.4)	(26.3)	(8.8)	(10.6)	(100.1)[a]	[1.00]
4. Feeling tired or having little energy	49	52	29	30	160	1.25
(%)	(30.6)	(32.5)	(18.1)	(18.8)	(100.0)	[0.87]
5. Poor appetite or overeating	109	28	9	14	160	0.55
(%)	(68.1)	(17.5)	(5.6)	(8.8)	(100.0)	[0.94]

Table 3.20 Distribution, Mean and Standard Deviation of Item Scores for the Patient Health Questionnaire (PHQ-9) and Total Scale Score (continued)

Scale Item	**Not At All 0 n**	**Several Days 1 n**	**More than Half the Days 2 n**	**Nearly Every Day 3 n**	**Total n**	**Mean [S.D.]**
Over the last 2 weeks, how often have you been bothered by any of the following problems?						
6. Feeling bad about your-self or that you are a failure or have let yourself or your family down.	114	32	8	6	160	0.41
(%)	(71.3)	(20.0)	(5.0)	(3.8)	(100.1)[a]	[0.76]
7. Trouble concentrating on things, such as reading the newspaper or watching television.	109	38	3	10	160	0.46
(%)	(68.1)	(23.8)	(1.9)	(6.3)	(100.1)[a]	[0.82]
8. Moving or speaking so slowly that other people could have noticed? Or the opposite- being so fidgety or restless that you have been moving around a lot more than usual.	136	18	1	5	160	0.22
(%)	(85.0)	(11.3)	(0.6)	(3.1)	(100.0)	[0.61]

Table 3.20 Distribution, Mean and Standard Deviation of Item Scores for the Patient Health Questionnaire (PHQ-9) and Total Scale Score (continued)

Scale Item	Not At All 0 n	Several Days 1 n	More than Half the Days 2 n	Nearly Every Day 3 n	Total n	Mean [S.D.]
Over the last 2 weeks, how often have you been bothered by any of the following problems?						
9. Thought that you would be better off dead or of hurting yourself in some way.	140	18	2	0	160	0.14
(%)	(87.5)	(11.3)	(1.3)	(0.0)	(100.1)[a]	[3.80]
Overall Total Scale Score					160	5.36 [3.91]

[a] Total does not equal 100 percent due to rounding error.

Table 3.21 Frequency and Proportion of Sample by Score and Level of Depression on Patient Health Questionnaire (PHQ-9)

Numerical Score	Levels of Depression	N	Percent
0	None	16	10.0
1 thru 4	Minimal	59	36.9
5 thru 9	Moderate	58	36.3
10 thru 14	Moderately Severe	27	16.9
Total		160	100.1

DIABETES SELF-MANAGEMENT RECOMMENDATIONS

Diabetes Self-Management Recommendations

A list of recommendations about diabetes self-care such as diet, exercise and blood glucose monitoring were read to the participants. The patients were then asked to indicate which recommendations their health care team (doctor, nurse, dietitian, or diabetes educator) had advised them to do. Participants were asked to indicate all that apply.

Tables 3.22 through 3.24 show the distributions of the self-reported recommendations given to participants by their health care provider in the areas of diet, exercise and blood glucose monitoring.

Table 3.22 Distribution of Sample by Diet Recommendations

Diet Recommendations	**N**[a]	**Row Percent**
Follow a low-fat eating plan		
Recommended	130	81.3
Not recommended	30	18.8[b]
Follow a complex carbohydrate diet such as fruits, vegetables and cereals		
Recommended	67	41.9
Not recommended	93	58.1
Reduce the number of calories you eat to lose weight		
Recommended	91	56.9
Not recommended	69	43.1
Eat lots of food high in dietary fiber		
Recommended	88	55.0
Not recommended	72	45.0
Eat lots (at least 5 servings per day) of fruits and vegetables		
Recommended	111	69.4
Not recommended	49	30.6
Eat very few sweets (for example: desserts, non-diet sodas, candy bars)		
Recommended	122	76.3
Not recommended	38	23.8[b]
I have not been given any advice about my diet by my health care team.		
Yes	9	5.6
No	151	94.4

[a] Each item has a total of 160 responses.
[b] Total does not equal 100 percent due to rounding error.

Table 3.23 Distribution of Sample by Exercise Recommendations

Exercise Recommendations	**N**[a]	**Row Percent**
Get low level exercise (such as walking) on a daily basis		
Recommended	126	78.8
Not recommended	34	21.3[b]
Exercise continuously for at least 20 minutes at least 3 times per week		
Recommended	51	31.9
Not recommended	109	68.1
Fit exercise into your daily routine (for example, take stairs instead of elevators, park a block away and walk, etc…)		
Recommended	20	12.5
Not recommended	140	87.5
Engage in a specific amount, type, duration and level of exercise		
Recommended	33	20.6
Not recommended	127	79.4
Other[c]		
Recommended	3	1.9
Not recommended	157	98.1
I have not been given any advice about exercise by my health care team.		
Yes	16	10.0
No	144	90.0

[a] Each item has a total of 160 responses.
[b] Total does not equal 100 percent due to rounding error.
[c] Other category includes not given specific exercise instructions but asked to do the best they can.

Table 3.24 Distribution of Sample by Self-Monitoring of Blood Glucose Recommendations

Self-Monitoring of Blood Glucose Recommendations	N[a]	Row Percent
Test your blood sugar using a drop of blood from your finger and a color chart.		
Recommended	16	10.0
Not recommended	144	90.0
Test your blood sugar using a machine to read the results.		
Recommended	141	88.1
Not recommended	19	11.9
Test your urine for sugar.		
Recommended	6	3.8
Not recommended	154	96.3[b]
Other [c]		
Recommended	7	4.3
Not recommended	153	95.6[b]

[a] Each item has a total of 160 responses.
[b] Total does not equal 100 percent due to rounding error.
[c] Do not need to self monitor blood glucose on regular basis.

Diabetes Medication Management

Participants were asked about the type of diabetes medication therapy they were currently prescribed. A total of 69.4 percent (n=111) of the sample were treated with oral hypoglycemic agents only, while 17.6 percent (n=28) were treated with oral agents and insulin, 10.0 percent (n=16) with insulin only and

3.1percent (n=5) were categorized as "other" therapy. Table 3.25 shows the distribution of the sample by type of diabetes medication therapy.

Table 3.25 Distribution of Sample by Type of Diabetic Medication Therapy

Medication Management	N	Percent
Single oral agent	68	42.5
Two oral agents	43	26.9
Insulin and one oral agent	22	13.8
Insulin and two agents	6	3.8
Insulin only	16	10.0
Other[a]	5	3.1
Total	160	100.1[b]

[a] Other includes "more than two oral agents" (n = 2) and "more than two oral agents and insulin" (n=3).
[b] Total does not equal 100 percent due to rounding error.

DIABETES FAMILY SUPPORT

Family Support-Diabetes Family Behavior Checklist II (DFBC-II)

Perceived family support is defined as the perceived support from family members specifically for diabetes-related behaviors. The Diabetes Family Behavior Checklist II (DFBC-II) was used to assess the actions of family members toward the person with type 2 diabetes in the following areas:

medication taking, glucose testing, exercise and diet.[460] The instrument contains 16 items that measure supportive and non-supportive family behaviors specific to diabetes. There are positive items that measure supportive behavior and negative items that measure non-supportive behavior.

Scoring of DFBC-II

The component scores can be calculated by summing all the positive items in the area of interest (diet, exercise, glucose testing or medication) and then summing the negative items and subtracting the negative item sum from the positive item sum. A high score indicates a strong perception of positive interactions with the rated family members. The response format was a five-point scale from "never" scored as "1" to "at least once a day" scored as "5."

Family Member Selected for DFBC-II

To complete the DFBC- II, respondents were asked to select one family member with whom they generally have the most contact. Table 3.26 presents the frequency and proportion of the sample by the family members rated. The family members most frequently selected were child (34.4%), husband (28.1%), and wife (21.9%). Respondents were asked how much time (waking hours) they spent with the person they selected on a typical day. The mean time spent with the person

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[460] Schafer L.C., McGaul K.D. and Glasgow R.E. Supportive and non-supportive family behaviors: relationship to adherence and metabolic control in persons with type 1 diabetes. *Diabetes Care* 9(2): 179-185, 1986.

was 7.6 hours (S.D. = 4.7). Table 3.27 presents the distribution of the sample by amount of time spent with person rated for DFBC-II scale.

Also, respondents were asked to rate how much does the person they selected know about diabetes. A seven-point rating question was used where the endpoints were labeled with "1" representing *hardly anything* and "7" representing *a great deal.* An intermediary point, "4" represented a *moderate amount*. The mean rating was 4.54 (S.D. = 2.18) which represents a moderate amount of knowledge regarding diabetes. Table 3.28 presents the distribution of the sample by their rating of the family member's knowledge regarding diabetes.

Table 3.26 Distribution of Sample by Family Member Rated in Diabetes Family Behavior Checklist II

Family Member Rated	N	Percent
Child	55	34.4
Husband	45	28.1
Wife	35	21.9
Other [a]	14	8.8
Sibling	8	5.0
Partner	3	1.9
Total	160	100.1[b]

[a] Other included roommate/housemate (n = 4), grandchildren (n=4), niece (n=2), daughter in-law (n=2), mother (n=1), and aunt (n =1).
[b] Total does not equal 100 percent due to rounding error.

Table 3.27 Distribution of Sample by Time Spent with Family Member Rated in Diabetes Family Behavior Checklist II

Average Time Spent In Hours On Typical Day	N	Percent
1 to 4	58	36.5
5 to 8	41	25.8
9 to 12	37	23.3
13 and greater	23	14.5
Total	159[a]	100.1[b]

[a] One person did not provide a response.
[b] Total does not equal 100 percent due to rounding error.

Table 3.28 Distribution of Sample by Rating of Family Member's Knowledge About Diabetes[a]

Rating of Family Member's Knowledge about Diabetes[b]	N	Percent
1 to 2	36	22.9
3 to 5	56	35.7
6 to 7	65	41.4
Total	157[c]	100.0

[a] Family member refers to the family member selected for the DFBC-II scale.
[b] Rating scale from "1" labeled as *hardly anything* to "7" labeled as *a great deal* and "4" labeled as a *moderate amount.*
[c] Three persons did not provide responses.

Exercise and Self -Monitoring of Blood Glucose Items

For the exercise and the self-monitoring of blood glucose components, a "not applicable" response choice was created.

Based on the method of scoring of the DFBC scale, the "not applicable" response would be treated as a missing value. In analyzing the data, there was concern regarding the missing values due to the "not applicable" responses. There were 31 "not applicable" responses for the "exercise with you" item and 21 "not applicable" responses for the "criticize you for not exercising." Perhaps a "never" may have been an appropriate response for the "not applicable" cases because the support is not there (negative or positive) regardless of the reason or the circumstances around it. For example, if the spouse or the family member is not able to exercise with the respondent because he/she is too ill or have other physical limitations then the support for exercise is not there, regardless of the reason why. Based on this reasoning, the "not applicable" responses given by the respondents for the exercise items were changed to "never."

The same process was used for the glucose testing items. A total of 22 "not applicable" responses for "nag you about testing your glucose level"; 26 for "help you decide if changes should be made based on glucose testing"; and 29 for "criticize you for not recording results" responses were changed from "not applicable" to a "never" response choice.

Table 3.29 contains the distribution, mean and standard deviation for the items on the DFBC-II scale. The last item of the scale is an open ended question and asks if there are any other supportive or non-supportive things that their family member does. This item is not used in the scoring of the scale.   Seven participants (4.4%) provided responses to this item. The "other" responses are listed in Table 3.30.

Table 3.31 depicts the distribution, mean and standard deviation for the four component scores of the instrument and the maximum scores for each component. The scores on the different components of the DFBC shows that the most positive family support is in the area of diet followed by medication, exercise and glucose monitoring.

Deletion of Exercise Item

The item on the DFBC that asks about "encourage you to participate in sports activities" was dropped from the analysis. There were 100 respondents that stated this item did not apply to them. This response for this item was not changed to a "never" because almost two-third of the sample stated this item didn't apply to them.

Table 3.29 Distribution, Mean and Standard Deviation for Diabetes B Family Behavior Checklist II Items

Scale Item[a]	Never 1 n	Once A Month 2 n	Once A Week 3 n	Several Times A Week 4 n	At Least Once A Day 5 n	Total n	Mean [S.D.]
How often does (family member):							
4. Praise you for following your diet?	58	2	32	34	34	160	2.90
(%)	(36.3)	(1.3)	(20.0)	(21.3)	(21.3)	(100.2)[b]	[1.59]
5. Nag you about testing your glucose level?	98	4	18	17	22	159	2.13
(%)	(61.6)	(2.5)	(11.3)	(10.7)	(13.8)	(99.9)[b]	[1.55]
6. Suggest things that might help you take your diabetes medication on time?	55	3	29	35	37	159	2.97
(%)	(34.6)	(1.9)	(18.2)	(22.0)	(23.3)	(100.0)	[1.63]
7. Criticize you for not exercising regularly?	127	5	7	8	13	160	1.59
(%)	(79.4)	(3.1)	(4.4)	(5.0)	(8.1)	(100.0)	[1.27]

Table 3.29 Distribution, Mean and Standard Deviation for Diabetes Family Behavior Checklist II Items (continued)

Scale Item[a]	Never 1 n	Once A Month 2 n	Once A Week 3 n	Several Times A Week 4 n	At Least Once A Day 5 n	Total n	Mean [S.D.]
How often does (family member):							
8. Help you decide if changes should be made based on glucose testing results?	89	8	24	31	8	60	2.13
(%)	(55.6)	(5.0)	(15.0)	(19.4)	(5.0)	(100.0)	[1.39]
9. Nag you about not following your diet?	67	10	28	19	36	160	2.67
(%)	(41.9)	(6.3)	(17.5)	(11.9)	(22.5)	(100.1)[b]	[1.63]
10. Argue with you about your diabetes self-care activities?	88	11	23	18	19	159	2.18
(%)	(55.3)	(6.9)	(14.5)	(11.3)	(11.9)	(99.9)[b]	[1.46]
11. Encourage you to participate in sports activities?	33	1	13	5	8	60	2.23
(%)	(55.0)	(1.7)	(21.7)	(8.3)	(13.3)	(100.0)	[1.51]

Table 3.29 Distribution, Mean and Standard Deviation for Diabetes Family Behavior Checklist II Items (continued)

Scale Item[a]	Never 1 n	Once A Month 2 n	Once A Week 3 n	Several Times A Week 4 n	At Least Once A Day 5 n	Total n	Mean [S.D.]
How often does (family member):							
12. Plan family activities so that they will fit in with your diabetes self-care schedule ?	65	16	51	19	9	160	2.32
(%)	(40.6)	(10.0)	(31.9)	(11.9)	(5.6)	(100.0)	[1.27]
13. Congratu-late you for sticking to your diabetes self-care schedule?	58	7	41	32	22	160	2.71
(%)	(36.3)	(4.4)	(25.6)	(20.0)	(13.8)	(100.1)[b]	[1.47]
14. Criticize you for not recording the results of glucose test?	134	4	5	8	9	160	1.46
(%)	(83.8)	(2.5)	(3.1)	(5.0)	(5.6)	(100.0)	[1.14]
15. Eat at the same time that you do?	8	2	9	14	127	160	4.56
(%)	(5.0)	(1.3)	(5.6)	(8.8)	(79.4)	(100.1)[b]	[1.02]

Table 3.29 Distribution, Mean and Standard Deviation for Diabetes Family Behavior Checklist II Items (continued)

Scale Item[a]	Never 1 n	Once A Month 2 n	Once A Week 3 n	Several Times A Week 4 n	At Least Once A Day 5 n	Total n	Mean [S.D.]
How often does (family member):							
16. Exercise with you?	112	2	15	17	14	160	1.87
(%)	(70.0)	(1.3)	(9.4)	(10.6)	(8.8)	(100.1)[b]	[1.41]
17. Let you sleep late rather than getting up to take your diabetes medication?	99	3	18	32	8	160	2.04
(%)	(61.9)	(1.9)	(11.3)	(20.0)	(5.0)	(100.1)[b]	[1.41]
18 Buy you things containing sugar to carry with you in case of a hypoglycemic reaction?	102	15	18	15	10	160	1.85
(%)	(63.8)	(9.4)	(11.3)	(9.4)	(6.3)	(100.2)[b]	[1.29]

Table 3.29 Distribution, Mean and Standard Deviation for Diabetes Family Behavior Checklist II Items (continued)

Scale Item[a]	Never 1 n	Once A Month 2 n	Once A Week 3 n	Several Times A Week 4 n	At Least Once A Day 5 n	Total n	Mean [S.D.]
How often does (family member):							
19. Eat foods that are not part of your diabetic diet?	23	7	25	32	72	159	3.77
(%)	(14.5)	(4.4)	(15.7)	(20.1)	(45.3)	(100.0)	[1.43]

[a] The scale starts with item # 4. Items #1 through #3 refer to the family member selected, time spent with family member, and how much the family member knows about diabetes.

[b] Total does not equal 100 percent due to rounding error.

Table 3.30 Other Supportive and Non-Supportive Responses for Diabetes Family Behavior Checklist -II Scale

Responses	N	Score
Supportive		
My son is very concerned with my health and helps me financially with my medication and supplies.	1	2 – Once a month
My daughter administers my shots every day.	1	5- At least once a day
Non Supportive		
Aunt is very "controlling" about my diabetes.	1	5- At least once a day
Husband is very non supportive about my diabetes.	1	5- At least once a day
Husband is an alcoholic and is very non supportive.	1	5- At least once a day
My niece is a "watchdog" and always keeps an eye on what I am eating.	1	5- At least once a day
My brother is a diabetic also but does not take care of himself and he gets mad at me because I try to take care of my diabetes.	1	4- Several times a week

Table 3.31 Descriptive Statistics for Diabetes Family Behavior Checklist-II by Regimen Area Scores

Regimen Area And Items		N	Range of Possible Scores	Mean		S.D.
Diet		159	-8 to 8	Overall Diet:	1.04	2.44
Positive	4 and 15	160			7.46	1.94
Negative	9 and 19	159			6.45	2.00
Exercise		160	-4 to 4	Overall Exercise:	0.28	1.68
Positive	16	160			1.87	1.41
Negative	7	160			1.59	1.27
Glucose Monitoring		159	-9 to 3	Overall Glucose:	-1.45	1.67
Positive	8	160			2.13	1.39
Negative	5 and 14	159			3.59	2.28
Medication		159	-4 to 4	Overall Medication:	0.92	2.02
Positive	6	159			2.97	1.60
Negative	17	160			2.04	1.41

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NON-FAMILY SUPPORT

The Non-Family Support scale included six items that asks about perceived support received from friends regarding their diabetes. These items were adapted from the Diabetes Care Profile (DCP).[461] The response format is a Likert scale using 1 through 5 with higher scores indicating better perceived non-family support. The dimension score was calculated by summing the scores and dividing by the number of non-missing items for each participant. Since items 2, 4, and 6 were negatively worded, the scores were reversed before calculating the dimension score.

A total of 11 participants skipped this section of the survey. Most of these participants stated that they did not have any friends or if they had friends, they do not discuss their illnesses or health with their friends. The mean score for the non-family support scale was 4.14 (S.D. = 0.59) which indicates a fairly high perceived support from non-family members (n = 149). Table 3.32 contains the descriptive statistics, mean and standard deviation for the non-family support scale.

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[461] Fitzgerald J.T., Davis W.K., Connell C.M., et al. Development and validation of the Diabetes Care Profile. *Evaluation and the Health Professions* 19(2): 208-230, 1996.

Table 3.32 Descriptive Statistics, Mean and Standard Deviation for Non-Family Support Scale Items

Item Scale	Strongly Disagree 1 n	Disagree 2 n	Neutral 3 n	Agree 4 n	Strongly Agree 5 n	Total	Mean [S.D.]
My friends:							
1. accept me and my diabetes	0	0	14	72	63	149	4.33
(%)	(0.0)	(0.0)	(9.4)	(48.3)	(42.3)	(100.0)	[0.64]
2. feel uncomfortable about me because of my diabetes	61	60	20	6	2	149	1.85
(%)	(40.9)	(40.3)	(13.4)	(4.0)	(1.3)	(99.9)[a]	[0.90]
3. encourage or reassure me about my diabetes.	4	6	30	57	52	149	3.99
(%)	(2.7)	(4.0)	(20.1)	(38.3)	(34.9)	(100.0)	[0.98]
4. discourage or upset me about my diabetes.	65	60	16	6	2	149	1.79
(%)	(43.6)	(40.3)	(10.7)	(4.0)	(1.3)	(99.9)[a]	[0.89]

Table 3.32 Descriptive Statistics, Mean and Standard Deviation for Non-Family Support Scale Items (continued)

Item Scale	Strongly Disagree 1 n	Disagree 2 n	Neutral 3 n	Agree 4 n	Strongly Agree 5 n	Total	Mean [S.D.]
My friends:							
5. listen to me when I want to talk about my diabetes.	2	4	23	66	54	149	4.11
(%)	(1.3)	(2.7)	(15.4)	(44.3)	(36.2)	(99.9)[a]	[0.86]
6. nag me about my diabetes	64	53	17	13	2	149	1.9
(%)	(42.9)	(35.6)	(11.4)	(8.7)	(1.3)	(99.9)[a]	[1.01]
Overall Scale Score						149[b]	4.14 [0.59]

[a] Total does not equal 100 percent due to rounding error.
[b] Eleven participants failed to complete this section because they stated they did not have any friends (n=6) or they do not discuss their health conditions with their friends (n=5).

FAMILY SATISFACTION

Family function was measured using the Family APGAR Scale.[462] Scores on the Family APGAR measure satisfaction with family life and provide an overall view of family function. The response format is a five-point scale (0 = never, 1 = hardly ever, 2 = some of the time, 3 = almost always, and 4 = always). The APGAR questions measure satisfaction of the participant with the five aspects of family life as they apply to each member of the family. The APGAR score for each family member was calculated by summing the scores of the five items in the scale. The total score ranges from 0 to 20. The higher the scores the more functional the family. The overall APGAR score for each participant was calculated by summing the APGAR scores for the participant and dividing by the number of family members rated. For example, if a participant rates only one family member, then his/her overall APGAR score is that score for that family member. If a participant rates four family members, then the overall score for that participant is the average of the four APGAR scores.

The maximum number of family members rated by a single participant was five. A total of 226 family members were rated with the APGAR measure. The overall mean APGAR score for the entire sample was 16.47 (S.D. = 4.35)

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[462] Smilkstein G. The Family APGAR: a proposal for a family function test and its use by physicians. *Journal of Family Practice* 6(6): 1231-1239, 1978.

which indicates highly functional family. The overall mean APGAR score for the entire sample was calculated by using the overall APGAR score for each participant.

Table 3.33 contains the frequency and distribution of the sample by the number of family members rated. For example, the table describes the number of people who only had one family member to rate, two family members to rate, and so on. Table 3.34 contains the mean and standard deviation of the overall APGAR score for each group. Table 3.35 presents the frequency and distribution of the APGAR scores by relationship of family member rated. Tables 3.36 through 3.41 present the distribution, mean and standard deviations for Family APGAR items for husbands, wives, sons, daughters, siblings and other family members.

Table 3.33 Distribution of Sample by Total Number of Family Members Rated[a]

Total Number of Members Rated	N	Percent
1	117	74.1
2	26	16.5
3	8	5.1
4	3	1.9
5	4	2.5
Total	158[b]	100.1

[a] Table describes the number of respondents by the total number of member(s) rated.
[b] One person did not wish to complete the APGAR scale and one person had missing responses
[c] Total does not equal 100 percent due to rounding error.

Table 3.34 Mean and Standard Deviation for Overall Family APGAR Score by Group (Based on Total Number of Family Members Rated)

Total Number of Members Rated	N	Mean APGAR Score	S.D.
1	117	16.64	4.51
2	26	15.81	4.20
3	8	16.50	3.63
4	3	17.75	1.75
5	4	14.70	3.73
Total	158[a]		

[a] One person did not wish to complete the APGAR scale and one person had missing responses.

Table 3.35 Frequency and Percentage of Family APGAR Scores by Family Member Relationship

Family Member Rated	N	Percent [a]
Son	55	24.6
Husband/Male Partner	48	21.4
Daughter	40	17.8
Wife/Female Partner	36	16.1
Other[b]	36	16.1
Sibling	9	4.0
Total	224	100.0

[a] Percentage of the total number of family members rated by sample.
[b] Other includes grandchildren (n=11), parents (n=7), daughter in-law (n=4), friend (n=4), son in law (n=3), nephew (n=2), niece (n=2), mother in-law (n=2), and aunt (n=1).

Table 3.36 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Husbands[a]

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my husband when something is troubling me.	3	1	12	8	24	48	3.02
(%)	(6.3)	(2.1)	(25.0)	(16.7)	(50.0)	(100.1)[b]	[1.19]
2. I am satisfied with the way my husband discusses items of common interest and shares problem-solving with me.	2	1	13	11	21	48	3.00
(%)	(4.2)	(2.1)	(27.1)	(22.9)	(43.8)	(100.1)[b]	[1.09]
3. I find that my husband accepts my wishes to take on new activities or make changes in my life-style.	4	3	10	12	19	48	2.81
(%)	(8.3)	(6.3)	(20.8)	(25.0)	(39.6)	(100.0)	[1.27]

Table 3.36 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Husbands[a] (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my husband expresses affection and responds to my feelings such as anger, sorrow, and love.	6	1	12	5	24	48	2.83
(%)	(12.5)	(2.1)	(25.0)	(10.4)	(50.0)	(100.0)	[1.40]
5. I am satisfied with the amount of time my husband and I spend together.	4	2	5	8	29	48	3.17
(%)	(8.3)	(4.2)	(10.4)	(16.7)	(60.4)	(100.0)	[1.28]
Total Score						48	14.83 [5.40]

[a] Includes one male member who was categorized as a partner.
[b] Total does not equal 100 percent due to rounding error.

Table 3.37 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Wives[a]

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my wife when something is troubling me.	1	0	2	13	20	36	3.42
(%)	(2.8)	(0.0)	(5.6)	(36.1)	(55.6)	(100.1)[b]	[0.84]
2. I am satisfied with the way my wife discusses items of common interest and shares problem-solving with me.	1	0	4	10	21	36	3.39
(%)	(2.8)	(0.0)	(11.1)	(27.8)	(58.3)	(100.1)[b]	[0.90]
3. I find that my wife accepts my wishes to take on new activities or make changes in my life-style.	1	0	4	14	17	36	3.28
(%)	(2.8)	(0.0)	(11.1)	(38.9)	(47.2)	(100.0)	[0.88]

Table 3.37 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Wives[a] (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my wife expresses affection and responds to my feelings such as anger, sorrow, and love.	1	0	6	6	23	36	3.39
(%)	(2.8)	(0.0)	(16.7)	(16.7)	(63.9)	(100.1)[b]	[0.96]
5. I am satisfied with the amount of time my wife and I spend together.	0	0	3	11	22	36	3.53
(%)	(0.0)	(0.0)	(8.3)	(30.6)	(66.1)	(100.0)	[0.65]
Total Score						36	17.00 [3.68]

[a] Includes two female members who were categorized as a partner.
[b] Total does not equal 100 percent due to rounding error.

Table 3.38 Distribution, Mean and Standard Deviation for Family APGAR Items for Rating of Sons

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my son when something is troubling me.	0	6	5	12	33	56	3.29
(%)	(0.0)	(10.7)	(8.9)	(21.4)	(58.9)	(99.9)[a]	[1.02]
2. I am satisfied with the way my son discusses items of common interest and shares problem-solving with me.	0	3	9	6	38	56	3.41
(%)	(0.0)	(5.4)	(16.1)	(10.7)	(67.9)	(100.1)[a]	[0.95]
3. I find that my son accepts my wishes to take on new activities or make changes in my life-style.	2	3	4	13	34	56	3.32
(%)	(3.6)	(5.4)	(7.1)	(23.2)	(60.7)	(100.0)	[1.06]

Table 3.38 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Sons (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my son expresses affection and responds to my feelings such as anger, sorrow, and love.	1	0	8	10	37	56	3.46
(%)	(1.8)	(0.0)	(14.3)	(17.9)	(66.1)	(100.1)[a]	[087]
5. I am satisfied with the amount of time my son and I spend together.	0	0	10	12	33	55	3.42
(%)	(0.0)	(0.0)	(18.2)	(21.8)	(60.0)	(100.0)	[0.79]
Total Score						55	16.93 [4.05]

[a] Total does not equal 100 percent due to rounding error.

Table 3.39 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Daughters

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my daughter when something is troubling me.	2	0	4	3	32	41	3.54
(%)	(4.9)	(0.0)	(9.8)	(7.3)	(78.0)	(100.1)[a]	[1.03]
2. I am satisfied with the way my daughter discusses items of common interest and shares problem-solving with me.	0	0	7	5	29	41	3.54
(%)	(0.0)	(0.0)	(17.1)	(12.2)	(70.7)	(100.0)	[0.78]
3. I find that my daughter accepts my wishes to take on new activities or make changes in my life-style.	0	1	5	5	30	41	3.56
(%)	(0.0)	(2.4)	(12.2)	(12.2)	(73.2)	(100.0)	[0.81]

Table 3.39 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Daughters (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my daughter expresses affection and responds to my feelings such as anger, sorrow, and love.	0	0	5	5	31	41	3.63
(%)	(0.0)	(0.0)	(12.2)	(12.2	(75.6)	(100.0)	[0.70]
5. I am satisfied with the amount of time my daughter and I spend together.	0	0	5	4	31	40	3.65
(%)	(0.0)	(0.0)	(12.5)	(10.0)	(77.5)	(100.0)	[0.70]
Total Score						40	17.87 [0.62]

[a] Total does not equal 100 percent due to rounding error.

Table 3.40 Distribution, Mean and Standard Deviation for Family APGAR Items for Rating of Siblings

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my sibling when something is troubling me.	0	0	3	2	4	9	3.11
(%)	(0.0)	(0.0)	(33.3)	(22.2)	(44.4)	(99.9)[a]	[0.93]
2. I am satisfied with the way my sibling discusses items of common interest and shares problem-solving with me.	1	0	3	1	4	9	2.78
(%)	(11.1)	(0.0	(33.3)	(11.1)	(44.4)	(100.2)[a]	[1.39]
3. I find that my sibling accepts my wishes to take on new activities or make changes in my life-style.	0	2	2	0	5	9	2.69
(%)	(0.0)	(22.2)	(22.2)	(0.0)	(55.6)	(100.0)	[1.36]

Table 3.40 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Siblings (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my sibling expresses affection and responds to my feelings such as anger, sorrow, and love.	0	0	2	4	3	9	3.11
(%)	(0.0)	(0.0)	(22.2)	(44.4)	(33.3)	(99.9)[a]	[0.78]
5. I am satisfied with the amount of time my sibling and I spend together.	0	0	2	3	4	9	3.22
(%)	(0.0)	(0.0)	(22.2)	(33.3)	(44.4)	(99.9)[a]	[0.83]
Total Score						9	15.11 [4.88]

[a] Total does not equal 100 percent due to rounding error.

Table 3.41 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Other Members [a]

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
1. I am satisfied with the help that I receive from my other member when something is troubling me.	7	4	3	6	16	36	2.56
(%)	(19.4)	(11.1)	(8.3)	(16.7)	(44.4)	(99.9)[b]	[1.61]
2. I am satisfied with the way my other member discusses items of common interest and shares problem-solving with me.	0	5	5	8	18	36	3.08
(%)	(0.0)	(13.9)	(13.9)	(22.2)	(50.0)	(100.0)	[1.11]
3. I find that my other member accepts my wishes to take on new activities or make changes in my life-style.	2	3	5	7	19	36	3.06
(%)	(5.6)	(8.3)	(13.9)	(19.4)	(52.8)	(100.0)	[1.24]

Table 3.41 Distribution, Mean and Standard Deviation for Family APGAR Items for Ratings of Other Members[a] (continued)

Scale Item	Never 0 n	Hardly Ever 1 n	Some of the Time 2 n	Almost Always 3 n	Always 4 n	Total n	Mean [S.D.]
4. I am satisfied with the way my other member expresses affection and responds to my feelings such as anger, sorrow, and love.	1	3	5	10	17	36	4.08
(%)	(2.8)	(8.3)	(13.9)	(27.8)	(47.2)	(100.0)	[1.11]
5. I am satisfied with the amount of time my other member and I spend together.	2	1	6	9	18	36	3.11
(%)	(5.6)	(2.8)	(16.7)	(25.0)	(50.0)	(100.1)[b]	[1.14]
Total Score						36	14.89 [5.43]

[a] Other includes grandchildren (n=11), parents (n=7), daughter in-law (n=4), friend (n=4), son in law (n=3), nephew (n=2), niece (n=2), mother in-law (n=2), and aunt (n=1).
[b] Total does not equal 100 percent due to rounding error.

Table 3.42 presents the descriptive statistics for the APGAR scores by the groups of family member rated. An independent t-test was conducted to test for differences in the mean APGAR scores for the husbands and the wives. There was a significance difference in the mean APGAR scores. Wives have higher APGAR scores (17.00 +/-3.68) than husbands (14.83 +/- 5.40).
[$t = -2.183$; $df = 81.3$; $p < 0.05$]

A one-way ANOVA showed that there were significant differences in the mean APGAR scores among the groups ($F= 3.20$; $df = 5$ and 218; $p< 0.01$). The Dunnett T3 was used for pairwise comparison. The analyses indicated that the mean APGAR rating was significantly higher for daughters (17.87 +/- 3.24) than husbands (14.83 +/- 5.40) at $p <0.05$. An independent t-test was conducted separately from the ANOVA to test for differences between husbands and wives.

Table 3.42 Descriptive Statistics for APGAR Scores by Groups of Family Member Rated

Family Member Rated	N	Mean[a]	S.D.
Daughters*	40	17.87	3.24
Sons	55	16.93	4.05
Wives	36	17.00	3.69
Siblings	9	15.11	4.89
Others	36	14.89	5.43
Husbands*	48	14.83	5.40
Total	224	16.26	4.59

[a] Scale for each item ranges from 1 to 5 where 1 = "never," 2 = "hardly ever," 3 = "some of the time," 4 = "almost always," and 5 = "always."
Total score ranges from 0 to 20 where higher numbers indicate more functional family

*Indicates significant differences in mean score based on post hoc comparison — Dunnett T3 (F = 3.25, d.f. = 5, and p = 0.007)

SOCIAL COGNITIVE VARIABLES

Barriers to Diabetes Self-Care

Perceived barriers to self-care were measured with the 31-item Barriers to Self-Care Scale developed by Glasgow and associates.[463] The scale measures the frequency of both environmental and cognitive factors that interfere with diabetes self-care. The scale assesses the barriers of glucose testing, regular exercise, healthy low-fat eating and diabetes medication taking. Each regimen area has seven items and an additional three general barrier items, which measure barriers such as traveling and unexpected events. The seven-point scale ranges from 1 to 7 (1 = very rarely or never, 2 = once per month, 3 = twice per month, 4 = once per week, 5 = twice per week, 6 = more than twice weekly, and 7 = daily). The four regimen specific subscales were scored by averaging the responses across the relevant items. Higher scores indicate higher frequency of the barriers. The overall barrier score was fairly low 2.53 (S.D.= 0.77) which is between "once per month" and "twice per month" frequency. The regimen area with the highest score was diet, followed by exercise, glucose monitoring and lastly medication. Table 3.43 shows the distribution and descriptive statistics for the 31 barriers to

[463] Glasgow R.E. Social-environmental factors in diabetes: Barriers to diabetes self-care in *Handbook of Psychology and Diabetes*. Bradley C., editor, Chur, Switzerland, Harwood Academics, 335-349, 1994.

care items. Table 3.44 depicts the descriptive statistics for the barriers by regimen area.

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
1. I am not at home and it is time to test my blood glucose level.	104	10	3	8	3	2	1	29	160	1.24
(%)	(65.0)	(6.3)	(1.9)	(5.0)	(1.9)	(1.3)	(0.6)	(18.1)	(100.1)a	[1.25]
2. I am not at home when it is time to take my diabetes medication (oral or insulin).	128	9	4	7	6	4	0	2	160	1.50
(%)	(80.0)	(5.6)	(2.5)	(4.4)	(3.8)	(2.5)	(0.0)	(1.3)	(100.1)[a]	[1.24]
3. I am not in a convenient location when it is time to exercise.	75	5	6	6	12	4	2	50	160	1.41
(%)	(46.9)	(3.1)	(3.8)	(3.8)	(7.5)	(2.5)	(1.3)	(31.3)	(100.2)[a]	[1.72]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
4. I am at a restaurant or someone else's house at meal times.	46	10	6	20	36	29	13	0	160	3.81
(%)	(28.8)	(6.3)	(3.8)	(12.5)	(22.5)	(18.1)	(8.1)	(0.0)	(100.1)	[2.10]
5. The weather is bad when I would like to exercise.	36	15	28	21	6	0	2	51	159	1.75
(%)	(22.6)	(9.4)	(17.6)	(13.2)	(3.8)	(0.0)	(1.3)	(32.1)	(100.0)	[1.68]
6. I am unsure about the amount of sugar in one or more food items I consume.	59	21	14	25	10	9	21	1	160	3.09
(%)	(36.9)	(13.1)	(8.8)	(15.6)	(6.3)	(5.6)	(13.1)	(0.6)	(100.0)	[2.16]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
7. I'll say to myself that it won't matter if I don't exercise. (%)	68 (42.5)	13 (8.1)	10 (6.3)	14 (8.8)	6 (3.8)	7 (4.4)	9 (5.6)	33 (20.6)	160 (100.1)[a]	1.97 [2.03]
8. I'll say to myself that it won't matter if I don't take my diabetes medication. (%)	136 (85.0)	5 (3.1)	3 (1.9)	9 (5.6)	2 (1.3)	2 (1.3)	2 (1.3)	1 (0.6)	160 (100.1)[a]	1.42 [1.19]
9. I'll say to myself that it won't matter if I don't follow my diet. (%)	100 (62.5)	10 (6.3)	9 (5.6)	14 (8.8)	11 (6.9)	4 (2.5)	12 (7.5)	0 (0.0)	160 (100.1)[a]	2.29 [1.97]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
10. I'll say to myself that it won't matter if I don't check my glucose level.	86	8	12	12	10	5	6	21	160	1.93
(%)	(53.8)	(5.0)	(7.5)	(7.5)	(6.3)	(3.1)	(3.8)	(31.1)	(100.1)[a]	[1.86]
11. I am extremely busy.	72	13	4	20	24	5	21	0	159	3.06
(%)	(45.3)	(8.2)	(2.5)	(12.6)	(15.0)	(3.1)	(13.2)	(0.0)	(99.9)[a]	[2.25]
12. I don't have the necessary material or equipment with me when it is time to take my diabetes medication.	111	27	9	8	0	1	3	1	160	1.57
(%)	(69.4)	(16.9)	(5.6)	(5.0)	(0.0)	(0.6)	(1.9)	(0.6)	(100.0)	[1.17]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
13. I don't have the necessary material or equipment with me when it is time to exercise.	42	5	1	1	0	0	3	108	160	0.50
(%)	(26.3)	(3.1)	(0.6)	(0.6)	(0.0)	(0.0)	(1.9)	(67.5)	(100.0)	[1.11]
14. I don't have the necessary material or equipment with me when it is time to test my glucose level.	88	20	11	4	0	5	9	23	160	1.69
(%)	(55.0)	(12.5)	(6.9)	(2.5)	(0.0)	(3.1)	(5.6)	(14.4)	(100.0)	[1.77]
15. I still feel hungry after finishing a meal.	71	12	14	32	9	4	17	0	159	2.85
(%)	(44.7)	(7.5)	(8.8)	(20.1)	(5.7)	(2.5)	(10.7)	(0.0)	(100.0)	[2.06]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
16. I feel sore and stiff.	27	5	15	41	20	8	44	0	160	4.39
(%)	(16.9)	(3.1)	(9.4)	(25.6)	(12.5)	(5.0)	(27.5)	(0.0)	(100.0)	[2.10]
17. I think about how much time it takes to prepare foods the way I should.	95	7	12	18	8	4	14	2	160	2.37
(%)	(59.4)	(4.4)	(7.5)	(11.3)	(5.0)	(2.5)	(8.8)	(1.3)	(100.2)[a]	[2.02]
18. I think about how much time it takes to take my diabetes medication.	140	3	1	1	0	2	12	1	160	1.56
(%)	(87.5)	(1.9)	(0.6)	(0.6)	(0.0)	(1.3)	(7.5)	(0.6)	(100.0)	[1.68]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
19. I think about how much time it takes to test my glucose level.	111	6	0	3	0	1	8	31	160	1.23
(%)	(69.4)	(3.8)	(0.0)	(1.9)	(0.0)	(0.6)	(5.0)	(19.4)	(100.1)[a]	[1.52]
20. I think about how much time it takes to exercise.	66	7	11	20	10	3	9	34	160	2.03
(%)	(41.3)	(4.4)	(6.9)	(12.5)	(6.3)	(1.9)	(5.6)	(21.3)	(100.2)[a]	[2.03]
21. I have visitors staying with me.	120	11	1	11	4	6	6	1	160	1.79
(%)	(75.0)	(6.9)	(0.6)	(6.9)	(2.5)	(3.8)	(3.8)	(0.6)	(100.1)[a]	[1.67]
22. I am still in bed when it is time to take my medication.	102	4	7	12	22	6	5	1	159	2.26
(%)	(64.2)	(2.5)	(4.4)	(7.5)	(13.8)	(3.8)	(3.1)	(0.6)	(99.9)[a]	[1.90]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
23. I am still in bed when it is time to test my glucose level.	90	3	5	10	13	5	4	30	160	1.71
(%)	(56.3)	(1.9)	(3.1)	(6.3)	(8.1)	(3.1)	(2.5)	(18.8)	(100.1)[a]	[1.84]
24. I feel awkward with other people around when it is time to test my glucose level.	118	2	0	8	1	0	1	30	160	1.04
(%)	(73.8)	(1.3)	(0.0)	(5.0)	(0.6)	(0.0)	(0.6)	(18.8)	(100.1)[a]	[0.99]
25. I feel awkward with other people around when it is time to take my medication.	147	2	0	6	1	0	3	1	160	1.26
(%)	(91.9)	(1.3)	(0.0)	(3.8)	(0.6)	(0.0)	(1.9)	(0.6)	(100.1)[a]	[1.04]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
26. I don't feel well.	36	10	31	35	20	10	18	0	160	3.59
(%)	(22.5)	(6.3)	(19.4)	(21.9)	(12.5)	(6.3)	(11.3)	(0.0)	(100.2)[a]	[1.93]
27. I am around people who are eating or drinking things I shouldn't.	28	14	4	20	11	8	75	0	160	4.85
(%)	(17.5)	(8.8)	(2.5)	(12.5)	(6.9)	(5.0)	(46.9)	(0.0)	(100.1)[a]	[2.40]
28. I think about the cost of my diabetes medications.	56	28	10	19	7	5	34	1	160	3.26
(%)	(35.0)	(17.5)	(6.3)	(11.9)	(4.4)	(3.1)	(21.3)	(0.6)	(100.1)[a]	[2.36]
29. I think about the cost of materials for testing my blood glucose levels.	51	26	6	15	7	3	32	20	160	2.86
(%)	(31.9)	(16.3)	(3.8)	(9.4)	(4.4)	(1.9)	(20.0)	(12.5)	(100.2)[a]	[2.49]

Table 3.43 Distribution, Mean and Standard Deviation for Barriers to Self-Care Scale Items (continued)

Scale Item	Very rarely or never 1 n	Once per Month 2 n	Twice Per Month 3 n	Once per week 4 n	Twice Per week 5 n	More Than twice weekly 6 n	Daily 7 n	Does not apply to me 0 n	Total n	Mean [S.D.]
30. I think about the cost of necessary equipment or fees for exercise.	36	3	2	4	0	1	2	112	160	0.53
(%)	(22.5)	(1.9)	(1.3)	(2.5)	(0.0)	(0.6)	(1.3)	(70.0)	(100.1)[a]	[1.18]
31. I think about the cost of the recommended foods to eat according to my meal plan.	53	17	10	42	7	5	25	1	160	3.28
(%)	(33.1)	(10.6)	(6.3)	(26.3)	(4.4)	(3.1)	(15.6)	(0.6)	(100.0)	[2.16]
Overall Barriers									143	2.53 [0.77]

[a] Total does not equal 100 percent due to rounding error.

Table 3.44 Descriptive Statistics for Regimen Area Based on Barriers to Diabetes Self-Care Scale Items

Regimen Area	N	Mean[a]	S.D.
Diet	159	3.22	1.09
Exercise	159	3.07	1.43
Glucose Monitoring	145	2.16	1.21
Medication	158	1.83	0.74
Overall Barriers	143	2.53	0.77

[a] Scale ranges from 1 to 7 where 1 = rarely or never, 2 = 0+

Diabetes Knowledge

General knowledge regarding diabetes and its complications and treatment was assessed with the Diabetes Knowledge Questionnaire (DKQ-24).[464] The responses choices for the items were “yes,” “no” and “don’t know.” The “don’t know” response choices were treated as incorrect responses. Items were scored as correct or incorrect (correct = 1 point and incorrect = 0 points) and the correct items

[464] Garcia A., Villagomez E.T., Brown S.A., et al. The Starr County Diabetes Education Study: development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care* 24(1): 16-21, 2001.

were summed to obtain a total score. A percent score was then calculated by dividing the number of items correct by 24 and then multiplied by 100. Table 3.45 contains the distribution of responses for the knowledge instrument. The mean score was 69.8 percent (S.D. = 14.6). Scores ranged from 29 percent to 100 percent.

Table 3.45 Distribution of Responses for Diabetes Knowledge Questionnaire (DKQ-24) Items [a]

Item	Yes n	No n	I Don't Know n	Correct	In-Correct
1.Eating too much sugar and other sweet foods is a cause of diabetes.	96	54	10	54	106
(%)	(60.0)	(33.8)	(6.3)	(33.8)	(66.3)
2. The usual cause of diabetes is not having enough insulin in the body that is working as well as it should.	140	6	14	140	20
(%)	(87.5)	(3.8)	(8.8)	(87.5)	(12.5)
3. Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	60	67	33	67	93
(%)	(37.5)	(41.9)	(20.6)	(41.9)	(58.1)
4. Kidneys produce insulin.	36	90	34	90	70
(%)	(22.5)	(56.3)	(21.3)	(56.3)	(43.8)
5. In untreated diabetes, the amount of sugar in the blood usually increases.	157	2	1	157	3
(%)	(98.1)	(1.3)	(0.6)	(98.1)	(1.9)
6. If I am diabetic, my children have a higher chance of being diabetic.	153	5	2	153	7
(%)	(95.6)	(3.1)	(1.3)	(95.6)	(4.4)
7. Diabetes can be cured.	47	104	9	104	56
(%)	(29.4)	(65.0)	(5.6)	(65.0)	(35.0)

Table 3.45 Distribution of Responses for Diabetes Knowledge Questionnaire (DKQ-24) Items[a] (continued)

Item	Yes n	No n	I Don't Know n	Correct	In-Correct
8. A fasting blood sugar level of 210 is too high.	153	5	2	153	7
(%)	(95.6)	(3.1)	(1.3)	(95.6)	(4.4)
9. The best way to check my diabetes is by testing my urine.	26	116	18	116	44
(%)	(16.3)	(72.5)	(11.3)	(72.5)	(27.5)
10. Regular exercise will increase the need for insulin or other diabetic medication.	33	101	26	101	59
(%)	(20.6)	(63.1)	(16.3)	(63.1)	(36.9)
11. There are two main types of diabetes: Type 1 and Type 2 (non-insulin dependent).	156	4	0	156	4
(%)	(97.5)	(2.5)	(0.0)	(97.5)	(2.5)
12. An insulin reaction is caused by too much food.	60	41	59	41	119
(%)	(37.5)	(25.6)	(36.9)	(25.6)	(74.4)
13. Medication is more important than diet and exercise to control my diabetes.	72	88	0	88	72
(%)	(45.0)	(55.0)	(0.0)	(55.0)	(45.0)
14. Diabetes often causes poor circulation.	156	1	3	156	4
(%)	(97.5)	(0.6)	(1.9)	(97.5)	(2.5)

Table 3.45 Distribution of Responses for Diabetes Knowledge Questionnaire (DKQ-24) Items[a] (continued)

Item	Yes n	No n	I Don't Know n	Correct	In-Correct
15. Cuts and abrasions on diabetics heal more slowly.	151	6	3	151	9
(%)	(94.4)	(3.8)	(1.9)	(94.4)	(5.6)
16. Diabetics should take extra care when cutting their toenails.	158	0	2	158	2
(%)	(98.8)	(0.0)	(1.3)	(98.8)	(1.3)
17. A person with diabetes should cleanse a cut with iodine and alcohol.	106	27	27	27	133
(%)	(66.3)	(16.9)	(16.9)	(16.9)	(83.1)
18. The way I prepare my food is as important as the foods I eat.	157	0	3	157	3
(%)	(98.1)	(0.0)	(1.9)	(98.1)	(1.9)
19. Diabetes can damage my kidneys.	155	1	4	155	5
(%)	(96.9)	(0.6)	(2.5)	(96.9)	(3.1)
20. Diabetes can cause loss of feeling in my hands, fingers, and feet.	151	4	5	151	9
(%)	(94.4)	(2.5)	(3.1)	(94.4)	(5.6)
21. Shaking and sweating are signs of high blood sugar.	77	66	17	66	94
(%)	(48.1)	(41.3)	(10.6)	(41.3)	(58.8)

Table 3.45 Distribution of Responses for Diabetes Knowledge Questionnaire (DKQ-24) Items[a] (continued)

Item	Yes n	No n	I Don't Know n	Correct	In-Correct
22. Frequent urination and thirst are signs of low blood sugar.	74	71	15	71	89
(%)	(46.3)	(44.4)	(9.4)	(44.4)	(55.6)
23. Tight elastic socks are not bad for diabetics.	32	126	2	126	34
(%)	(20.0)	(78.8)	(1.3)	(78.8)	(21.3)
24. A diabetic diet consists mostly of special foods.	109	46	5	46	114
(%)	(68.1)	(28.8)	(3.1)	(28.8)	(71.3)

[a] The row percentage represents the percentage of the sample who provided the particular response "yes," "no," or "I don't know" and represents the percentage of the sample who answered the item correctly and incorrectly. There were a total of 160 responses for each item.

Self-Efficacy

Participants were asked to rate how confident they were in their ability to perform behaviors specific to the diabetes self-care activities with a five-item scale. The measure used a five-point Likert scale from "1" to "5," ranging from 1 to 5. Table 3.46 presents the distribution and the descriptive statistics for the self-efficacy scale. To calculate the score for the diet subscale, which consist of two items, take the average of the diet items. The other regimen areas have only a single item. The overall self-efficacy score for the sample was 3.93 (S.D. = 0.76) which indicates that they were moderately confident in their ability to perform diabetes self-care behaviors. Table 3.47 presents the self-efficacy scores by each regimen area. The data shows that respondents had the highest self-efficacy in taking their diabetes medication as directed, followed by self-monitoring of their blood glucose, then following their diet. The lowest self-efficacy score was in exercising regularly.

Table 3.46 Distribution, Mean and Standard Deviation for Self-Efficacy Scale Items

Scale Item	Strongly Disagree 1 n	Disagree 2 n	Neutral 3 n	Agree 4 n	Strongly Agree 5 n	Total n	Mean [S.D.]
1. I am confident in my ability to follow my diet.	10	13	10	54	73	160	4.04
(%)	(6.3)	(8.1)	(6.3)	(33.8)	(45.6)	(100.1)[a]	[1.19]
2. I am confident in my ability to test my blood sugar at the recommended frequency.	14	9	8	44	76	151	4.05
(%)	(9.3)	(6.0)	(5.3)	(29.1)	(50.3)	(100.0)	[1.28]
3. I am confident in my ability to exercise regularly.	14	29	27	36	50	156	3.51
(%)	(9.0)	(18.6)	(17.3)	(23.1)	(32.1)	(100.1)[a]	[1.35]
4. I am confident in my ability to keep my weight under control.	11	19	12	61	57	160	3.84
(%)	(6.9)	(11.9)	(7.5)	(38.1)	(35.6)	(100.0)	[1.23]
5. I am confident in my ability to keep my blood sugar level under control.	9	12	2	68	60	151	4.05
(%)	(6.0)	(7.9)	(1.3)	(45.0)	(39.7)	(99.9)[a]	[1.13]

Table 3.46 Distribution, Mean and Standard Deviation for Self-Efficacy Scale Items (continued)

Scale Item	Strongly Disagree 1 n	Disagree 2 n	Neutral 3 n	Agree 4 n	Strongly Agree 5 n	Total n	Mean [S.D.]
6. I am confident in my ability to resist food temptations.	20	27	18	55	40	160	3.43
(%)	(12.5)	(16.9)	(11.3)	(34.4)	(25.0)	(100.1)[a]	[1.36]
7. I am confident in my ability to take my diabetes medication as directed (insulin or pills).	1	5	1	49	104	160	4.56
(%)	(0.6)	(3.1)	(0.6)	(30.6)	(65.0)	(99.9)[a]	[0.72]
Overall Self-Efficacy						160	3.92 [0.76]

[a] Total does not equal 100 percent due to rounding error.

Table 3.47 Descriptive Statistics for Regimen Area Based on Self- Efficacy Scale Items

Regimen Area and Items	N	Mean[a]	S.D.
Diet Items 1 and 6	160	3.73	1.13
Exercise ***Item 3***	156	3.51	1.35
Glucose Monitoring Item 2	151	4.05	1.28
Medication Item 7	160	4.56	0.72
Overall Self-Efficacy	160	3.92	0.76

[a] Scale ranges from 1 to 5 where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

DIABETES SELF-CARE ACTIVITIES

A self-report measure of the frequency of completing different regimen activities over the preceding seven days was assessed with the revised Summary of Diabetes Self-Care Activities (SDSCA) scale.[465] Scores were calculated for each of the three regimen areas- diet, exercise, and blood-glucose testing using the

[465] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self- Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

mean number of days per week on a scale of 0 to 7. Table 3.48 presents the distribution, mean and standard deviation for the scale.

Table 3.48 Distribution, Mean and Standard Deviation for Individual Items and Overall Scores for Diet, Exercise, and Self-Blood Glucose Monitoring Regimen Areas of Diabetes Self-Care Activities Scale

Scale (Days per week) **Item**	**0** **n**	**1** **n**	**2** **n**	**3** **n**	**4** **n**	**5** **n**	**6** **n**	**7** **n**	**Total** **n**	**Mean** **[S.D.]**
General Diet										
1. How many of the last SEVEN DAYS have you followed a healthful eating plan? **(%)**	10 (6.3)	2 (1.3)	5 (3.1)	15 (9.4)	18 (11.3)	41 (25.6)	19 (11.9)	50 (31.3)	160 (99.9)[a]	4.99 [1.98]
2. On average, over the past month, how many DAYS PER WEEK have you followed your eating plan? **(%)**	10 (6.3)	2 (1.3)	4 (2.5)	17 (10.7)	17 (10.7)	44 (27.7)	22 (13.8)	43 (27.0)	159 (100.0)	4.92 [1.94]
Specific Diet										
3. On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables? **(%)**	6 (3.8)	4 (2.5)	13 (8.1)	17 (10.6)	27 (16.9)	12 (7.5)	9 (5.6)	72 (45.0)	160 (100.0)	5.04 [2.13]

Table 3.48 Distribution, Mean and Standard Deviation for Individual Items and Overall Scores for Diet, Exercise, and Self-Blood Glucose Monitoring Regimen Areas of Diabetes Self-Care Activities Scale (continued)

Scale (Days per week) **Item**	**0** **n**	**1** **n**	**2** **n**	**3** **n**	**4** **n**	**5** **n**	**6** **n**	**7** **n**	**Total** **n**	**Mean** **[S.D.]**
Specific Diet										
4. On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products? **(%)**	28 (17.5)	34 (21.3)	33 (20.6)	27 (16.9)	11 (6.9)	9 (5.6)	1 (0.6)	17 (10.6)	160 (100.0)	2.47 [2.10]
5. On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day. **(%)**	22 (13.8)	7 (4.4)	17 (10.6)	26 (16.3)	25 (15.6)	12 (7.5)	8 (5.0)	43 (26.9)	160 (100.1)[a]	3.93 [2.43]
Overall General Diet									159	4.95 [1.94]
Overall Specific Diet									160	4.50 [1.49]

Table 3.48 Distribution, Mean and Standard Deviation for Individual Items and Overall Scores for Diet, Exercise, and Self-Blood Glucose Monitoring Regimen Areas of Diabetes Self-Care Activities Scale (continued)

Scale (Days per week) **Item**	**0** **n**	**1** **n**	**2** **n**	**3** **n**	**4** **n**	**5** **n**	**6** **n**	**7** **n**	**Total** **n**	**Mean** **[S.D.]**
Exercise										
6. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity?	67	7	15	15	6	9	0	41	160	2.74
(%)	(41.9)	(4.4)	(9.4)	(9.4)	(3.8)	(5.6)	(0.0)	(25.6)	(100.1)[a]	[2.90]
7. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?	59	10	10	17	10	9	1	44	160	3.00
(%)	(36.9)	(6.3)	(6.3)	(10.6)	(6.3)	(5.6)	(0.6)	(27.5)	(100.1)[a]	[2.91]
Overall Exercise Score									160	2.87 [2.79]

Table 3.48 Distribution, Mean and Standard Deviation for Individual Items and Overall Scores for Diet, Exercise, and Self-Blood Glucose Monitoring Regimen Areas of Diabetes Self-Care Activities Scale (continued)

Scale (Days per week) **Item**	**0** **n**	**1** **n**	**2** **n**	**3** **n**	**4** **n**	**5** **n**	**6** **n**	**7** **n**	**Total** **n**	**Mean** **[S.D.]**
Blood Sugar Testing										
8. On how many of the last SEVEN DAYS did you test your blood sugar?	40	5	4	12	3	5	1	89	159	4.5
(%)	(25.2)	(3.1)	(2.5)	(7.5)	(1.9)	(3.1)	(0.6)	(56.0)	(99.9)[a]	[3.1]
9. On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?	35	4	4	11	5	6	1	89	155	4.67
(%)	(22.6)	(2.6)	(2.6)	(7.1)	(3.2)	(3.9)	(0.6)	(57.4)	(100.0)	[2.98]
Overall Blood Sugar Testing									155	4.64 [2.98]

[a] Total does not equal 100 percent due to rounding error.

Diet

The diet subscale consists of general and specific diet items. Thus, it is difficult to identify a single multi-item factor for diet.[466] The various components of a healthy diet are not highly correlated and to obtain an accurate assessment of eating behavior, it is necessary to measure the component of diet with separate measures. There were two general items that ask how many of the last seven days has the individual followed a healthful eating plan as well as their own eating plan. There were three specific diet items that ask about eating fruits and vegetables, high fat foods, and spacing carbohydrates evenly through the day. The scores for the general and specific diet subscales were calculated by using the mean number of days for their respective items. For example, the general diet items are items #1 and #2 and the specific diet items are # 3, #4 and #5. (Refer to Table 3.48 for Diet scale items). To score item #4, which is a negative behavior, reverse coding is used. For example,e to calculate the score for the diet scale:

Let x_1 = item 1, x_2 = item 2, x_3 = item 3, etc…

The denominator is the number of items in the scale (2 for *general* and 3 for *specific*).

Score for *general* diet = $\frac{x_1 + x_2}{2}$

[466] Johnson S.B., Tomer A. and Cunningham W.R. Adherence in childhood diabetes: results of a confirmatory factor analysis. *Health Psychology* 9(4): 493-501, 1990.

Score for *specific* diet $= \dfrac{x_3 + x_4 + x_5}{3}$

The mean score for the general diet scale was 4.95 (S.D. = 1.94) and for the specific diet scale was 4.50 (S.D. = 1.49). Thus, the results show that average respondents follow a healthful diet approximately five out of seven days. On average, respondents follow a *specific* diet (defined as eating fruits and vegetables, eating low fat foods, and spacing carbohydrates evenly through the day) four and one-half days out of seven days.

Exercise

The instrument has two questions which ask about the their physical activity over the past seven days. One question asks about participating in at least 30 minutes of physical activity and the other question asks about participating in any exercise, such as swimming or walking. The score for the exercise scale is calculated by taking the mean number of days for the two items. The mean number of days during the last seven days for the exercise scale was 2.87 (S.D. = 2.79). Thus, the scores show that on average, respondents participate in exercise almost three out of seven days.

Blood Glucose Monitoring

In the scale, two questions ask participants about the level of self-monitoring of blood glucose. One question asks how many of the last seven days did the individual test their blood sugar levels and the other question asks about how many times they test it according to the recommendations made by their health care provider. The self-monitoring of blood glucose score was calculated by taking the mean number of days for both items. The mean number of days out of the last seven days for monitoring blood sugar as recommended by the health care provider was 4.64 (S.D. = 2.98).

Medication Taking

Participants were asked about their diabetes medication taking behavior over the past seven days. Respondents were asked the following questions: In the past seven days, 1.) how many doses of diabetes medication did you skip or miss or purposely not take; 2.) how many times did you take an extra (dose); and 3.) how many times did you reduce the dose of their medication without the advice of their health care provider. It is noted that some patients have been advised to adjust their medications accordingly, such as insulin. If the participants stated that this was the case, their responses were not counted as being non-adherent. The compliance rate for each participant was calculated as follows:

$$\frac{\text{Total \# of doses during the past 7 days that medication(s) were taken as prescribed}}{\text{Total \# of doses that were prescribed during past 7 days}} \times 100\% = \text{compliance rate}$$

The mean medication adherence (compliance) rate was 91.6% (S.D. = 15.2). It was not possible to conduct the analysis on the medication model because of the ceiling effects and lack of variability among respondents with respect to medication adherence. This problem has been reported in the literature regarding patient's self-report of medication adherence.[467] The researchers attempted to avoid this problem by developing a scale which asks about medication taking behavior in a non-threatening manner.

[467] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self-Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

PATH ANALYSIS

Path analysis is a method for studying patterns of causation among a set of variables.[468] It is a method applied to a causal model formulated by the researcher on the basis of knowledge and theoretical considerations. The path diagram displays graphically the theorized, directional relationships among a set of variables.

In this study, path analysis was used to evaluate the relationships between the variables in two derived models–– the diet and exercise models. The hypotheses were driven by the paths based on the Social Cognitive Theory and the findings from the literature. The use of path analysis allowed an evaluation of how the variables in the model behave to predict the levels of diet and exercise self-care behavior in older adults with type 2 diabetes. The results of the path analysis are presented in two sections. The first section presents the results of the path analysis using multiple regression and the second section presents the results of the analysis using a structural equation modeling program, Analysis of Moment Structures (AMOS).[469]

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[468] Asher H.B. *Causal Modeling*. Sage University Paper Series on Quantitative Applications in the Social Sciences 07-003. Newberry Park, Sage Publications, 8 -9, 1983.

[469] Analysis of Moment Structure (AMOS 4.0), SPSS Inc, Chicago, Illinois, 1995.

REGRESSION MODELS

General Diet Model

The diet model was tested using regression analysis for both the *general* diet and the *specific* diet behaviors. The results of the general diet model are presented here. A summary of the results for the specific diet model is provided later in this chapter.

The eleven variables included in the diet model represent both the exogenous and endogenous variables. The variability of the six exogenous variables is determined outside the model. The exogenous variables include gender, duration of diabetes, diabetes-related comorbidities, acculturation, cognitive function and self-efficacy. The endogenous variables, which include perceived family diabetes support, family function, barriers to diet, knowledge, and general diet self-care behavior, are influenced by other variables within the model or by the random outside disturbance effects.

The path model that was formed based on hypothetical relationships among the eleven variables is shown in Figure 3.1. It was hypothesized that five variables (self-efficacy, family diabetes support, family function, barriers to diet, and knowledge) are directly related to the level of general diet self-care behavior. The path model is a recursive model in which each of the thirteen straight, single-headed arrows in Figure 3.1 represents a hypothesized relationship between the exogenous and endogenous variables or between endogenous variables. The relationships between the exogenous variables in the model are represented by the double-headed, curved arrows.

This model has five endogenous variables; therefore, there are five regression equations. After the path coefficients have been solved, there may be some insignificant path coefficients. In order to specify the output model, the insignificant paths were dropped if the standardized coefficients fell below a set a priori limit (alpha level = 0.05). As mentioned previously, each arrow also represents a hypothesis. If the path is significant, then the hypothesis is supported. If the path is insignificant, then the hypothesis is not supported.

The exogenous variables are defined as follows:

Z_1 = Gender

Z_2 = Duration of diabetes

Z_3 = Diabetes related comorbidities

Z_4 = Acculturation

Z_5 = Cognitive function

Z_6 = Self efficacy

The endogenous variables in their standardized forms are:

Z_7 = Family diabetes support

Z_8 = Family function

Z_9 = Barriers to diet

Z_{10} = Knowledge

Z_{11} = General diet self-care behavior

e = disturbance error or residual term

The standardized forms of the five structural equations that describe the model are listed below.

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

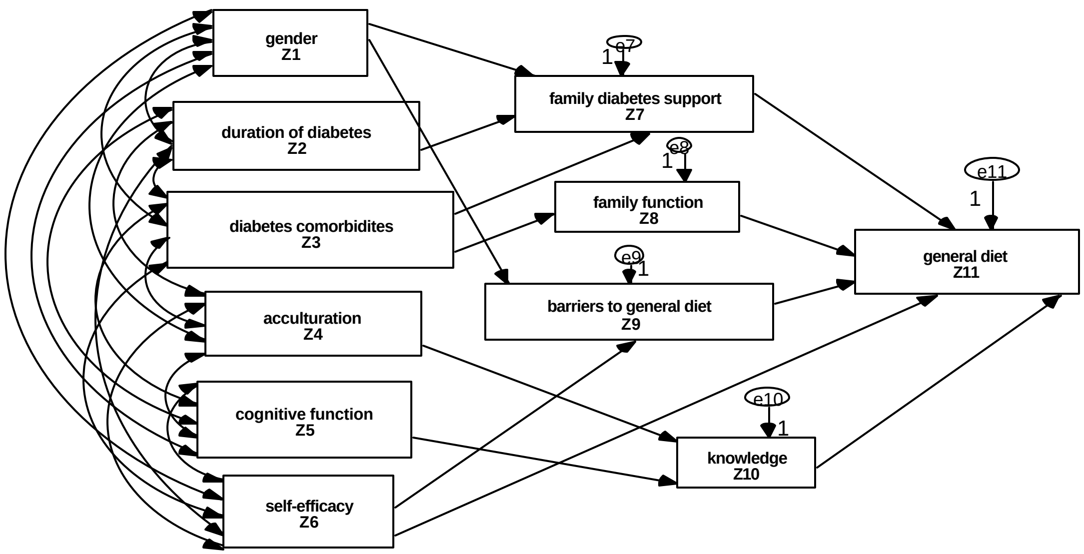
$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

Figure 3.1 Proposed General Diet Path Model



General Diet Model

Table 3.49 presents the zero-order correlation coefficients for each set of variables in the model. These coefficients describe the relationship between each set of variables when the effects of the other variables are not controlled.

Full Model- General Diet

After the five regression analyses were conducted, the following six paths were significant in the full model:

1.) family diabetes support and general diet self-care;
2.) self-efficacy and general diet self-care;
3.) barriers to diet and general diet self-care;
4.) self-efficacy and barriers to diet;
5.) acculturation and knowledge; and
6.) cognitive function and knowledge.

Family diabetes support and self-efficacy each had a direct positive effect on general diet self-care behavior. The more perceived support and self-efficacy one has, the better the levels of diet self-care. Barriers to diet had a direct negative effect on general diet self-care behavior. The more perceived barriers one has to diet, the lower the level of diet self-care. In addition to the direct effect self-efficacy had on general diet self-care, self-efficacy had an indirect effect via barriers to diet. Acculturation and cognitive function both had direct positive effects on knowledge. The more acculturated an individual is, the higher the scores on the knowledge instrument. The higher the score on the CLOX instrument (better cognitive function), the higher the score on the knowledge instrument.

Figure 3.2 presents the standardized path coefficients for the general diet model. The significant path relationships between the variables are shown by asterisks beside the path coefficients. The paths for which the relationships were not significant were eliminated and the regression analyses were repeated.

Table 3.49 Zero-Order Intercorrelation Matrix of Model Variables for Diet Model[a]

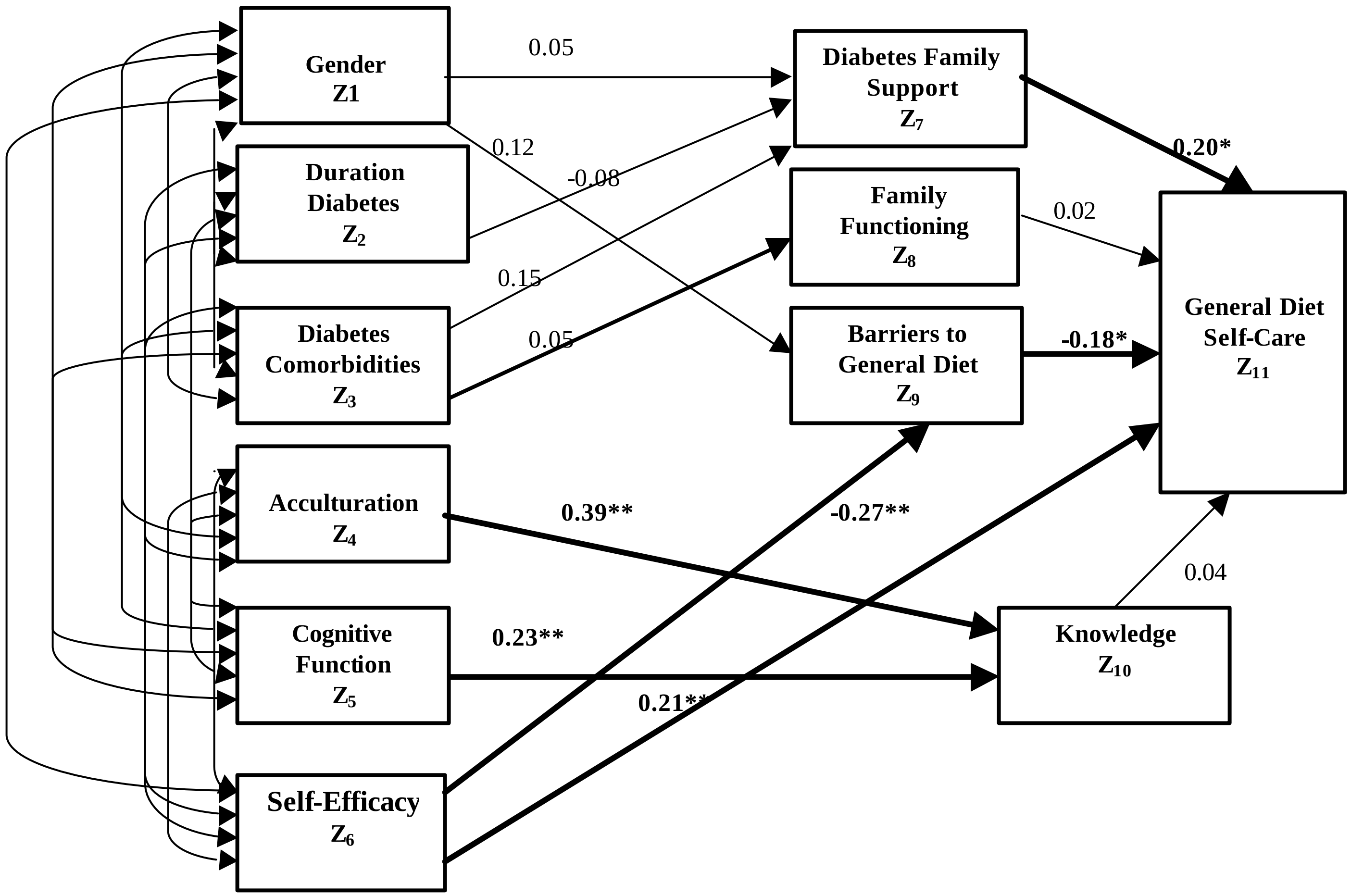
VARIABLE	GEN	DUR	COM	ACCULT	COGFX	FAMDIET	APGAR	BARDIET	SEDIET	KNOW	DIETSC
GEN	1	-0.02	-0.11	0.11	0.02	0.02	0.08	0.13	-0.05	0.12	0.11
DUR		1	0.12	-0.02	-0.12	-0.07	-0.03	-0.12	-0.07	-0.09	-0.03
COM			1	-0.03	-0.18*	0.14	0.05	-0.10	0.09	-0.03	-0.11
ACCULT				1	0.15	0.09	0.11	-0.04	-0.05	0.42**	0.15
COGFX					1	0.05	-0.10	0.01	0.01	0.28**	-0.02
FAMDIET						1	0.17*	-0.20*	0.22**	-0.04	0.26**
APGAR							1	-0.06	0.18*	-0.03	0.09
BARDIET								1	-0.27**	-0.02	-0.27**
SEDIET									1	-0.08	0.29**
KNOW										1	0.03
DIETSC											1

* Correlation is significant at the 0.05 level ** Correlation is significant at the 0.01 level

[a] Key for Variables

GEN	= Gender	FAM DIET	= Family Diabetes Support	DIETSC	= General Diet Self-Care
DUR	= Duration Diabetes	APGAR	= Family Function		
COM	= Diabetes Comorbidites	BARDIET	= Barriers to General Diet		
ACCULT	= Acculturation	SEDIET	= Self-Efficacy		
COGFX	= Cognitive Function	KNOW	= Knowledge		

Figure 3.2 General Diet Path Model with Standardized Path Coefficients

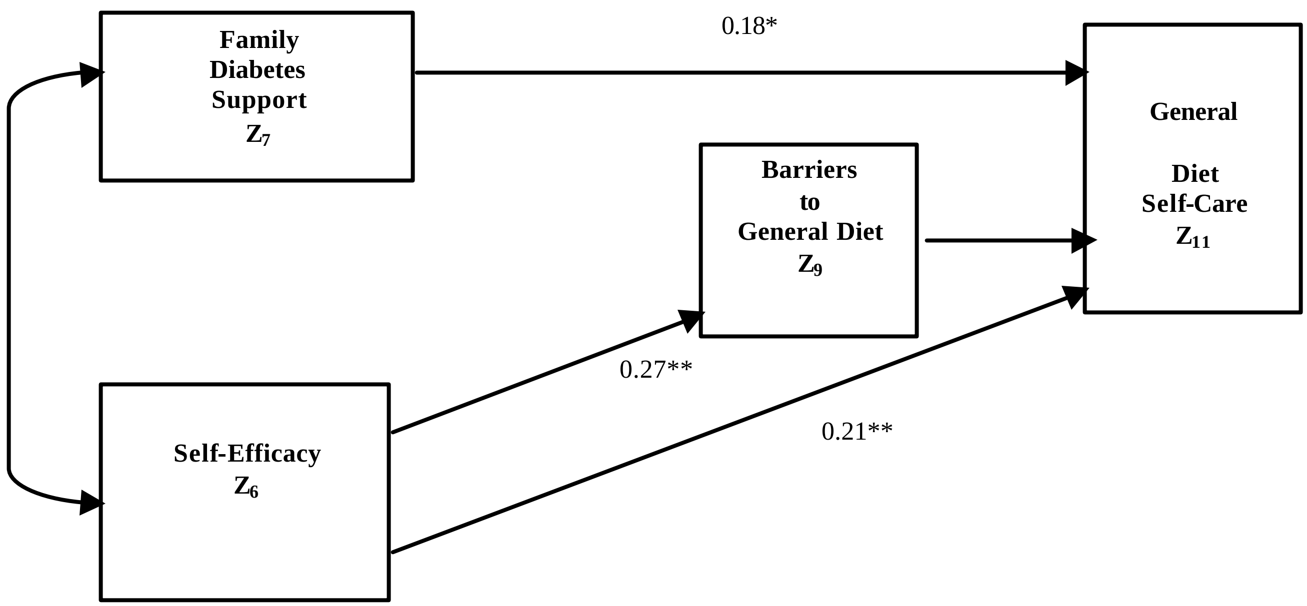


* significant at p <0.05 level;   ** significant at p <0.01 level

Final Model- General Diet

After the insignificant paths from the full model were eliminated, the regression analyses were repeated. A total of four significant paths were found in the final model, which is depicted in Figure 3.3. The acculturation and cognitive function paths were not significant in the second regression analysis. The final model shows that family diabetes support has a direct effect on general diet self-care, while self-efficacy has both a direct and an indirect effect moderated by barriers to diet. Barriers to diet, as expected, had a direct negative effect on general diet self-care. Based on the standardized coefficients, there was little difference between the direct and indirect effect of self-efficacy on general diet self-care. No difference was found in the magnitude of the direct effects of family diabetes support and barriers to diet on general diet self-care. The path coefficients were the same, with barriers having a negative effect. The adjusted R^2 for the final model was 0.14. The model explained 14 percent of the variance in the general diet self-care behavior. Table 3.50 presents the standardized model equations and squared multiple correlations for the final general diet model.

Figure 3.3 Final General Diet Path Model Depicting Significant Standardized Path Coefficients



* significant at p <0.05 level ; ** significant at p < 0.01

Table 3.50 Standardized Model Equations and Squared Multiple Correlations for FINAL Diet Model

Dependent Variable[a]	Model Equations	R^2
BARDIET =	0.27SEDIET + 0.28$e_{bardiet}$	0.073
DIETSC =	0.18FAMDIET + - 0.18BARDIET + 0.21SEDIET + 0.28 e_{dietsc}	0.165

[a]BARDIET = barriers to general diet
DIETSC = general diet self-care
FAMDIET = family diabetes support
SEDIET = self-efficacy (diet)
e = error

The unstandardized correlation coefficients for the variables in the final diet model are shown in Table 3.51. For the dependent variable (barriers to general diet) the unstandardized path coefficient for the independent variable (self-efficacy), quantifies the effect of self-efficacy on barriers to diet when other variables in the model are controlled. The frequency of barriers to diet decreased by 0.26 units for each unit increase in the self-efficacy scale.

For the dependent variable (general diet self-care), the unstandardized path coefficient of each of the three independent variables quantifies the variables' effects on general diet self-care when other variables in the model are controlled. Following a general diet increased by 0.14 days per week for each unit increase in the family diabetes support scale. Following a general diet decreased by 0.32

days per week for each unit increase in the frequency of barriers to diet scale. Also, following a general diet increased by 0.36 days per week for each unit increase in the self-efficacy scale.

Table 3.51 Unstandardized Correlation Coefficients for Paths Included in Final Diet Model

Dependent Variable and Independent Variable	**Unstandardized Coefficient**
Barriers to General Diet	
Self-Efficacy	-0.26
General Diet Self-care	
Family Diabetes Support	0.14
Barriers to General Diet	-0.32
Self-Efficacy	0.36

Direct and Indirect Effects

Table 3.52 shows the effects of the variables on the final model for general diet behavior. From the table, it can be seen that the effects of the independent variable is primarily a direct effect on the dependent variable.

Table 3.52 Effects of Variables on General Diet Behavior

Variable	Total Effect	Direct	Indirect[a]	Joint Effect or Spuriousness
Self-efficacy	0.291	0.206	0.05	0.035
Family Diabetes Support	0.258	0.180	- - - - - - - - -	0.078
Barriers to General Diet	-0.265	-0.177	- - - - - - - - - -	-0.09

[a] Indirect effect is the product of path coefficients of self-efficacy to barriers (-0.270) and barriers to general diet self-care (-0.177).

Specific Diet Model

A path analysis was conducted on the model using *specific* diet behavior in the place of *general* diet behavior. The following variables were used in the regression analysis where the dependent variable was *specific* diet behavior and the independent variables were family diabetes support, family function, barriers to diet and knowledge. The other regression analyses for the other dependent variables (self-efficacy, family diabetes support, family function, barriers and knowledge) are the same analyses conducted for the general diet model.

The regression analysis for the dependent variable *specific* diet was conducted and is represented by the following structural equation:

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

In the regression equation,

Z_6 = Self-efficacy

Z_7= Family diabetes support

Z_8 = Family function

Z_9 = Barriers to diet

Z_{10} =Knowledge

Z_{11} =Specific diet self-care behavior

In this analysis, only one path was found to be significant–– the path between self-efficacy and the specific diet behavior. The path coefficient for diet self-efficacy was 0.25; $p < 0.01$. In the regression model using general diet behavior as the dependent variable, there were an additional three significant paths. Therefore, the general diet scale was used in the diet model.

Exercise Model

This next section presents the results of the path analysis on the exercise model. The exercise model is very similar to the general diet model with the exception of the self-efficacy variable. In the diet model, self-efficacy was an exogenous variable whereas in the exercise model, self-efficacy is considered an endogenous variable. The literature suggests that males have higher self-efficacy scores for exercise than females.[470] Thus, self-efficacy is an endogenous variable that is influenced by another variable within the model (gender). The other endogenous variables include family diabetes support, family function, barriers to diet, knowledge, and the level of exercise. The exogenous variables include gender, duration of diabetes, diabetes-related comorbidities, acculturation, and cognitive function.

The path model for exercise was formed based on hypothetical relationships among the eleven variables and is shown in Figure 3.4. It is hypothesized that five variables (self-efficacy, family diabetes support, family function, barriers to diet, and knowledge) are directly related to the level of exercise. Similar to the diet model, the exercise model is recursive and each of the fourteen straight, single-headed arrows shown in Figure 3.4 represents the

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[470] Glasgow R.E., Toobert D.J., Riddle M., et al. Diabetes–specific social learning variables and self-care behaviors among persons with type 2 diabetes. *Health Psychology* 8(3): 285-303, 1989.

hypothesized relationships between the exogenous and endogenous variables or between endogenous variables.

In a path analysis, there are as many regression equations as there are endogenous variables specified in the model. The exercise model has six endogenous variables; therefore, six regression equations were analyzed. The exogenous variables are defined as follows:

Z_1 = Gender

Z_2 = Duration of diabetes

Z_3 = Diabetes related comorbidities

Z_4 = Acculturation

Z_5 = Cognitive function

The endogenous variables in their standardized forms are:

Z_6 = Self efficacy

Z_7= Family diabetes support

Z_8 = Family function

Z_9 = Barriers to exercise

Z_{10} =Knowledge

Z_{11} =Exercise self-care behavior

e= disturbance error or residual term

The standardized forms of the six structural equations that described the model are listed below.

$$Z_6 = P_{61} Z_1 + e_6$$

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

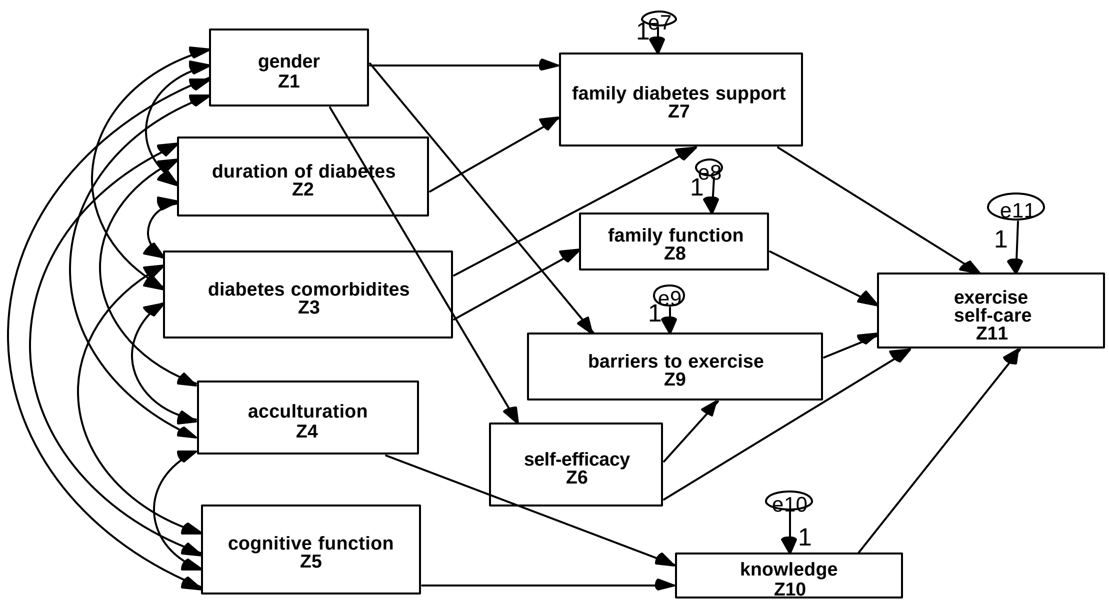
$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

Figure 3.4 Proposed Exercise Path Model



Full Model- Exercise

Table 3.53 presents the zero-order correlation coefficients for each set of variables in the model. After the six regression analyses were conducted, the following seven paths were significant in the full model:

1.) family diabetes support and exercise self-care;
2.) barriers to exercise and exercise self-care;
3.) self-efficacy and barriers to exercise;
4.) self-efficacy and exercise self-care;
5.) acculturation and knowledge;
6.) cognitive function and knowledge; and
7.) knowledge and exercise self-care.

Family diabetes support and self-efficacy each had a direct positive effect on exercise self-care behavior. Barriers to exercise had a direct negative effect on exercise self-care behavior. The lower the frequency of perceived barriers, the greater the level of exercise self-care behavior. Based on the standardized path coefficients, family diabetes support and self-efficacy were about equal in strength in their direct effects on exercise self-care. In addition to the direct effect self-efficacy had on exercise self-care, self-efficacy had an indirect effect via barriers to exercise. The regression analysis with cognitive function, acculturation and knowledge used in the diet model was the same analysis in the exercise model. That is acculturation and cognitive function both had direct positive effects on knowledge. The more acculturated an individual is, the higher the scores on the knowledge instrument. The higher the score on the CLOX instrument (better cognitive function), the higher the score on the knowledge instrument.

Figure 3.5 presents the standardized path coefficients for the exercise model. The significant path relationships between the variables are shown by asterisks beside the path coefficients. A total of seven paths were found to be significant. The paths for which the relationships were not significant were eliminated and the regression analyses were repeated.

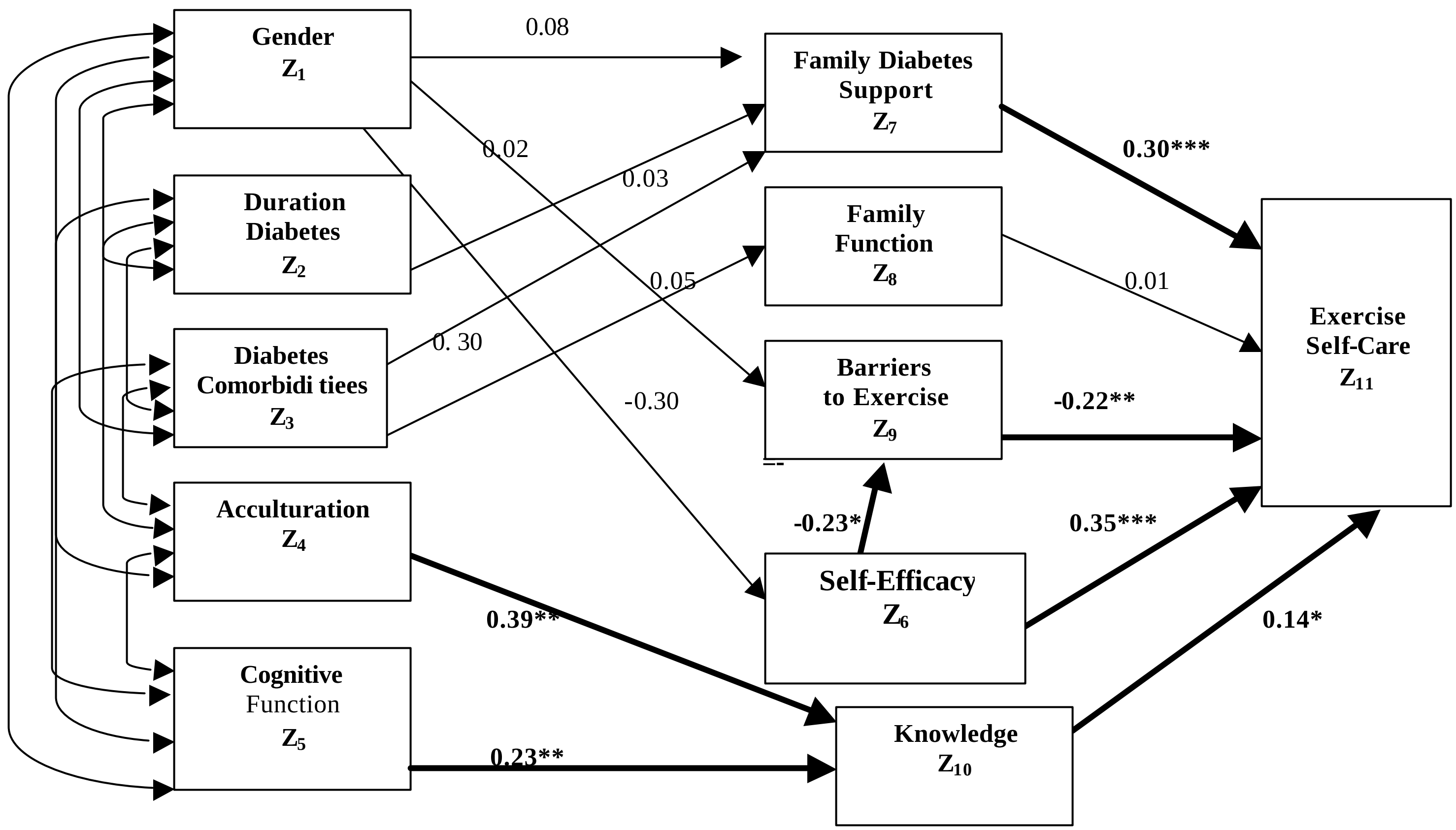
Table 3.53 Zero-Order Intercorelation Matrix of Model Variables for Exercise Model[a]

VARIABLE	GEN	DUR	COM	ACCULT	COG FX	FAMEX	APGAR	BAR EX	SE EXER	KNOW	EXERSC
GEN	1	-0.02	-0.11	0.110	0.02	0.07	0.08	-0.04	-0.03	0.12	0.05
DUR		1	0.12	-0.02	-0.12	0.02	-0.03	-0.04	-0.08	-0.09	0.06
COM			1	-0.03	-0.18*	0.02	0.05	-0.09	0.08	-0.03	-0.03
ACCULT				1	0.15	0.22**	0.11	-0.02	0.05	0.42**	0.05
COGFX					1	0.17*	-0.10	-0.04	-0.07	0.28**	0.08
FAMEX						1	0.05	-0.17*	0.11	0.19	0.42*
APGAR							1	-0.04	0.25**	-0.03	0.11
BAREX								1	- 0.23**	-0.02	-0.36**
SEEXER									1	-0.08	0.43**
KNOW										1	0.19
EXERSC											1

* Correlation is significant at the 0.05 level ** Correlation is significant at the 0.01 level

[a] Key for Variables: GEN = Gender; DUR = Duration Diabetes; COM = Diabetes Comorbidities; ACCULT = Acculturation; COGFX = Cognitive Function; FAMEX = Family Diabetes Support; APGAR = Family Function; BAREX = Barriers to Exercise; SEEXER = Self-Efficacy; KNOW = Knowledge; EXERC = Exercise Self-Care

Figure 3.5 Exercise Path Model with Standardized Path Coefficients



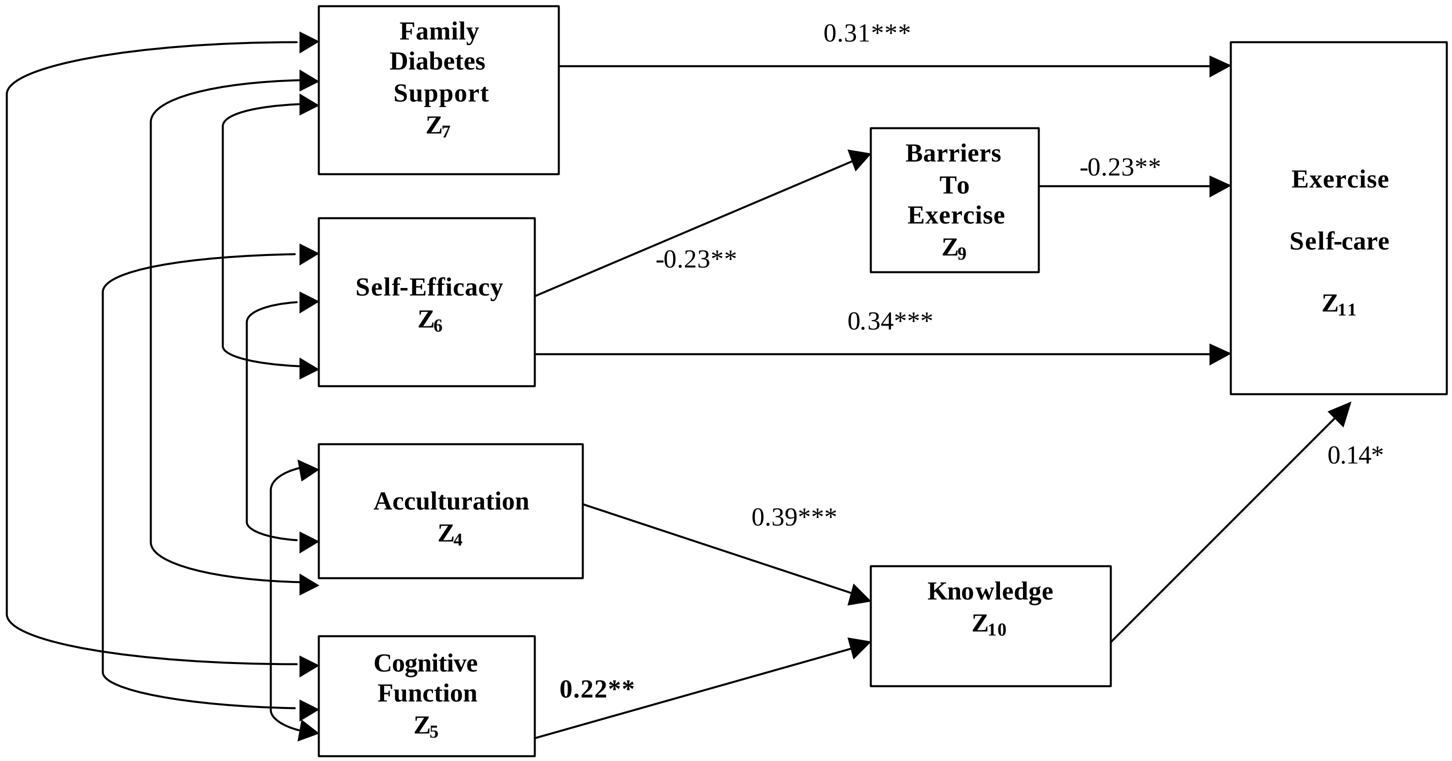
* significant at p <0.05 level ** significant at p < 0.01 *** significant p <0.001

__Final Model- Exercise__

After the insignificant paths from the full model were eliminated, the regression analyses were repeated. The final model has seven significant paths and is depicted in Figure 3.6. The paths that were significant in the full model remained significant in the second analysis.

The final model shows that family diabetes support, self efficacy, barriers and knowledge have direct effects on exercise. Self-efficacy also has an indirect effect moderated by barriers to exercise. Barriers to exercise, as hypothesized had a direct negative effect on exercise self-care. Based on the standardized coefficients, self-efficacy has a greater direct effect than an indirect effect on exercise self-care. The magnitude of the direct effects of family diabetes support and self-efficacy on exercise self-care behaviors were similar. Knowledge had the weakest direct effect on exercise self-care. The adjusted R^2 of the final exercise model was 0.37. The model explained 37 percent of the variance in the exercise self-care behavior. Table 3.54 presents the standardized model equations and squared multiple correlations for the final exercise model.

Figure 3.6 Final Exercise Model with Standardized Path Coefficients



* significant p <0.5; ** significant at p < 0.01; *** significant at p < 0.001

Table 3.54 Standardized Model Equations and Squared Multiple Correlations for FINAL Exercise Model

Dependent Variable[a]	Model Equations	R^2
BAREX	$= -0.23SEEXER + 0.26e_{barex}$	0.054
KNOW	$= 0.39ACCULT + 0.22COGFX + 4.3e_{know}$	0.233
EXERSC	$= 0.31FAMEX + {}^{-}0.23BAREX + 0.34SEEXER + 0.14KNOW + 1.12\ e_{exersc}$	0.386

[a] ACCULT = acculturation
BAREX =barriers to exercise
COGFX = cognitive function
EXERSC = exercise self-care
FAMEX = family diabetes support (exercise)
KNOW = knowledge
SEEXER = self-efficacy (exercise)
e = error

The unstandardized correlation coefficients for the variables in the final exercise model are shown in Table 3.55. For the dependent variable, (barriers to exercise), the unstandardized path coefficient for the independent variable (self-efficacy) quantifies the effect of self-efficacy on barriers to exercise when other variables in the model are controlled. The frequency of barriers to exercise decreased by 0.24 units for each unit increase in the self-efficacy scale. For the dependent variable, knowledge regarding diabetes, the unstandardized path coefficient of each of the three independent variables quantifies the variables' effects on knowledge when other variables in the model are controlled. Performance on the knowledge instrument increased by 0.94 percent for each unit increase in the acculturation scale. Performance on the knowledge instrument increased by 0.38 percent for each unit (point) increase in the CLOX 1.

The unstandardized path coefficient of each of the four independent variables quantifies the variables' effects on exercise self-care when other variables in the model are controlled. The number of days per week older adults exercised increased by 0.53 days for every unit increase in the family diabetes support scale. The number of days per week older adults exercised increased by 0.70 days for every unit increase in self-efficacy scale. The number of days per week older adults exercised increased by 0.03 days for each one percent increase in the knowledge scale.

Table 3.55 Unstandardized Correlation Coefficients for Paths Included in Final Exercise Model

Dependent Variable and Independent Variable	Unstandardized Coefficient
Perceived Barriers -exercise	
Self-efficacy- exercise	-0.24
Knowledge	
Acculturation	0.94
Cognitive Function	0.38
Exercise Self-care	
Perceived Family Support -exercise	0.53
Perceived Barriers- exercise	-0.46
Self-efficacy – exercise	0.70
Knowledge	0.03

Direct and Indirect Effects

Table 3.56 shows the effects of the variables on the final model for exercise self-care behavior. From the table, it can be seen that the primary effect on the dependent variables is the direct effects from the independent variables. The contribution through intervening variables was weak.

Table 3.56 Effects of Variables on Exercise Self-Care Behavior

Variable	Total Effect	Direct	Indirect	Joint Effect or Spuriousness
Self-efficacy	0.43	0.34	0.05[a]	0.04
Family Diabetes Support	0.42	0.31	----------------	0.11
Barriers to Exercise	-0.36	-0.23	-----------------	-0.13
Acculturation	0.05	------	0.06[b]	-0.007
Cognitive Function	0.08	------	0.03[c]	0.05
Knowledge	0.19	0.14	-----------------	0.05

[a] Indirect effect is calculated as the product of the path coefficients of the variables involved (-0.23) x (-0.23)
[b] indirect effect = (0.39) x (0.14)
[c] indirect effect = (0.22) x (0.14)

Assumptions of Linear Regression

Steps were taken to check for violations in the assumptions for linear regression. The assumptions in linear regression are that the variables are normally distributed, relationships between the dependent and independent variables are linear, and the errors are independent and follow a normal distribution with constant variance.[471] Histograms of the dependent variables and the residuals were examined to determine whether the assumptions of normality, constant variance and linearity had been violated.

Normality

Histograms of the dependent variables in both the diet and exercise models were examined. In addition, the skewness and kurtosis of the variable were examined. The index of skewness takes a value from +3 to –3 with 0 being a symmetrical distribution.[472] A positively skewed distribution indicates that most of the cases are below the mean and negatively skewed means the opposite. Kurtosis is the proportion of scores that occur in middle of distribution or in its tail relative to those in normal curves.[473] Positive kurtosis means that there are

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[471] Stevens J. Multiple Regression in *Applied Multivariate Statistics for the Social Sciences*, New Jersey, Lawrence Erlbaum, 92-100, 1996.

[472] Kline R. Preparation and Screening in *Principles and Practice of Structural Equation Modeling,* New York, Guilford Press, 67-91, 1998.

[473] Ibid.

too many cases in the tails and too few in the middle. Negative kurtosis implies the opposite–– too few cases in tails and too many in the middle. The normal probability plots were also examined to determine if the residuals are from a normal distribution. When the residuals are from a normal distribution, the plotted values fall close to the line in the normal probability plot.

The histograms and normal probability plots for the following variables are shown in Appendix F (Figures F.1 through F.18): diabetes family support-diet, diabetes family support- exercise, family function, barriers to diet, barriers to exercise, knowledge, self-efficacy- exercise, general diet self-care, and exercise self-care.

The histograms of the dependent variables indicated that several of the dependent variables were not normally distributed. The family function (Figure F.5), general diet self-care (Figure F.15) and exercise self-care (Figure F.17) variables appear to violate the assumption of normality.   The Kolmogorov-Smirnov statistic was used to test the null hypothesis that the data are from a normal distribution. All of the dependent variables had Kolmogorov-Smirnov statistics with p levels < 0.001 (which rejects the null hypothesis that the data is from a normal distribution) with the exception of the barriers to diet scores, with a Kolmogorov-Smirnov statistic = 0.067 and $p = 0.080$.

The histogram for family function appears negatively skewed (Figure F.5). The skewness = -1.43 which means most of the cases are above the mean and kurtosis = 1.63 which indicates that too many cases are in the tail of the distribution. In the cumulative normal probability plot, the points did not fall along the line. Many of the points in the middle of the plot appeared right above the line rather than on the line (Figure F.6). In this regression model, the assumption of normality was violated.

Family diabetes support- exercise appears to be non-normally distributed with peaks in the histogram (Figure F.3). The skewness is –0.097 and kurtosis = 1.18. The distribution is negatively skewed with a positive kurtosis. The normal probability plot indicates that there are two peaks in the distribution (Figure F.4).

The histogram of barriers to exercise and the normal probability plot of the residuals indicated that the distribution appears to be slightly positively skewed (Figures F.9 and F.10.). The normal probability plot indicates that there are points that lie below the line. The skewness = 0.93 and kurtosis = 0.77.

The histogram for general diet self- care is negatively skewed. The data on the cumulative probability plot did not fall along the reference line but mainly fell above the line. Skewness = -1.03 and kurtosis = 0.57 (Figures F.15 and F.16).

The histogram of self-efficacy- exercise shows a negatively skewed distribution (Figure F.13). The skewness = -0.41 and kurtosis = -1.11. Most of the cases are above the mean and the negative kurtosis implies that too many cases are in the middle and not that many in the tails. The normal probability plot has *granularity*, which indicates that certain discrete values occur repeatedly in the data.[474] They appear as plateaus separated by gaps and the data does not fall around the line at all (Figure F.14).

The histogram for exercise self- care shows the variable is not normally distributed (Figure F.17). The data appears to be distributed at the extreme–– low and high values. The skewness = 0.57 and kurtosis = -1.38. However, the normal probability plot of the residuals shows that the residuals are from a normal distribution. The points tend to fall on the reference line (Figure F.18).

The distributions of some of the dependent variables do violate the normality assumption. This is a limitation of the study and the results of the study may be biased.

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[474] Hamilton L. *Regression with Graphics*. Belmont, Wadsworth Publishing, 1-17, 1992.

Constant Variance

In the constant variance assumption, the values for the dependent variable are normally distributed for each value of the independent variable. To determine if the assumption of constant variance has been violated, the scatter plots of the residuals against the predicted values of the dependent variables were examined. The standardized residuals should scatter randomly about the horizontal line. Any systematic pattern or clustering of the residuals suggests a model violation.[475]

The scatterplots for regression residuals versus the standardized predicted values for the variables in the diet and exercise models are shown in Appendix G. The scatterplots for the residuals appear to be evenly distributed for barriers to diet (Figure G.2), knowledge (Figure G.4), and barriers to exercise (Figure G.7). The scatterplots for the regression residuals for family function, general diet self-care, family diabetes support- exercise, self-efficacy –exercise, and exercise self-care violate the assumptions of constant variance.

The scatterplot of the residuals for the dependent variable family function shows heteroscedasticity (Figure G.3). The distribution for the family function scores were negatively skewed. The scatterplot of the residuals for the dependent variable family diabetes support –exercise reflects the distribution of the family diabetes support variable, with a single peak in the middle of the distribution

[475] Stevens J. Multiple Regression in *Applied Multivariate Statistics for the Social Sciences*. New Jersey, Lawrence Erlbaum, 92-96, 1996.

(Figure G.6). The scatterplot of the residuals for the dependent variable self-efficacy- exercise reflects two parallel lines which is probably due to the dichotomous independent variable- gender (Figure G.8). The scatterplot for the mean exercise score appears to violate the assumption for constant variance. (Figure G.9). This may be due to the distribution of the mean exercise score where there is a bipolar distribution with greater frequency of scores at the extreme and a few cases in the middle of the distribution.

Linearity

The scatterplots of the standardized residuals versus predicted values used to check the constant variance were used to check for linear relationships. The standardized residuals should scatter randomly about a horizontal line.[476] Any systematic pattern or clustering of the residuals would suggest a model violation.

The scatterplots of the standardized residuals versus predicted values for family function (Figures G.3), family diabetes support- exercise (Figure G.6), and exercise self-care (Figure G.9) violate the linearity assumptions. However, non-linear relations between variables are not a problem per se.[477] It has been shown that the F and T tests are robust statistics and can resist violation of the

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[476] Stevens J. Multiple Regression in *Applied Multivariate Statistics for the Social Sciences.* New Jersey, Lawrence Erlbaum, 92-96, 1996.

[477] Kline R. Data Preparation and Screening in *Principles and Practice of Structural Equation Modeling.* New York ,Guilford Press, 67-91, 1998.

assumption.[478] In general, one can proceed with multiple regression analysis; however, one must be aware that serious violations of the assumptions can distort the results.

MULTICOLLINEARITY

Multicollinearity occurs when there are moderate to high intercorrelations among the predictors.[479] The *tolerance* of a variable is used as a measure of colinearity. It is the proportion of the variance in the variable that is not accounted for by other independent variables. Tolerance is defined as 1 - squared multiple correlation (R^2). Therefore, a tolerance of 0 indicates perfect colinearity. Tolerance values less than 10% may indicate multicollinearity and squared multiple correlations (R^2) greater than 0.90 suggest multicollinearity.[480]

The variance inflation factor (VIF) is the ratio of the variable's total variance in standardized terms to its unique variance. The VIF is the reciprocal of tolerance. Variables with high tolerance have small variance inflation factors

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[478] Kerlinger F.N. and Pedhazur E.J. Elements of multiple regression theory and analysis: two independent variables in *Multiple Regression in Behavioral Research.* New York, Holt, Rinehart and Winston, 47-48, 1973.

[479] Stevens J. Multiple Regression in *Applied Multivariate Statistics for the Social Sciences.* New Jersey, Lawrence Erlbaum, 76-78, 1996.

[480] Kline R. Data Preparation and Screening in *Principles and Practice of Structural Equation Modeling.* New York, Guilford Press, 67-91, 1998.

and vice versa. A VIF value greater than 10 may indicate there is redundancy among the variables.

Multicollinearity was assessed in the study by examining the *tolerance* and *VIF* values of the independent variables. The VIF values ranged from 1 to 1.02 and the tolerance values ranged from 0.877 to 1.0. There was not a problem with multicollinearity in the study based on the tolerance and the VIF values.

OUTLIERS

The regression program in SPSS identified residuals outside 3 standard deviations. An influential data point is defined as one that when deleted produces a substantial change in at least one of the regression coefficients.[481] Cook's distance measures the combined influence of the case being an outlier on the actual scores and on the set of predictors. A Cook's distance greater than one would generally be considered large.[482]

There were three cases identified as outliers in the diabetes-related comorbidities variable. The Cook's distance ranged from 0.051 to 0.090. Two cases were identified as outliers in the barriers to exercise variable. The Cook's distance ranged from 0.033 to 0.096. There was no need to delete the cases because they would not have affected the results of the analysis.

[481] Stevens J. Multiple Regression in *Applied Multivariate Statistics for the Social Sciences.* New Jersey, Lawrence Erlbaum, 76-78, 1996.
[482] Ibid.

MISSING DATA

There was a total of 23 instances of missing data in the *diet* model. These instances occurred over 21 respondents. The range of missing data for variables in the diet model ranged from 0.6% to 9.3%. In the exercise model, there was a total of 21 instances of missing data and they were spread over 22 respondents. The range of missing data for variables in the exercise model was the same as in the diet model- ranged from 0.6 to 9.3%. The variable with the greatest number of missing data was the cognitive function score. As discussed earlier in this chapter, these participants declined to perform the clock drawing tasks for various reasons.

To determine if the patterns of missing observations were random or systematic, the respondents with complete data were compared with those with missing data. There were 139 participants with complete data on all variables in the diet model and 21 with missing data. In the exercise model, there were 138 participants with complete data on all variables in the exercise model and 22 with missing data. Independent groups t-tests were used to compare means on all variables in the respective model between the participants with complete data and those with missing data. There were significant differences between the groups in the diet and exercise model. In the diet model, there were significant differences on the number of diabetes-related comorbidities and the knowledge score ($p < 0.05$

for both variables). The participants with a complete data in the diet model had a lower group mean for number of comorbidites (1.86 vs 2.50) and a higher mean score on the knowledge scale (70.5% vs 64.9%).

In the exercise model, there were significant differences between the groups in number of diabetes-related comorbidities, knowledge score and level of acculturation. The participants with a complete data in the exercise model had a lower group mean for number of comorbidites (1.87 vs 2.43) and higher mean score on the knowledge scale (71.3% vs 60.6%). The group mean for level of acculturation was also significantly different. Those with complete data were more acculturated with a mean acculturation score of 2.14 vs 1.50 for those with incomplete data. The missing data pattern is systematic and this implies that cases with missing observations differ systematically from those with scores on that variable. This pattern of data loss is not ignorable because the results from respondents with complete data may not be generalized to those for whom scores are missing.

The *listwise* method was used to handle missing data. In this method only respondents who have data for all variables in the analysis are included in the analysis. In l*istwise* deletion only cases with complete data are included and this number can be smaller than the original n.

RESPONSE SET BIAS

Some researchers have found that Hispanics tend to use extreme response categories in proportions that are higher than those found among the non-Hispanic white population.[483] They have found that Hispanic respondents are less likely to select the middle response categories whenever they are presented with response scales such as a five-point Likert scale. Hispanics more often choose the extremes *strongly agree* or *strongly disagree* and are less likely to select the scales in between.

The frequencies of the score distributions for the items used in the scales for the path models were examined to determine if there was a preference for extreme responses. Of the 16 items used in the Diabetes Family Behavior Checklist-II, seven of those items had a distribution of scores where over 50 percent selected an extreme response. For example, the items "criticize you for not recording blood glucose results" and "exercise with you," approximately 70-80 percent of the sample selected "never." For the item "eat with you," 80 percent selected "at least once a day."

The family satisfaction scale was negatively skewed, with many participants selecting "agree" and "strongly agree." In the 28-item barriers scale,

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[483] Marin G. and Marin B. Potential problems in interpreting data in *Research with Hispanic Populations.* Newbury Park, California, Sage Publications, 101-123, 1991.

there were 15 items where over 50 percent of the respondents selected an extreme score. There was a pattern in the frequency of barriers. Respondents selected extreme scores for some of the items that measure the same type of barrier. For example “time to prepare food,” “time to take medication” and “time to test blood glucose” all had over 50 percent of the respondents selecting the extreme response 1 = very rarely or never.

The Family APGAR scale was negatively skewed where the majority of the respondents selected “agree” or “strongly agree.” The non-family support scale had 50-60 percent of the respondents selecting extreme scores in the items. There was one item on the self-efficacy scale “confidence to take meds where 65 percent of the respondents selected “strongly agree” but 30 percent selected “agree.” In the Summary of Diabetes Self-care Activities, there was a bimodal type of distribution in scores seen in the two exercise items. There were some items where the distribution of scores were high on the extreme responses, but overall, there did not appear to be a problem with response set bias.

MODEL FIT

AMOS

Multiple regression was used to analyze the path models for diet and exercise. The Analysis of Moment Structure (AMOS 4.0)[484] program was used to compare the hypothesized models of interrelations among the variables with the actual data set. The AMOS model fitting program was used to evaluate the full models and the final models for global model fit for both exercise and diet models.

In the modeling program, a covariance matrix was analyzed. The parameters were estimated using maximum likelihood estimation procedure (ML). ML estimation is robust to moderate departures from multivariate normality.[485] Error is assumed to be uncorrelated with every other predictor variable–- a fundamental assumption in linear regression .[486]

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[484] Analysis of Moment Structure (AMOS 4.0), SPSS Inc, Chicago, Illinois, 1995.

[485] Kline R. Data Preparation and Screening in *Principles and Practice of Structural Equation Modeling.* New York, Guilford Press, 67-91,1998.

[486] Arbuckle J.L. and Wothke W. *Amos 4.0 User's Guide*. Chicago, SmallWater's Corporation, 109, 1999.

Tests of Absolute Fit

Diet Model

Full Model

AMOS provides the overall *chi-square* value which serves as an overview of model fit. In structural equation modeling (SEM), the primary task in model-fitting is to determine the goodness of fit between the hypothesized model and the sample data. The researcher specifies a model and then tests the model with the sample data. In SEM, the null hypothesis that is being tested is that the specified model holds in the population. Unlike traditional statistical procedures, the researcher hopes to NOT reject the null hypothesis.

In the full general diet model, the chi square test of overall model fit for the full model was 59.36 (df = 27; $p < 0.001$). With the probability value of the chi-square test being less than 0.05, the null hypothesis was rejected. Based on the significant chi-square statistic, the data does not fit the model.

The modification indices and the significant levels of the parameters were used to add paths to the model to improve the fit. Adding paths to the model to improve the fit must be justified theoretically. The modification indices for the full diet model suggested adding the following covariance paths:

error term on family support $\longleftrightarrow$ self-efficacy diet

error term on family function $\longleftrightarrow$ self-efficacy diet

error term on diet self- care $\longleftrightarrow$ gender

One must consider the implications of respecifying the model. When one respecifies the model based on the modification index results, one is respecifying the model based on sample dependent results. [487] When this happens, one is relying on empirical data rather than theory to specify the model. This may be more difficult to replicate the results in studies with different samples. Modification of the models should be based upon theory as well as empirical data provided by the modification indices. In looking at the modification indices for this model, it does not seem possible to correlate the residuals of family support and the self-efficacy measure; or the residuals of family function on self-efficacy; or likewise, the residuals of diet self care on gender.

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[487] Structural Equation Modeling using AMOS: An Introduction, available at http://www.utexas.edu//cc/stat/tutorials/amos/index.html, Accessed June 3, 2002.

Final Model

The trimmed model with the deletion of the non-significant paths was tested. The *chi-square* test of overall model fit for the final diet model was 3.09 (df =1; p =0.079). The null hypothesis was accepted; the data fits the model.

Exercise Model

Full Model

The *chi-square* test of overall model fit for the full model was 44.83 (df = 31; p = 0.052). With the probability value of the *chi-square* test being greater than 0.05 level, the null hypothesis was accepted; the data fit the model.

Final Model

The trimmed model with the deletion of the non-significant paths was tested. The *chi-square* test of overall model fit for the final exercise model was 7.98 (df = 8; p=0.44). The null hypothesis that the data fit the model was accepted.

Goodness of Fit Statistics

AMOS provides multiple goodness of fit statistics. The incremental or comparative indexes are based on a comparison of the hypothesized model and some standard model, usually the independence model. There are several comparative indexes, such as the normed fit index, comparative fit index, incremental fit index, and Tucker-Lewis index. The normed fit index (NFI) and the comparative fit index (CFI) are derived from comparison of a hypothesized model with an independence model.[488] Values range from zero to one. A value greater than 0.95 has been recommended as representative of a well fitting model. The NFI and CFI values were 0.98 and 0.99, respectively, for the full diet model and 1.0 for both the NFI and CFI of the final diet model. The NFI and CFI values were 0.99 and 1.0, respectively, for the full exercise model and 1.0 for both the NFI and CFI for the final exercise model.

The incremental index of fit (IFI) is a derivative of the NFI but takes into consideration parsimony and sample size. Values close to 0.95 are indicative of good fit. The IFI for the full diet model was 0.99 and for the final model was 1.0. Another comparative index is the Tucker Lewis Index (TLI) which compares the absolute fit of your model with the absolute fit of the independence model.

[488] Byrne B. *Structural Equation Modeling with AMOS.* New Jersey, Lawrence Erlbaum, 78-88, 2001.

Values for Tucker Lewis Index (TLI) > 0.95 are indicative of good fit.[489] The TLI for all four models were > 0.95.

The root mean square error of approximation (RMSEA) takes into account the error of approximation in the population. The RMSEA measures the discrepancy and is expressed per degrees of freedom. The RMSEA is sensitive to the number of estimated parameters in the model (or the complexity of the model). Values less than 0.05 indicate good fit and values as high as 0.08 to 0.10 indicate mediocre fit, and those greater than 0.10 indicate poor fit. The confidence intervals provided for the RMSEA gives the researcher more information in evaluating model fit. If there is a small RMSEA but a wide confidence interval, one may conclude that the estimated RMSEA may be imprecise. The confidence interval for RMSEA is influenced by complexity (number of parameters) and sample size. If the sample size is small, but the number of parameters is large, the confidence interval will be wide.

The RMSEA value for the full diet model was 0.087, indicating a mediocre fit and for the final diet model was 0.115 indicating a poor fit. The RMSEA model for both exercise models indicated good fit. Based on the goodness of fit statistic, the final exercise model appeared to have pretty good fit

[489] Ibid.

followed by the full exercise and diet. Table 3.57 presents the goodness of fit measures for the diet and exercise models.

The most commonly reported fit statistics are the *chi-square*, its degrees of freedom, its probability value, the Tucker Lewis Index, The Root Mean Square Error of Approximation and its lower and upper confidence interval boundaries.[490]

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[490] Structural Equation Modeling using AMOS: An Introduction, available at http://www.utexas.edu//cc/stat/tutorials/amos/index.html, Accessed June 3, 2002.

Table 3.57 Goodness of Fit Measures for Diet and Exercise Models

Goodness of Fit Statistic	Criteria	Diet Model Full	Diet Model Final	Exercise Model Full	Exercise Model Final
Chi-Square	Not significant	59.36	3.09	44.84	7.98
	(p>0.05)	0.000	0.079	0.052	0.435
NFI	>0.95= good fit	0.983	0.997	0.985	0.996
CFI		0.991	0.998	0.995	1.000
IFI		0.991	0.998	0.995	1.000
TLI		0.977	0.982	0.990	1.000
RMSEA	<0.05=	0.087	0.115	0.053	0.000
Lower	good fit	0.057	0.000	0.000	0.000
Upper		0.117	0.270	0.085	0.093
	0.08 to 0.10 = mediocre fit				

NFI — Normed Fit Index
CFI — Comparitive Fit Index
IFI — Incremental Fit Index
TLI — Tucker Lewis Index
RMSEA — Root Mean Square Error of Approximation

MISSING DATA- AMOS

AMOS computes full information maximum likelihood estimates (FIML) in the presence of missing data.[491] This is based on the assumption that the data are missing at random.

[491] Arbuckle J.L. and Wothke W. *Amos 4.0 User's Guide.* Chicago, Small Water's Corporation, 331-334, 1999.

NON-FAMILY SUPPORT

Since the scores on the two measures of support — family support and non-family support cannot be combined to form a composite score, additional regression analyses were conducted for the non-family support measure for both diet and exercise behaviors. In the path model, non-family support was substituted for family support in both the diet and exercise model.

Diet Model

The proposed model for non-family support and diet self-care is depicted in Figure 3.7.

The exogenous variables are defined as follows:

Z_1 = Gender
Z_2 = Duration of diabetes
Z_3 = Diabetes related comorbidities
Z_4 = Acculturation
Z_5 = Cognitive function
Z_6 = Self efficacy

The endogenous variables in their standardized forms are:

Z_7= Non-family support

Z_8 = Family function

Z_9 = Barriers to diet

Z_{10} =Knowledge

Z_{11} =General diet self-care behavior

e= disturbance error or residual term

The standardized forms of the five structural equations that described the model are listed below.

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

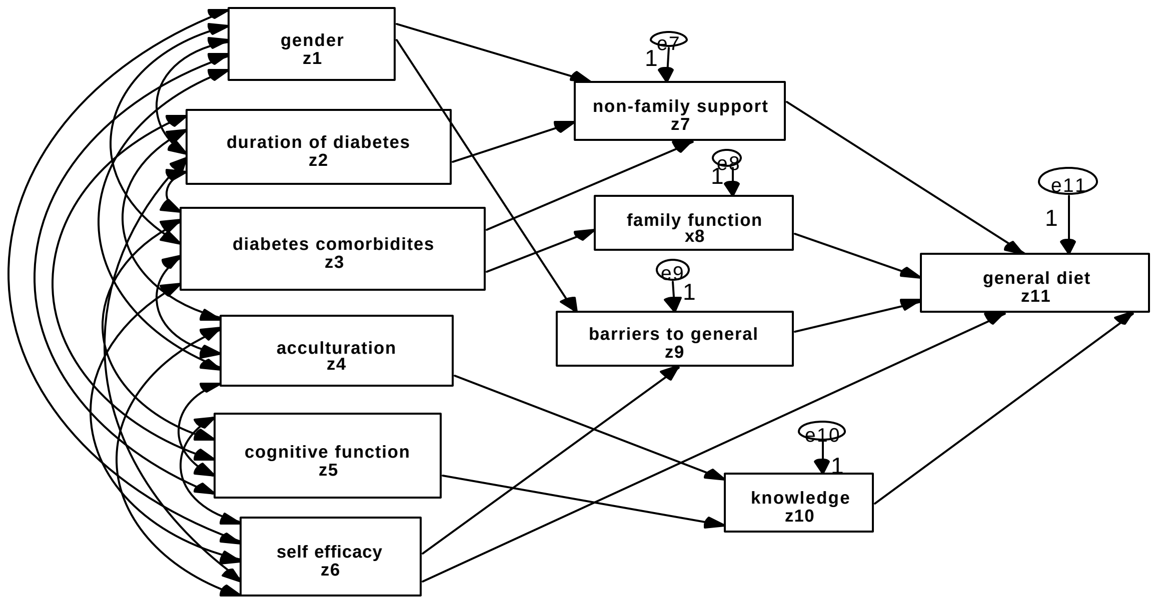
$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

Figure 3.7 Proposed Non-Family Support and General Diet Path Model

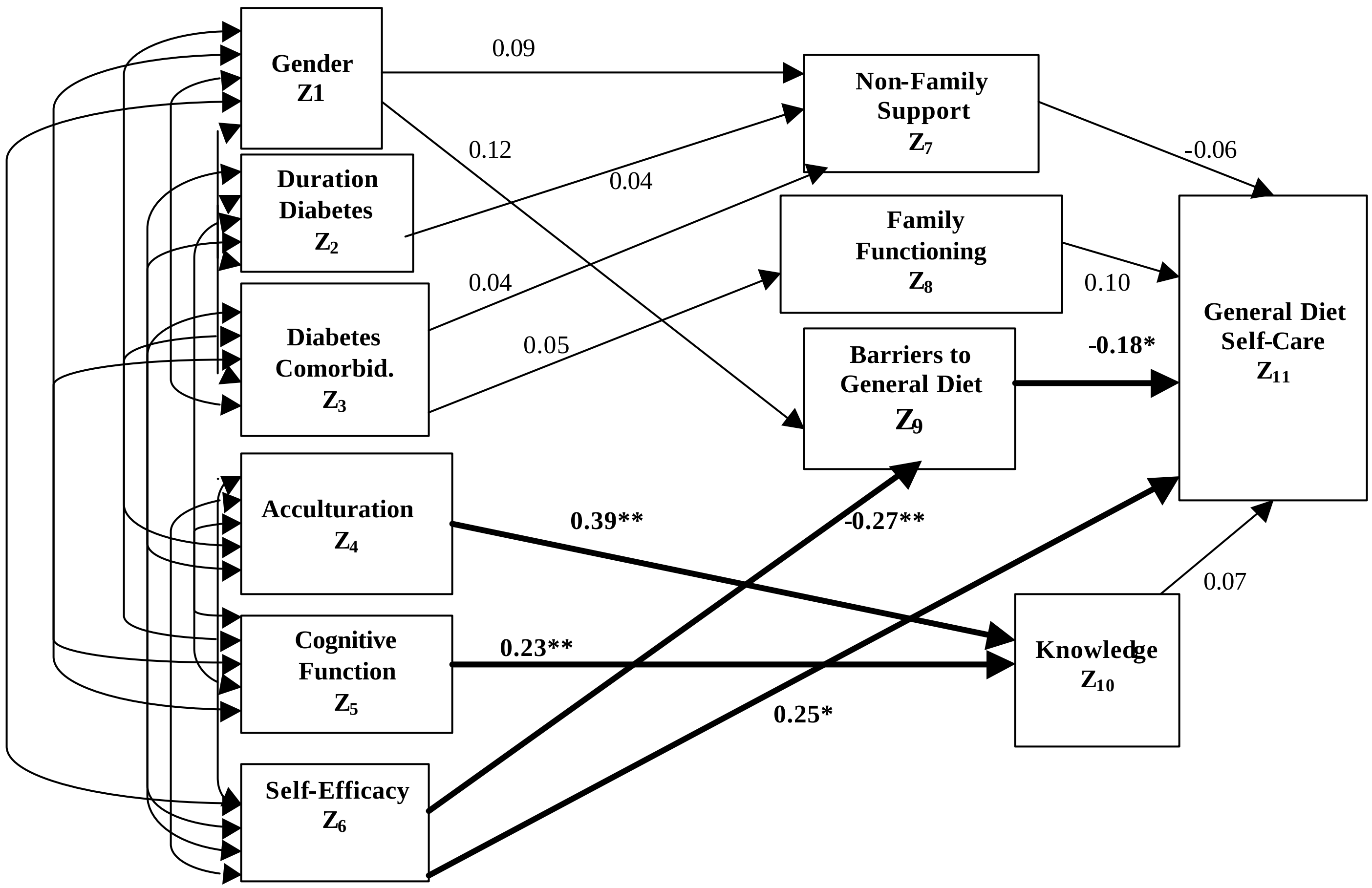


After the five regression analyses were conducted, a total of five paths were found significant. None of the paths with non-family support were significant. The five significant paths included the following:

1.) self-efficacy and general diet self-care;
2.) barriers to diet and general diet self-care;
3.) self-efficacy and barriers to diet;
4.) acculturation and knowledge ; and
5.) cognitive function and knowledge.

Figure 3.8 presents the non-family support and general diet model with the standardized path coefficients. The significant path relationships between the variables are shown by asterisks beside the path coefficients.

Figure 3.8 Non-Family Support and General Diet Path Model with Standardized Path Coefficients



** significant at p <0.05 level ** significant at p <0.01 level

Exercise Model

The proposed model for non-family support and exercise self-care is depicted in Figure 3.9. The exogenous variables are defined as follows:

Z_1 = Gender

Z_2 = Duration of diabetes

Z_3 = Diabetes related comorbidities

Z_4 = Acculturation

Z_5 = Cognitive function

The endogenous variables in their standardized forms are:

Z_6 = Self efficacy

Z_7= Non-family support

Z_8 = Family function

Z_9 = Barriers to exercise

Z_{10} =Knowledge

Z_{11} =Exercise self-care behavior

e= disturbance error or residual term

The standardized forms of the six structural equations that described the model are listed below.

$$Z_6 = P_{61} Z_1 + e_6$$

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$

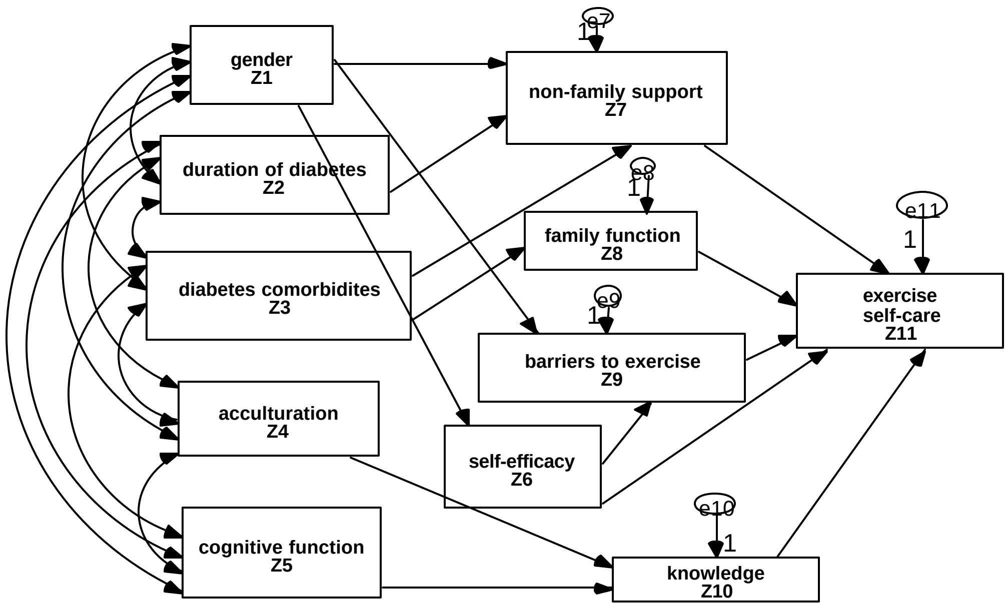
$$Z_8 = P_{83} Z_3 + e_8$$

$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$

$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$

$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

Figure 3.9 Proposed Non-Family Support and Exercise Path Model

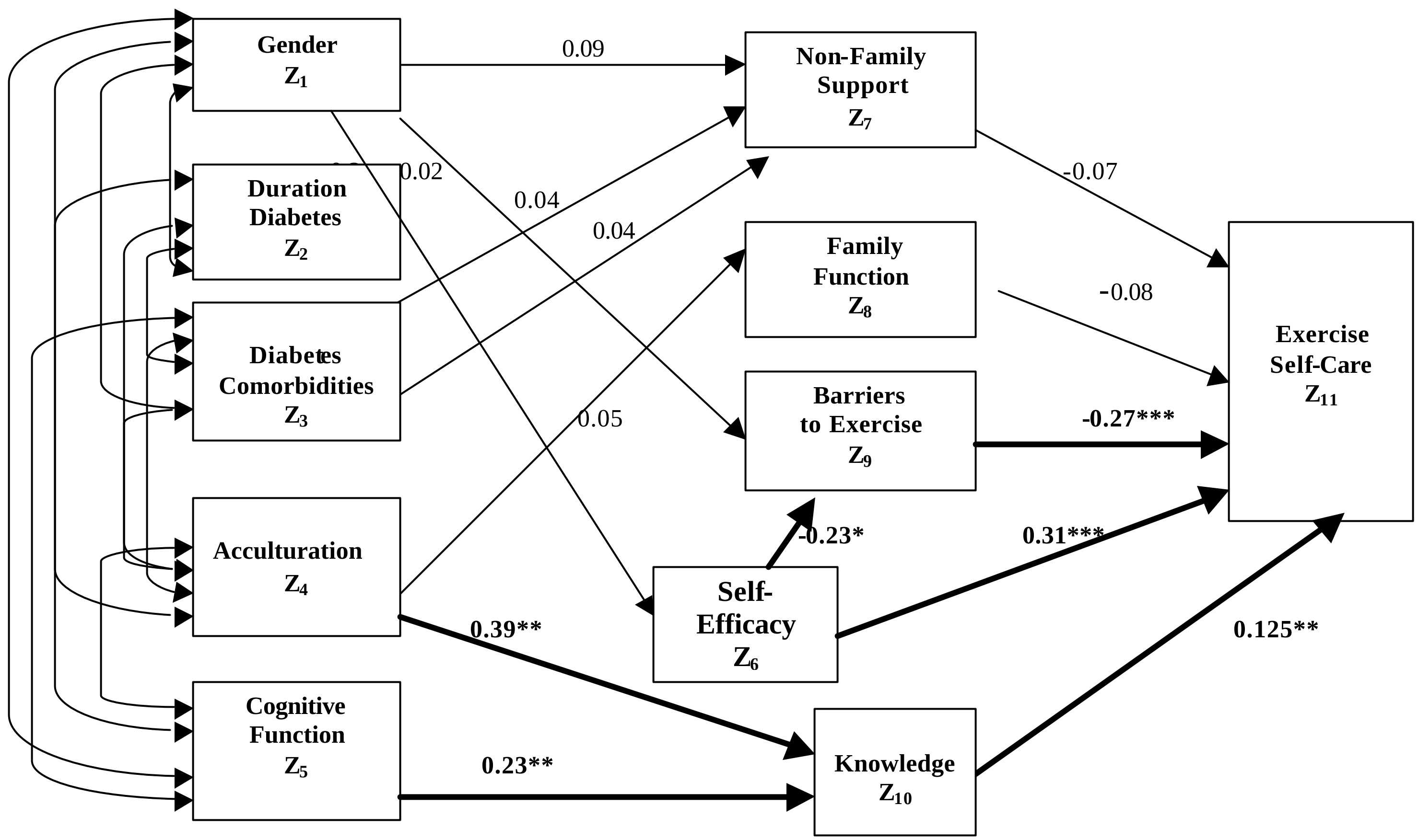


After the six regression analyses were conducted, a total of six paths were found significant. None of the paths with non-family support were significant. The six significant paths included the following:

1.) barriers to exercise and exercise self-care;
2.) self-efficacy and barriers to exercise;
3.) self-efficacy and exercise self-care;
4.) acculturation and knowledge ;
5.) cognitive function and knowledge; and
6.) knowledge and exercise self-care.

Figure 3.10 presents the non-family support and exercise model with the standardized path coefficients. The significant path relationships between the variables are shown by asterisks beside the path coefficients. Like the diet model, non-family support did not have a significant effect on exercise self-care.

Figure 3.10 Non-Family Support and Exercise Path Model with Standardized Path Coefficients



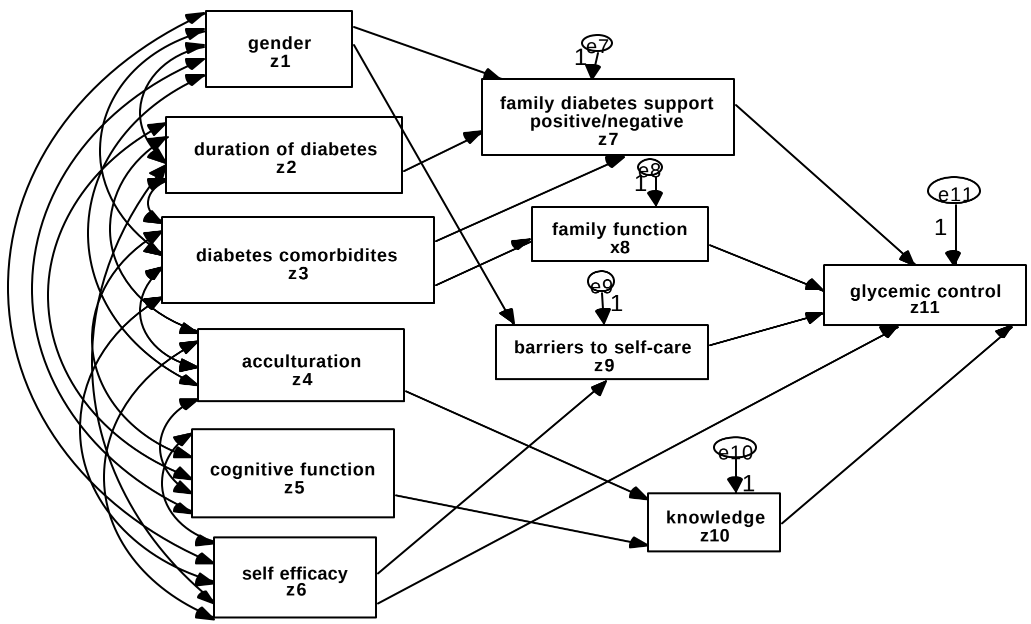
* significant at p <0.05 level ** significant at p < 0.01 *** significant p <0.001

EXPLORATORY ANALYSIS

Although adherence is not the same as diabetes control and researchers should not use glycemic control as an index of adherence, the HbA1C values can serve as a check on construct validity of the self-care measures. Additional analyses were conducted to examine the relationships between family support and the other social cognitive variables and glycemic control (HbA1Cs). A path analysis was conducted where the most recent HbA1C values (within twelve months preceding the interview) was placed as an endogenous variable in the path model (as a substitute for level of self-care behavior). The proposed path model with HbA1C is depicted in Figure 3.11.

For family diabetes support, the overall positive diabetes family support scores and the negative support scores were used to represent family support in two separate path analysis. In addition, the overall barriers score and overall self-efficacy score were used.

Figure 3.11 Proposed Path Model with Family Environment and Social Cognitive Variables on Glycemic Control



In the path model with glycemic control and positive family diabetes support, the exogenous variables are defined as follows:

Z_1 = Gender
Z_2 = Duration of diabetes
Z_3 = Diabetes related comorbidities
Z_4 = Acculturation
Z_5 = Cognitive function
Z_6 = Self efficacy

The endogenous variables in their standardized forms are:

Z_7= Family diabetes support (positive)
Z_8 = Family function
Z_9 = Barriers to self-care
Z_{10} =Knowledge
Z_{11} =glycemic control
e= disturbance error or residual term

The standardized forms of the five structural equations that described the model are listed below.

$$Z_7 = P_{73} Z_3 + P_{72} Z_2 + P_{71} Z_1 + e_7$$
$$Z_8 = P_{83} Z_3 + e_8$$
$$Z_9 = P_{96} Z_6 + P_{91} Z_1 + e_9$$
$$Z_{10} = P_{10\,5} Z_5 + P_{10\,4} Z_4 + e_{10}$$
$$Z_{11} = P_{11\,10} Z_{10} + P_{11\,9} Z_9 + P_{11\,8} Z_8 + P_{11\,7} Z_7 + P_{11\,6} Z_6 + e_{11}$$

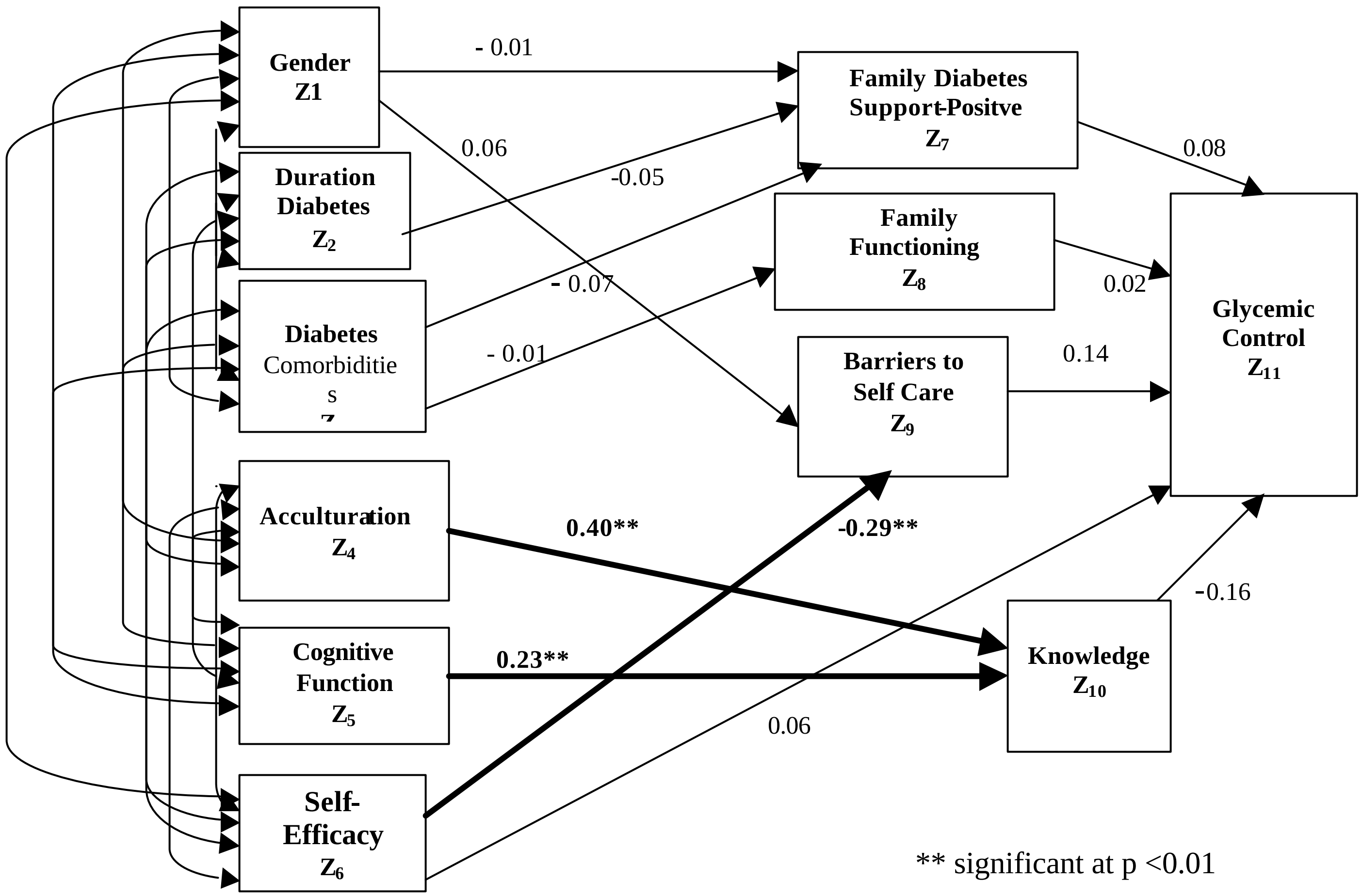
After the five regression analyses were conducted, a total of three paths were found significant. None of the paths to glycemic control were significant. The three significant paths included the following:

1.) self-efficacy and barriers to self-care;
2.) acculturation and knowledge ; and
3.) cognitive function and knowledge.

Figure 3.12 presents the path model of glycemic control and family diabetes support (positive) with the standardized path coefficients. The significant path relationships between the variables are shown by asterisks beside the path coefficients.

The analysis was repeated using family diabetes support (negative). None of the direct paths to glycemic control was significant. The same three paths that were found significant in the model with positive family support were significant using negative family support. Because the results were very similar to the positive support model, the results with the standardized path coefficients will not be presented here.

Figure 3.12 Path Model with Glycemic Control and Family Diabetes Support- Positive with Standardized Path Coefficients



** significant at p <0.01

TESTS OF THE HYPOTHESES

DIET MODEL

The model for *dietary behavior* can be described by the following set of hypotheses. Regression analysis was used to test if the paths were significant.

H1. Women will report lower levels of perceived family diabetes support for diet than men.

NOT SUPPORTED

Standardized Beta Weight = 0.049; t= 0.608; p = 0.544

There was no significant difference in perceived family support between men and women.

H2. Women will report greater frequency of barriers to diet self-care than men.

NOT SUPPORTED

Standardized Beta Weight = 0.119; t=1.549; p = 0.123

There was no significant differences in perceived family support between men and women.

H3. Duration of diabetes is positively related to perceived family diabetes support**.**

NOT SUPPORTED

Standardized Beta Weight = -0.080; t = -1.00; p = 0.319

There was not a significant association between the duration of diabetes and one's perception of family support. Having diabetes for a longer period of time was not associated with greater perception of family support.

H4. Diabetes related comorbidities is inversely related to the perceived family diabetes support. (The more comorbidities an individual has, the lower the level of perceived diabetes specific support.)

NOT SUPPORTED

Standardized Beta Weight = 0.150; $t = 1.871$; $p = 0.063$

There was not a significant association between the number of diabetes related comorbidities and perceived family support.

H5. Diabetes related comorbidities is inversely related to the perceived family function. (The more comorbidities an individual has, the more that individual will perceived their family as being dysfunctional.)

NOT SUPPORTED

There was not a significant association between the number of diabetes related comorbidities and perceived family function.

Standardized Beta Weight = 0.051; $t= 0.636$; $p = 0.526$

H6. Acculturation is positively related to knowledge. The more acculturated, the higher the scores on the knowledge instrument.

SUPPORTED

Standardized Beta Weight = 0.394; $t =5.304$; $p < 0.001$

The path coefficient for acculturation is positive and significant. The higher the level of acculturation (higher score on scale) the higher the score on the knowledge scale.

H7. Cognitive function is positively related to knowledge. The better the cognitive function, the higher the scores on the knowledge instrument.

SUPPORTED

Standardized Beta Weight = 0.226; $t=3.041$; $p < 0.01$

The path coefficient for cognitive function is positive and significant. It does support the hypothesis that the better the cognitive function, the higher the scores on the knowledge instrument.

H8. Perceived family support is positively related to levels of diet self-care.

SUPPORTED

Standardized Beta Weight = 0.198; $t=2.525$; $p = 0.013$

The greater the perceived family support, the better the level of diet self-care.

H9. Perceived family functioning (more functional) is positively related to levels of diet self-care.

NOT SUPPORTED

Standardized Beta Weight = 0.018; $t= 0.231$; $p = 0.818$

There is not a significant direct path from family function to levels of diet self-care.

H10. Perceived barriers to self-care is inversely related to levels of diet self-care.

SUPPORTED

Standardized Beta Weight = -0.175; $t= -2.237$; $p = 0.027$

The path coefficient is negative indicating an inverse relationship and the parameter is significant.

H11. Self-efficacy is inversely related to barriers to self-care.

SUPPORTED

Standardized Beta Weight = -0.265; t= -3.456; p = 0.001

The path coefficient for self-efficacy is negative and significant.
The more self-efficacy in diet self-care, the less the perceived barriers to diet.

H12. Self-efficacy is positively related to levels of diet self-care.

SUPPORTED

Standardized Beta Weight = 0.207; t = 2.595; p = 0.001

The path coefficient for self-efficacy is positive and significant .The more self-efficacy in diet, the better the level of diet self-care.

H13. Knowledge is positively related to levels of diet self-care.

NOT SUPPORTED

Standardized Beta Weight = 0.044; t = 0.584; p = 0.560

There was not a significant relationship found between knowledge and levels of diet self-care.

EXERCISE MODEL

The model for *exercise self-care* can be described by the following set of hypotheses. Regression analysis was used to test if the paths were significant.

H1. Women will report lower levels of perceived family support for exercise than men.

NOT SUPPORTED

Standardized Beta Weight = 0.069; t =0.862; p = 0.392

There was not any significant difference in perceived family diabetes support between men and women.

H2. Women will report greater frequency of barriers to exercise than men.

NOT SUPPORTED

Standardized Beta Weight = -0.026; t= -0.326; p = 0.745

There was not any significant difference in perceived frequency of barriers to exercise between men and women.

H3. Men will report greater self-efficacy for exercise than women.

NOT SUPPORTED

Standardized Beta Weight = -0.027; t-0.335; p = 0.738

There was not any significant difference in perceived self-efficacy in exercise between men and women.

H4. Duration of diabetes is positively related to perceived family support.

NOT SUPPORTED

Standardized Beta Weight = 0.02; t= 0.254; p = 0.80

There was not a significant relationship found between the duration of diabetes and one's perception of family support for exercise.

H5. Diabetes related comorbidities is inversely related to the perceived level of family support for exercise. (The more comorbidities an individual has, the lower the level of perceived family support.)

NOT SUPPORTED

Standardized Beta Weight = 0.020; t =0.242; p = 0.809

H6. Diabetes related comorbidities is inversely related to the perceived family function. (The more comorbidities an individual has, the more that individual will perceived their family as being dysfunctional.)

NOT SUPPORTED

Standardized Beta Weight = 0.051; t=0.636; p = 0.526

There was not a significant association between the number of diabetes related comorbidities and perceived family support.

H7. Acculturation is positively related to knowledge. The more acculturated, the higher the scores on the knowledge instrument.

SUPPORTED

Standardized Beta Weight = 0.394; t =5.304; p < 0.001

The path coefficient for acculturation is positive and significant.

H8. Cognitive function is positively related to knowledge. The better the cognitive function, the higher the scores on the knowledge instrument.

SUPPORTED

Standardized Beta Weight = 0.226; $t = 3.041$; $p < 0.01$

The path coefficient for cognitive function is positive and is significant.

H9. Perceived family support is positively related to levels of exercise self-care.

SUPPORTED

Standardized Beta Weight = 0.322; $t = -4.282$; $p < 0.001$

The greater the perceived family support, the better the level of exercise self-care.

H10. Perceived family functioning (more functional) is positively related to levels of exercise behavior.

NOT SUPPORTED

Standardized Beta Weight = -0.032; $t = -0.439$; $p = 0.661$

There was not a significant relationship found between family functioning and levels of exercise behavior.

H11. Perceived barriers to exercise is inversely related to levels of exercise self-care.

SUPPORTED

Standardized Beta Weight = -0.243; $t = -3.215$; $p < 0.01$

The path coefficient is negative indicating an inverse relationship and the parameter is significant.

H12. Self-efficacy is inversely related to barriers to exercise.

SUPPORTED

Standardized Beta Weight =-0.233; t = -2.958; $p < 0.01$

The path coefficient in this analysis is the correlation between the two variables.

H13. Self-efficacy is positively related to levels of exercise self-care.

SUPPORTED

Standardized Beta Weight = 0.291; t =3.859; $p <0.001$

The path coefficient for self-efficacy is positive and significant .The more self- efficacy in diet, the better the level of exercise self-care.

H14. Knowledge is positively related to levels of exercise self-care.

SUPPORTED

Higher scores on the knowledge exam were positively related to higher self-reported levels of exercise.

Standardized Beta Weight = 0.143; t = 2.19; $p = 0.030$

CHAPTER 4

DISCUSSION AND CONCLUSIONS

Adherence to the diabetes regimen is multidimensional, thus making it difficult to attribute observed relationships based on one particular factor. With a better understanding of the factors that influence regimen adherence in older diabetics, interventions can be designed to improve these outcomes. To better understand the factors which influence self-care behaviors, the Social Cognitive Theory (SCT) was employed to derive a model that depicts the complex and multidimensional aspects of the diabetes self-care regimen. Variables most consistently associated with diabetes self-care behaviors include self-efficacy, perceptions of the social and environmental influences and barriers to diabetes self-care activities.[492]

The main objective of this study was to examine how factors (personal and environmental) influence diabetes self-care behavior among older adults. The derived model depicts the relationships among the SCT constructs: environment/situation (perceived diabetes-specific support, perceived family

[492] Glasgow R.E. Behavioral research on diabetes at the Oregon Institute. *Annals of Behavioral Medicine* 17(1): 32-40, 1995.

function, barriers to self-care); behavioral capability (knowledge); and self-efficacy on diabetes self-care behaviors.

This chapter is divided into four sections. The first section provides a summary and discussion of the results, including the unexpected findings. In the second section, the limitations of the study are addressed. The third section discusses the implications for further research and the last section includes the conclusions.

SUMMARY AND DISCUSSION OF RESULTS

RESPONDENT DEMOGRAPHICS

The mean age of the sample population was 63.9 years (S.D. = 6.65). The sample was generally female (66.9%), married (53.8%), and Hispanic (86.3%). Over one-third of the sample lived with their spouse or significant other (36.9%). Almost half of the study population had less than an eighth grade education (44.7%) and 23.3 percent had a high school education or more. Over half reported a family monthly income of less than $1000 (55.6%). A total of 56 percent of the sample reported they were not employed; over one-fourth of the sample were retired (28.3%); and only 15.7 percent were employed at the time of the survey. The average level of language-based acculturation was 2.05

(S.D. = 1.16). Acculturation was measured on a 0 to 4 scale, with 4 reflecting higher acculturation levels.

In a national sample of Mexican American adults with type 2 diabetes, the median age was 56.1 years, 61.3 percent were female, 23.1 percent had a high school education or more and 35 percent had an annual family income of greater than $20,000.[493] Compared to the national sample, the sample in this study was older, more female and the family income level was lower. The educational level of this sample is similar to that of the national sample.

HEALTH VARIABLES

The mean duration of diabetes (time since diagnosis) was 12.94 years (S.D. = 9.37). Seventy percent of the sample had an HbA1C value greater than seven percent. The mean number of diabetes-related comorbidities was 1.94 (S.D. = 1.14) and the mean HbA1C was 8.14 percent (S.D. = 1.85). Almost one-half of the sample had dyslipidemia (48.1%) and 74.4 percent had hypertension. In the screen for cognitive impairment, the mean score on the CLOX 1 was 10.41 with a cut point of 10/15 representing the 5th percentile for young adult controls. A total of 26.9 percent of the sample scored below the cut scores for the CLOX 1.

[493] Harris M. Racial and ethnic differences in health care access and health outcomes for adults with type 2 diabetes. *Diabetes Care* 24(3): 454-459, 2001.

The mean score for the depression screen (Patient Health Questionnaire-PHQ-9) was 5.36 (S.D. = 3.91), which represents mild depression. Ten percent of the sample was classified by the PHQ-9 as not experiencing any depressive symptoms. A little over one-third of the sample (36.9%) was classified as experiencing a “minimal” level of depression and a similar proportion (36.3%) was classified as experiencing a “moderate” level of depression. Approximately 17 percent of the sample was classified in the “moderately severe” category of depression.

In the national sample of Mexican-Americans, 65.5 percent of the sample had an HbA1C greater than or equal to seven percent; the median duration of diabetes (time since diagnosis) was 5.4 years; 53.8 percent had hypertension and 51.2 percent had dyslipidemia. Compared to the national sample, the sample in the present study had a longer duration of diabetes, a greater percentage of patients with hypertension, and a slightly greater percentage of patients with HbA1C greater than seven percent. The percentage of patients with dyslipidemia was about the same.

DIABETES SELF-CARE RECOMMENDATIONS

Before focusing on how well patients manage their diabetes, it is important to understand what advice or recommendations they have been given. This section presents the summary of the self-reported recommendations for diet, exercise and glucose self-testing. Of the diet recommendations, the three most commonly reported recommendations participants received from their health care providers were: 1.) following a low-fat eating plan; 2.) eating very few sweets; and 3.) eating fruits and vegetables. A small percentage of respondents reported not being given any advice about their diet (5.6%).

For exercise, the three most commonly reported recommendations given included: 1.) getting a low level of exercise on a daily basis; 2.) exercising continuously for at least 20 minutes at least 3 times per week; and 3.) engaging in a specific amount, type, duration and level of exercise. Ten percent of the sample reported not receiving any advice about exercise from their health care provider.

For the self-monitoring of blood glucose, the majority of the sample reported being advised to test their blood sugar using a machine for results. Ten percent of the sample reported being advised to test their sugar using a color chart and a small percentage (4.3%) reported not having to self-monitor their blood sugars on a regular basis.

Over 90 percent of the sample indicated they were given advice about their diet, exercise and self-monitoring of their glucose. The self-reported recommendations by a health care provider for diabetes self-care behaviors were higher in the present study than what has been reported in the literature. Ruggiero and associates employed a mail survey to examine the self-reported recommendations and patterns in a national sample of over two thousand participants.[494] They reported that 78 to 87 percent of the sample indicated they were given advice about their diet and 74 percent reported they were given advice about exercise. In their study, a majority of the type 2 diabetics on insulin reported they were given advice about monitoring their glucose and 55 percent of the type 2 diabetics who were not on insulin reported they were given advice about self-monitoring their glucose.

Methodological differences between the studies may explain these differences. The patients in the present study were surveyed while they were in the clinic, where they receive their medical care and may have been more likely to give socially desirable answers than participants would in a mail survey. There were also differences in the type of sample and the characteristics of the sample. The Ruggiero study employed a larger, national sample and the present study used a small, convenience sample. The sample in the Ruggerio study was

[494] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self-management. *Diabetes Care* 20(4): 568-576, 1997.

younger, predominantly Caucasian, and had a higher level of education than the sample in the present study.

LEVELS OF SELF-CARE BEHAVIOR

Diet

The mean number of days, of the last seven days, participants followed a healthful eating plan was 4.95 days (S.D. = 1.94). The mean number of days for the specific diet scale was 4.5 days (S.D.= 1.49). The specific diet scale has items which asks about specific eating habits such as eating fruits and vegetables, high fat foods and spacing carbohydrates throughout the day. Almost one-third of the sample reported that of the last seven days, they followed a healthful eating plan every day. Only six percent reported that they did not follow a healthful eating plan at all during the last seven days. The percentage of people who reported not following their eating plan at all is similar to the percentage of people in the study conducted by Ruggiero and associates (5.5%).[495] However, the percentage of people who reported they followed a healthful eating plan every day (31.3%) is

[495] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self-management. *Diabetes Care* 20(4): 568-576, 1997.

much higher than the number reported in the Ruggiero study, where only 11.8% indicated that they "always" followed their diet recommendations.

Exercise

Given the importance of physical activity to diabetes management, the low levels of physical activity reported in this study should raise some concerns. The mean number of days during the last seven days for participating in exercise was 2.87 (S.D. = 2.79). Approximately 40 percent of the population reported they did not participate in at least 30 minutes of physical activity at all (0 days) and 36.9 percent reported not participating in any specific exercise session (0 days). One fourth of the sample (25.6%) reported participating in at least 30 minutes of physical activity during all seven days of the week. These findings are consistent with the study conducted by Hays and Clark, where in a sample of older adults with type 2 diabetes, the majority of the respondents reported zero minutes of weekly physical activity.[496]

Self-Monitoring of Blood Glucose

The majority of the sample (88.1%) reported that they had been advised to monitor their blood glucose using a meter. On average, participants tested their blood glucose approximately four and one-half days per week. According to the

[496] Hays L.M., and Clark D.O. Correlates of Physical Activity in a Sample of Older Adults with Type 2 Diabetes. *Diabetes Care* 22(5): 706-712, 1999.

American Diabetes Association, the optimal frequency of self monitoring of blood glucose for individuals with type 2 diabetes is not known; however, the frequency should be adequate to obtain glucose goals.[497] Self-monitoring of blood glucose is recommended for all patient treated with insulin. Ruggerio and associates examined the self-reported recommendations and patterns in a large sample of patients with diabetes and found that the most common recommendation for frequency of self-monitoring of blood glucose was once per day.[498] For patients with type 2 diabetes and on insulin, the mean times per week was10.4 (S.D. = 7.8) and for type 2 diabetics on oral meds, the mean times per week was 5.6 (S.D. = 5.3).

Medication

The mean medication adherence rate was 91.6 percent (S.D. = 15.2). The adherence rate is based on how many doses of diabetes medications were taken as prescribed during the past seven days. Self-management scores for medication taking were heavily skewed toward maximum adherence. Other studies have

[497] American Diabetes Association. Tests of glycemia in diabetes. *Diabetes Care* 25: (Supp 1): S97-S99, 2002.
[498] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self management: self-reported recommendations and patterns in a large population. *Diabetes Care* 20(4): 568-576, 1997.

reported the same problem.[499,500] Ruggiero et al. reported that nearly all of the individuals taking insulin (97%) or oral diabetes medications (93%) indicated they "always" or "usually" take their medication as recommended.

The pattern of the self-reported frequency of following recommend self-management plans are similar to what has been found in other studies. Specifically, individuals in the present study reported the frequency of following recommendations on diabetes self-management in the following order from highest frequency (most closely followed) to lowest frequency (least closely followed): medication regimen, diet, self-monitoring of blood glucose, and exercise. Other studies have found that individuals self-report most closely following their medication regimen then self-monitoring of glucose and were least likely to follow the diet and exercise recommendations.[501, 502]

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[499] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self- Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[500] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self-management. *Diabetes Care* 20(4): 568-576, 1997.

[501] Toobert D.J., Hampson S.E. and Glasgow R.E. The Summary of Diabetes Self- Care Activities Measure: results from seven studies and a revised scale. *Diabetes Care* 23(7): 943-950, 2000.

[502] Ruggiero L., Glasgow R.E., Dryfoos J.M., et al. Diabetes self-management. *Diabetes Care* 20(4): 568-576, 1997.

Health and Demographic Variables

Gender, duration of diabetes and diabetes-related comorbidities were not significantly associated with any of the variables in the models as hypothesized. Both acculturation and cognitive function indirectly affected exercise self-care through knowledge about diabetes. The San Antonio Heart Study found that in a sample of Mexican Americans, as acculturation and socioeconomic status increased, body mass index linearly decreased among middle aged Mexican American women.[503] Acculturation exerts its effects through its association with language skills, employment, and education.[504] As acculturation increases, knowledge about diabetes and exercise increases, thus increasing the levels of exercise. There was also an association between cognitive function and exercise self-care. As the level of cognitive function decreases, the performance on the knowledge instrument decreases. As cognitive impairment decreases, the level of physical activity decreases as well. A limitation of the study is that the sample population was predominantly female. This may have contributed to not finding any significant relationships between gender and some of the other variables (self-efficacy, barriers and family support).

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[503] Ibid.

[504] Bassford T.L. Health status of Hispanic elders. *Clinics in Geriatric Medicine* 11(1): 25-38, 1995.

FAMILY ENVIORNMENT

Diabetes Family Support

The perceived family support for both exercise and diet were relatively low. The mean diet score from the Diabetes Family Behavior Checklist (DFBC) was 1.04 (S.D. =2.44). The range of scores is from –8 to +8, with higher scores indicating better perceived support for diet. The mean exercise support score was 0.28 (S.D. = 1.68). The range of scores is from –4 to +4 and the higher the score, the better the perceived support for exercise. The regimen-specific measures for both diet and exercise had direct significant effects on levels of self-care. Glasgow and Toobert found that the pattern of means reported from all of the regimen-specific variables on the (DFBC) measures produced statistically significant results in the expected order. For example, the group means on the exercise family support scale were –0.85, 0.50 and 1.43 for subjects classified as *low*, *medium* and *high* on exercise adherence, respectively.[505] The diabetes family support variables had significant direct effects on both exercise and diet self-care behaviors. However, the indirect effects of diabetes support via gender, duration of diabetes or diabetes comorbidities were not significant. Previous research has

[505] Glasgow R.E. and Toobert D.J. Social environment and regimen adherence among Type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.

found that the duration of diabetes and the number of diabetes comorbidites are significantly associated with the perceived support. Connell and associates found that adult diabetics who had the disease longer, perceived a greater amount of general support.[506] Older adults with more health problems have reported the least amount of social support.[507] The patients' comorbidities have been found to be significantly associated with diabetes-related care received from the family member.

Family Function/ Satisfaction

Family function or satisfaction did not have a significant influence on diet or exercise self-care. The mean score for family satisfaction (range from 0 to 20 with higher numbers indicting greater satisfaction with family) was 16.47, which reflects that the sample reported satisfaction with the family. Previous studies

[506] Connell C.M., Davis W.K., Gallant M.P., et al. Impact of social support, social cognitive variables and perceived threat on depression among adults with diabetes. *Health Psychology* 13(3): 263-273.

[507] Jenny J.L. Differences in adaptation to diabetes between insulin dependent and non-insulin dependent patients: implications for patient education. *Patient Education and Counseling* 8(1): 39-50, 1986.

have found that higher Family APGAR scores were associated with better glycemic control.[508, 509]

Non-Family Support

Non-family support was tested in both models in the place of diabetes-specific support and was not found to be a significant predictor of diet or exercise behavior. This finding is contrary to the results of the study by Talbot and associates, in which they reported that levels of social support were predictive of adherence to exercise recommendations in adults with type 2 diabetes.[510] However, the sample in their study was predominantly male and from Canada. On average, the sample was younger and had diabetes for a shorter duration of time. It may be that the role of social support may vary in different ethnic, age or gender groups.

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508 Cardenas L., Vallbona C., Baker S., et al. Adult onset diabetes mellitus: glycemic control and family function. *American Journal of Medical Sciences* 293(1): 28-33, 1987.

509 Konen J.C., Curtis L.G. and Summerson J.H. Symptoms and complications of adult diabetic patients in a family practice. *Archives of Family Medicine* 5(3): 135-145, 1996.

510 Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the Multidimensional Diabetes Questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

SOCIAL COGNITIVE VARIABLES

Knowledge

Research has shown that knowledge about medications, diet, exercise and self-glucose monitoring is necessary to effectively self manage diabetes. However, knowledge alone does not guarantee effective self-management.[511] In this study, many of the participants missed the items regarding the cause of diabetes and the signs and symptoms of hyperglycemia and hypoglycemia. The mean score on the knowledge instrument was 69.8 percent or 16 out of 24 items were correct. Over 60 percent of the sample answered the question regarding "eating too much sugar and other foods is a cause of diabetes" incorrectly and 58 percent missed the item "diabetes is caused by failure of the kidneys to keep sugar out of the urine." Approximately one third of the sample answered *yes* to the item "diabetes can be cured." Overall, the scores on the knowledge section indicated that almost one-half of the participants answered the items regarding hyperglycemia and hypoglycemia incorrectly. Almost fifty percent of the sample (48.1%) answered *yes* to "shaking and sweating are signs of high blood sugar"

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[511] Garcia A., Villagomez E.T., Brown S.A., et al. The Starr County Diabetes Education Study: development of the Spanish-language diabetes knowledge questionnaire. *Diabetes Care* 24(1): 16-21, 2001.

and 46.3 percent answered *yes* to "frequent urination and thirst are signs of low blood sugar."

It is also interesting to note that the Diabetes Knowledge Questionnaire was developed for the average educational level for Starr County, which was sixth grade education and many of the items were written in simple language. The population in this study was thought to be similar to the Starr County population in terms of level of education. From the pilot study, several of the participants indicated difficulty in understanding some of the terms used in the knowledge instrument such as the term "effective."

Acculturation and Cognitive Function

Levels of language-based acculturation and cognitive function were both significantly associated with performance on the knowledge instrument. Those who scored higher on the acculturation scale and the clock drawing scale also scored higher on the knowledge instrument. In the exercise model, there was a direct effect between diabetes knowledge and reported levels of exercise self-care activity. Hays and Clark reported that knowledge about exercise was a significant correlate of reported weekly physical activity.[512]

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[512] Hays L.M. and Clark D.O. Correlates of physical activity in a sample of older adults with type 2 diabetes. *Diabetes Care* 22(5): 706-712, 1999.

Self-Efficacy

The overall self-efficacy score for the sample was moderately high. Self-efficacy scores were highest for the medication regimen, followed by glucose, diet and then exercise. Lower self-efficacy beliefs were significantly associated with lower levels of diet and exercise self-care. The results of the study are consistent with the findings from other studies where self-efficacy was consistently associated with self-care in the areas of diet, exercise and blood glucose testing.[513, 514, 515]

Talbot and associates found that women reported lower levels of social support than men.[516] Traditionally, women are more involved in the management of their husband's diabetes than men are in their wives and this may explain why women reported lower levels of support than men. In this study, no differences were found between gender on the levels of family support. However, this could be due to not having enough males in the sample.

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[513] Williams K.E. and Bond M.J. The roles of self-efficacy outcome expectancies and social support in the self-care behaviors of diabetics. *Psychology Health and Medicin.* 7(2e: 127-141, 2002.

[514] Skelly A.H., Marshal J.R., Haughey B.P., et al. Self-efficacy and confidence in outcomes as determinants of self-care practices in inner-city, African-American women with non-insulin-dependent diabetes. *Diabetes Educator* 21(1): 38-46, 1995.

[515] Aljasem L.I., Peyrot M., Wissow L., et al. The impact of barriers and self-efficacy on self-care behaviors in type 2 diabetes. *Diabetes Educator* 27(3): 393-404, 2001.

[516] Talbot F., Nouwen A., Gingras J., et al. The assessment of diabetes-related cognitive and social factors: the multidimensional diabetes questionnaire. *Journal of Behavioral Medicine* 20(3): 291-309, 1997.

The sample was predominantly Mexican Americans and for Mexican Americans, the extended family is considered a primary support group.[517] By tradition, older Mexican Americans strongly expect to receive assistance and support from their children.[518] Thus with the high levels of support among the Mexican Americans, it may be difficult to find differences on levels of family support.

Barriers to Self Care

The overall barriers score indicated that the frequency of barriers to self-care was fairly low. The barriers scale measured the frequency participants encountered barriers to the self-care regimen. The regimen area with the most frequently perceived barriers was diet, followed by exercise, glucose monitoring and lastly medication. The pattern of the frequency of the barriers is consistent with that reported by Glasgow et al. using the same barriers scale.[519]

The mean barrier score for diet was 3.22 (twice per month) (S.D. = 1.09). The mean barrier score for exercise was 3.07 (twice per month) (S.D. = 1.43). The mean barrier scores for the overall scale and each of the subscales were higher

[517] Tamez E.G. and Vacalis T.D. Health beliefs, the significant others and compliance with therapeutic regimens among adults Mexican American diabetics. *Health Education* 20(6): 24-31, 1989.
[518] Phillips L.R., Komnenich P., Killen M., et al. The Mexican American care giving experience. *Hispanic Journal of Behavioral Science* 22(3): 296-313, 2000.
[519] Glasgow R. and Toobert D.J. Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.

(greater frequency) than the mean scores reported by Glasgow and associates. The overall barriers score for the present study was 2.53 (S.D. = 0.77). Glasgow reported an overall scale score of 1.90 (S.D. = 0.66). However, the sample in the Glasgow study was predominantly Caucasian and was more educated than the sample in the present study. The sample in the Glasgow study was similar in age to the sample in the present study.

Barriers to self-care moderate the effect between self-efficacy and levels of diet and exercise self-care. Barriers to care had an inverse relationship with levels of self-care. Participants who reported more barriers to exercise and diet, reported lower levels of physical activity and diet.

SUMMARY OF MODELS

On the basis of the results from the full model, a trimmed model that included only those paths found to be significant in the full model was tested. The trimmed model explained 37 percent of the variance in the exercise model and 14 percent of the variance in the diet model. The major findings (significant paths) reported with the full models were replicated in the final models.

The most significant predictors in the *diet* model included self-efficacy, perceived barriers and perceived family support. The most significant predictors in order of largest total effect size in the diet model included self-efficacy, barriers to diet and family support (total effects were 0.291, -0.265, and 0.258, respectively). In the *exercise* model, the most significant predictors in order of largest total effect size included family support, barriers to exercise and self-efficacy (total effects = 0.43, -0.37, and 0.34 respectively). Family support was the most significant predictor for exercise but not for diet. A possible explanation is that the sample was predominantly female and women have a traditional role in preparing meals for the family. When it comes to following a recommended diet regimen, self-efficacy is a more important predictor than family support.

With respect to direct effects, self-efficacy had a stronger direct effect than family support in both the exercise and the diet models. In this study, self-efficacy was found to be the strongest correlate of physical activity among older adults. This is consistent with findings reported from other studies.[520,521] Perceived barriers and family support had the same direct effect on diet self-care behaviors. In the exercise model, family support had a stronger direct effect than barriers. Knowledge regarding diabetes played a weak, however significant, role in exercise self-care. Acculturation and cognitive function indirectly influenced levels of physical activity through knowledge.

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[520] Hays L.M. and Clark D.O. Correlates of physical activity in a sample of older adults with type 2 diabetes. *Diabetes Care* 22(5): 706-712, 1999.

[521] Sallis J.F., Hovell M.F., Hofstetter C.R., et al. A multivariate study of determinants of vigorous exercise in a community sample. *Preventive Medicine* 18: 20-34, 1989.

The demographic and health variables (gender, diabetes related comorbidities and duration of diabetes) were not significant predictors in either the diet or the exercise models. The indirect paths from gender, duration of diabetes and the number of diabetes-related comorbidities through diabetes-specific family support were not significant in either model, indicating that diabetes-specific support had negligible mediating effects on these relationships.

Overall, the tested trimmed model for exercise provided a good fit to the data and explained 37 percent of the variance in exercise self-care. The tested trimmed diet model explained a modest 14 percent of the variance for the general diet behavior. The exercise model appears to be a stronger model in predicting self-care behavior than the diet model. However, there were more violations of the assumptions to linear regression with the exercise model than the diet model.

The AMOS model fitting program was used to evaluate the full models and the trimmed (final) models for global model fit for both exercise and diet models. The trimmed diet model and both the full and trimmed exercise models had non-significant *chi-square* statistics which indicate the model is a good representation of the data. However, using the relative fit measures, the exercise trimmed model had a better fit than the full exercise or trimmed diet model.

EXPLORATORY ANALYSIS

The exploratory analysis examined the relationship between the family environment and social cognitive variables on glycemic control as measured by HbA1C level. Glycemic control was substituted for the diet self-care in the diet path model. None of the direct paths to glycemic control were found to be significant. Family variables and the other social cognitive variables (self-efficacy, barriers, knowledge) were not directly related to glycemic control. Neither the positive nor the negative family support measure from the DFBC scale had an effect on glycemic control. The results from the exploratory analysis were not surprising because research in this area has had conflicting results. Numerous factors affect glycemic control such as the degree of insulin deficiency, insulin resistance, and other comorbidities. The effect of any one variable, such as family support may be difficult to examine. The findings from the exploratory analysis are consistent with other research. Trief and associates examined whether the family environment was related to the adequacy of metabolic control using the DFBC and found that scores on the scale were not related to glycemic control.[522]

[522] Trief P.M., Elbert K., Grant W., et al. Family environment, glycemic control and the psychosocial adaptation of adults with diabetes. *Diabetes Care* 21(2): 241-245, 1998.

UNEXPECTED FINDINGS

There were several unexpected findings that emerged from this study. Knowledge was found to be a significant predictor in the exercise model but not in the diet model. It could be that in the Hispanic culture, it may be more difficult to change diet, especially in the older population, than it is to change their exercise behavior.

Research has demonstrated that social networks and social support have been shown to have a direct effect on health behaviors.[523] Family support specific to diabetes had a direct effect on the levels of diet and exercise self-care but family function (satisfaction) and non-family support did not have any significant association with levels of self-care behavior. This could be due to the non-family support measure which was a global diabetes support measure and not specific to the regimen areas like the family support measure.

Another possible reason why non-family support was not associated with levels of self-care behaviors is that research has shown that Mexican American elders prefer to rely on family for support rather than on friends or formal

[523] Heaney C.A. and Israel B.A. Social networks and social support in *Health Behavior and Health Education: Theory Research and Practice.* Glanz K., Lewis F.M. and Rimer B.K. editors, San Francisco, Jossey-Bass, 179-206, 1997.

supports.[524, 525, 526] Traditionally, elderly Mexican Americans strongly expect to receive assistance and support from their children.[527] Thus, it could be that Mexican Americans do not rely on support from their friends.

Another unexpected finding was the scores on the clock drawing task, the CLOX. Almost one-half of the pilot population (45.5%) did not meet the minimal score and over one-fourth (26.9%) of the participants in the final study did not meet the minimal score. This finding may warrant further investigation. Is the performance on the CLOX indicative of low functioning in this socioeconomic population or is it due to the microvasuclar changes that are secondary to the complications of diabetes? Would the same results occur in a similar sample with a disease other than diabetes?

To date, there is no published data available on the CLOX scores and adults with type 2 diabetes. Sinclair and associates examined the association

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[524] Phillips L.R., Komnenich P., Killen M., et al. The Mexican American care giving experience. *Hispanic Journal of Behavioral Science* 22 (3): 296-313 2000.

[525] Wishner W.J. and O'Brien M.D. Diabetes and the family. *Medical Clinic of North America* 62(4): 849-856, 1978.

[526] Keefe S.B. The Mexican American extended family as an emotional support system. *Human Organization* 38: Summer, 144-152, 1979.

[527] Phillips L.R., Komnenich P., Killen M., et al. The Mexican American care giving experience. *Hispanic Journal of Behavioral Science* 22(3): 296-313, 2000.

between cognitive impairment and changes in self-care behaviors on older adults with type 2 diabetes.[528] The researchers used the Mini-Mental State Examination (MMSE)[529] and a clock-drawing test. Compared to the control non-diabetics, the subjects with diabetes performed worse on both the MMSE and the clock-drawing test. However, it is difficult to directly compare the results of the CLOX with other clock-drawing tests in other studies because of the different methodologies employed. Previous research has suggested that executive control function is associated with levels of self-care.[530] Perhaps patients with diabetes are affected by executive control dysfunction and this is not detected in speaking with the patient and asking closed-ended type questions. It may be that the patients with diabetes should be routinely screened for cognitive impairment. Further studies are needed regarding the use of the CLOX and patients with diabetes and in a population similar to the one in the present study (predominantly Hispanic and low levels of education).

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[528] Sinclair A.J., Girling A.J. and Bayer A.J. Cognitive dysfunction in older subjects with diabetes mellitus: impact on diabetes self-management and use of care services. *Diabetes Research and Clinical Practice*. 50(3): 203-212, 2000.

[529] Folstein M.F., Folstein S.E., and McHugh P.R. "Mini Mental State" A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 12(3): 189-198, 1975.

[530] Royall D.R., Cabello M. and Polk M. Executive dyscontrol: an important factor affecting the level of care received by older retirees. *Journal of the American* Geriatrics Society 46: 1519-1524, 1998.

STUDY LIMITATIONS

Findings of the study should be interpreted within several limitations. A major limitation is that the design is cross-sectional rather than longitudinal; therefore, causality cannot be determined. The cross- sectional design of the study does not allow causal inferences to be tested. The study provides only a static snapshot of the model effects. Reciprocal causation cannot be ruled out when simultaneously assessing self-care behaviors with each of the model constructs. It may be plausible that some of the paths such as self-efficacy and barriers are not unidirectional. Future research that is based on longitudinal data and considers reciprocal causation is needed. The final models were determined partly by model trimming; they may reflect idiosyncrasies of the particular sample.

Another limitation is that the measures of self-care management are self-reported. The participants may have reported socially desirable behaviors and their reported levels of self-care behaviors may have been inflated. Bias may have been introduced by the participants' knowledge that the interview was conducted at the clinic where they receive their medical care. Although the participants were told that their responses would remain confidential, this may have impacted the accuracy of the information reported.

In addition, there are several limitations that pertain to the study instrument. One limitation is that the instrument was developed by using many existing scales. Some of the response formats vary from one section of the survey to the other (i.e., Likert Scale to dichotomous type responses) and this may have been confusing for some of the participants. Having the instrument administered by a researcher or trained interviewer may have minimized some of the confusion. Comprehension of the questionnaire items is another limitation. The internal consistencies of some of the scales were low. The Cronbach's alphas for the barriers subscales and the knowledge scale were weak.

Another concern about the instrument was the possibility of extreme response sets with the Hispanic population. Some researchers have suggested that Hispanics often choose the extreme responses on Likert-type scales more so than non-Hispanic whites.[531] This problem may have been minimized by the fact that the response scales on the Likert-type items were presented to participants on laminated sheets and they were periodically reminded of their response choices and that they could select any response in between the extreme choices.

It should be restated that the results are based on a sample of low-income older adults, predominantly Hispanic with type 2 diabetes. This can be viewed as a limitation as well as a strength. This limits the generalizaibitly of the results of the study to the non–Hispanic population. However, this can be viewed as a strength because Mexican Americans have a higher prevalence of type 2 diabetes

[531] Marin G. and Marin B. Potential problems in interpreting data in *Research with Hispanic Populations.* Newbury Park, California, Sage Publications, 101-123, 1991.

and are also more likely to experience diabetic complications.[532, 533] The burden of diabetes is disproportionately higher in the Hispanic population.[534] Thus, it is important that we have a better understanding of the family environment and other factors that affect diabetes self-care behaviors in the Hispanic population.

In addition, the results of the study cannot be generalized to older adults in general. The sample population was limited to those living in a family environment, thus, the results are only generalizable to older adults living in a family environment.

Another limitation related to generalizability is that there were significant differences found between the groups with complete data versus those who did not have complete data in both the diet and exercise models. In the diet model, significant differences were found in number of diabetes-related comorbidities and the knowledge score. Those with complete data had fewer diabetes-related comorbidities and higher scores on the knowledge measure. In the exercise model, there were the same differences as the diet model but the groups also

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[532] National Diabetes Fact Sheet, Center for Disease Control (For Release November 1998) Available at http://www.cdc.gov/diabetes/pubs/facts98.htm. Accessed July 31, 2001.

[533] Black S.A., Ray L.A. and Markides K.S. The prevalence and health burden of self- reported diabetes in older Mexican Americans: findings from the Hispanic established populations for epidemiologic studies of the elderly. *American Journal of Public Health* 89(4): 546-552, 1999.

[534] Ibid.

differed in acculturation level. Those with complete data in the exercise model had higher scores on the language-based acculturation scale.

There were also some violations to the assumptions of linearity, constant variance and normality. Although the regression analysis is robust to some violations in linearity, the results of the study should be interpreted carefully, especially with the exercise model.[535]

The survey was administered at the clinic where the patients receive their medical care and this could have influenced the participants to provide social desirable responses. We were not able to collect information on non-responders; thus, there may be some non-response bias. Other limitations of the study include reliability and accuracy of data from the clinic.

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[535] Kerlinger F.N. and Pedhazur E.J. Elements of multiple regression theory and analysis: two independent variables in *Multiple Regression in Behavioral Research.* New York, Holt, Rinehart and Winston, 47-48, 1973.

IMPLICATIONS/ FUTURE RESEARCH

Despite the limitations, this study addressed some important gaps in the literature with respect to the influence of the family environment and other social cognitive factors on diabetes self-care behaviors in older adults. An important finding of this study is that the context of the family is an important determinant of diet and exercise self-care behaviors. Family members provide the necessary physical and emotional support for each other primarily because of their proximity and intimacy.[536, 537] Interventions should be designed to include the family and to improve the family's understanding of diabetes.

Future research could involve designing and implementing interventions to help older patients develop specific plans for overcoming barriers to adherence and enhancing their self-efficacy in managing their diabetes. These interventions should involve the family. Pharmacists and other health care providers can help identify families in which there is little support and provide education and counseling to enhance the level of support.

Since self-efficacy, perceived barriers, family support and knowledge about diabetes were significant predictors in this study, interventions that address these areas, could be designed and tested. For example, interventions could be

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[536] Wishner W.J. and O'Brien M.D. Diabetes and the family. *Medical Clinic of North America* 62(4): 849-856, 1978.
[537] Fisher L., Chesla C.A., Bartz R.J., et al. The family and type 2 diabetes: a framework for intervention. *Diabetes Educator* 24 (5): 599-607, 1998.

developed that would specifically address mastery experiences to improve self-efficacy. Having a history of successful diabetes self-care abilities are likely to enhance the patient's confidence in his/her self-care abilities.

Motivational interviewing has been well-studied in specialist settings such as addiction, but there has been considerable interest in apply motivational interviewing in community health care settings.[538] Motivational interviewing has been defined as a "directive, client-centered counseling style for eliciting behavior change by helping clients to explore and resolve ambivalence." [539] A key component of motivational interviewing is the support for self-efficacy to perform the steps necessary for behavior change. In a behavioral weight-control program in older obese women with type 2 diabetes, motivational interviewing was found to improve adherence in the program.[540] Interventions should be designed in which health care providers, such as physicians and pharmacists, use motivational interviewing techniques in counseling patients about their diabetes self-management.

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[538] Emmons K.M. and Rollnick S. Motivational interviewing in health care settings: opportunities and limitations. *American Journal of Preventive Medicine* 20(1): 68-74, 2001.

[539] Ibid.

[540] Smith D.E., Heckemeyer C.M., Kratt P.P., et al. Motivational interviewing to improve adherence of a behavioral weight-control program for older obese women with NIDDM: a pilot study. *Diabetes Care* 20(1): 52-54, 1997.

This study can also be repeated with a larger sample and with individuals in other ethnic groups. Evaluating the models in a sample population with different demographics such as socioeconomic status and ethnicity would increase the generalizability of the findings. Future studies using longitudinal data would allow consideration of reciprocal causation in the model.

CONCLUSIONS

According to the Social Cognitive Theory (SCT), there is a continuous interaction between the characteristics of the person, the environment and the behavior itself. The SCT was employed to develop a model that depicts the relationship between the personal characteristics and the environment (family and social support and barriers to self-care) on the levels of diet and exercise self-care. A model for family environment and social cognitive variables was supported empirically in predicting diet and exercise self-care behaviors in older adults with type 2 diabetes.

In diabetes behavioral research, variables that have been associated most consistently with regimen adherence and self-care behaviors are self-efficacy, perceptions of the social and environmental influences, such as family support and barriers to self-care activities.[541, 542] The results of the study support these findings. In summary, results from the present study provide evidence that perceived availability of family support specific to diabetes is associated with the levels of diet and exercise self-care. High levels of perceived family support specific to the diabetic regimen are directly associated with higher levels of exercise and dietary self-care behaviors. Additionally, high levels of self-efficacy were associated with higher levels of diet and exercise self-care. Perceived barriers to self-care is associated with lower levels of exercise and self-care behavior. Self-efficacy has both a direct and indirect effect on levels of exercise and diet self-care. Knowledge about diabetes and its management has a direct effect (although weak) on levels of exercise self-care but not on diet.

The exploratory analysis that examined the relationship between family environment, social cognitive variables, and the health and demographic variables on glycemic control found no significant effects (direct or indirect) on glycemic control. Because there are numerous factors that influence glycemic control, the family environment may only play a minor role.

The self-reported frequencies of following recommended diabetes self-management plans were examined. Individuals in this study reported that they

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[541] Glasgow R. and Toobert D.J. Social environment and regimen adherence among type II diabetic patients. *Diabetes Care* 11(5): 377-386, 1988.

[542] McCaul K.D., Glasgow R.E., and Schafer L.C. Diabetes Regimen Behaviors: predicting adherence. *Medical Care* 25(9): 868-881, 1987.

most closely adhered to their medication regimen, followed by diet, then glucose monitoring and least closely adhere to their exercise recommendations. On average, individuals in this sample participated in physical activity almost three days per week. Approximately 40 percent of the sample indicated they did not participate in at least 30 minutes of physical activity at all during the last seven days.

The results suggest that interventions aimed at improving family support specific to diabetes, enhancing the person's self efficacy, educating on the disease and its management and overcoming the barriers to self-care may be important for diabetes management. The importance of the family environment suggests that health care providers should spend more time improving the family's understanding of diabetes. The family should be involved in the management of the patient. Future work should examine educational interventions that include the family. Pharmacists and other health care providers should involve the family and significant others in the management of the patient.

Longitudinal studies are needed to examine the role of the family environment over time. This study was cross-sectional; thus, causality could not be determined. We cannot conclude that family support causes one to follow his/her diet and exercise recommendations more closely. It could be that individuals who follow their diet and exercise regimens have a more positive attitude and may perceive their family to be more supportive. The findings from this study, although modest, may help health professionals better understand the extent to which different factors influence diabetes self-management among older adults and direct future research.

APPENDIX A

INFORMED CONSENTS
PILOT AND FINAL

(English and Spanish)

SUBJECT CONSENT TO TAKE PART IN A STUDY OF

The Relationship of Family Environment and Other Social Cognitive Variables on Diabetes Self-Care Behaviors in Older Adults with Type 2 Diabetes

(Pilot Study)
The University of Texas Health Science Center in San Antonio
University Health Center-Downtown
and
The University of Texas at Austin

We are asking you to take part in a research study of how older adults with diabetes take care of themselves and diabetes. The researcher is Lonnie Wen and she is a graduate student at The University of Texas at Austin. This study is being conducted as a required research project for the graduate program. We want to learn about how the family and other factors may affect how people take care of their diabetes. We are asking you to take part in this study because you are 55 years of age or older, you have had Type 2 diabetes for one year or more, and you live with a family. If you participate, you will be one of approximately 12 people in the study.

If you decide to take part, we will ask you to complete a survey that asks about many different things that may be related to your diabetes self-care activities. We want to make sure the questions on the survey are clear and easy to understand. The survey asks about the following areas:

- how often family and non-family members do things related to your daily self-care activities;
- your satisfaction with each family member;
- things that can sometimes make it more difficult to follow your diabetes self-care activities;
- general questions about diabetes, the treatment, and other health problems that can come with diabetes;
- your diabetes self-care activities,
- how you have been feeling recently; and
- language you prefer to speak.

In addition, there are a few questions that check your mood, concentration, and memory.

The survey may take anywhere from 45 minutes to 1 hour to complete and is just a one time survey. You have the right to skip or not answer any specific question(s) in the survey. We will also look at your medical chart for information about your health and your diabetes, such as lab values and other illnesses you may have.

We do not guarantee that you will benefit from taking part in this study. The information collected from this survey will not affect the standard treatment provided by your physician(s).

As a token of our appreciation for your time, you will receive a copy of the book, <u>101 Medication Tips for People with Diabetes</u> or if you prefer, <u>Diabetes from A to Z,</u> the Spanish edition. There is no cost to you for participating in this study.

The Relationship of Family Environment and Other Social Cognitive Variables on Diabetes Self-Care Behaviors in Older Adults with Type 2 Diabetes

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Lonnie Wen, M.S. Graduate Student	The University of Texas at Austin	(512) 471-6892
Michael Parchman, M.D.	The University of Texas Health Science Center at San Antonio	(210) 358-3998
Marv Shepherd, PhD Supervising Professor	The University of Texas at Austin	(512) 471-6892

If you have any questions or concerns about your treatment as a research participant in this study, you may contact the committee that reviews research on human subjects (Institutional Review Board). The numbers for the committees in San Antonio and Austin are listed below.

The University of Texas Health Science Center at San Antonio (210) 567-2351

Professor Clarke Burnham
Chair of the University of Texas at Austin Institutional Review Board (512) 232-4383

YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO TAKE PART IN THIS RESEARCH STUDY AND THAT YOU HAVE READ AND YOU UNDERSTAND THE INFORMATION GIVEN ABOVE AND EXPLAINED TO YOU.

______________________________ ______________________________
Signature of Subject Signature of Witness

__________________/____________ ______________________________
Date Time Signature of Person Obtaining Consent

____
Printed Name & Title of Person Obtaining Consent

page 2 of 2

CONSENTIMIENTO DEL PARTICIPANTE PARTICIPAR EN UNA INVESTIGACION DE

La Relación del Ambiente Familiar y Otros Factores Sociales a los Comportamientos en cuanto al Auto-cuidado de la Diabetes en Personas de Mayor Edad con Diabetes Tipo 2.

Pilot Study

The University of Texas Health Science Center in San Antonio
University Health Center-Downtown
and
The University of Texas at Austin

Le pedimos a Ud. que participe en una investigación de cómo las personas de mayor edad con diabetes se cuidan de si mismos y de su diabetes. La investigadora es Lonnie Wen y ella es una estudiante graduada en la University of Texas at Austin. Se hace esta investigación como un requisito para el programa de estudios graduados. Queremos aprender cómo la familia y otros factores puedan afectar cómo la gente se cuida de su diabetes. Le pedimos a Ud. que participe en nuestra investigación porque Ud. tiene 55 años o más, ha padecido de la diabetes Tipo 2 por un año o más, y porque Ud. vive con la familia. Si Ud. participa, Ud. será uno de unas 12 personas en la investigación.

Si Ud. decide participar, le vamos a pedir que complete una encuesta que hace muchas preguntas diferentes que puedan ver con las actividades que Ud. hace para cuidarse de su diabetes. Nosotros queremos saber que las preguntas son claros y facil para entender. La encuesta pregunta sobre los asuntos siguientes:

- La frequencia con que las personas de su familia y otras personas no familiares hacen cosas relacionadas a las actividades cotidianas que Ud. hace relacionadas a su diabetes;
- La satisfacción de Ud. en cuanto a cada miembro familiar;
- Las cosas que a veces lo hacen difícil seguir sus actividades relacionadas a la diabetes;
- Preguntas generales sobre la diabetes, el tratamiento, y otro problemas médicos que resultan de la diabetes;
- Cómo Ud. se ha sentido reciéntamente; y
- El idioma que Ud. prefiere hablar.

En adición hay algunas preguntas sobre su humor, concentración, y memoria.

La encuesta puede durar de 45 minutos hasta una hora para completar y es una encuesta que se toma solamenta una vez. Ud. tiene el derecho de no contestar a cualquier pregunta en la encuesta. También vamos a mirar su récord médico para información sobre su salud y su diabetes.

No podemos garantizar que Ud. se beneficiará de participar en nuestro estudio. La información que se recoge de esta investigación no afectará el tratamiento general que Ud. recibe de su(s) médico(s).

De nuestro agradacimiento por su tiempo, Ud. recibirá una copia de la edición en español del libro <u>101 Medication Tips for People with Diabetes</u>, o si Ud. prefiere, <u>Diabetes from A to Z</u>. No le cuesta nada participar en esta investigacion.

Haremos todo lo posible para garantizar su confidencialidad. Si publicamos los resultados de esta investigación en una revista científica o en un libro, no lo vamos a identifcar a Ud. de ninguna manera.

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Marv Sheperd, Ph.D. Profesor Supervisante	The University of Texas at Austin	(512) 471-6892

Si Ud. tiene cualquiera pregunta o preocupación acerca de su tratamiento como participante en esta investigación, Ud. puede ponerse en contacto con el comité que examina investigaciones que tratan de participantes humanos (Institutional Review Board). Los números de teléfono de los comités en San Antonio y en Austin están abajo.

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Profesor Clarke Burnham Chair of the University of Texas at Austin Institutional Review Board	(512) 232-4383

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________________________________ Firma del participante	______________________________________ Firma del testigo
___________________/____________ Fecha Hora	______________________________________ Firma de la person que consigue el consentimiento
	______________________________________ Nombre de letra y título de la persona que consigue el consentimiento

SUBJECT CONSENT TO TAKE PART IN A STUDY OF

The Relationship of Family Environment and Other Social Cognitive Variables on Diabetes Self-Care Behaviors in Older Adults with Type 2 Diabetes

The University of Texas Health Science Center in San Antonio
University Health Center-Downtown
and
The University of Texas at Austin

We are asking you to take part in a research study of how older adults with diabetes take care of themselves and diabetes. The researcher is Lonnie Wen and she is a graduate student at The University of Texas at Austin. This study is being conducted as a required research project for the graduate program. We want to learn about how the family and other factors may affect how people take care of their diabetes. We are asking you to take part in this study because you are 55 years of age or older, you have had Type 2 diabetes for one year or more, and you live with a family. If you participate, you will be one of approximately 160 people in the study.

If you decide to take part, we will ask you to complete a survey that asks about many different things that may be related to your diabetes self-care activities. The survey asks about the following areas:

- how often family and non-family members do things related to your daily self-care activities;
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______________________________ Signature of Witness

________________/____________ Date Time

______________________________ Signature of Person Obtaining Consent

______________________________ Printed Name & Title of Person Obtaining Consent

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La Relación del Ambiente Familiar y Otros Factores Sociales a los Comportamientos en cuanto al Auto-cuidado de la Diabetes en Personas de Mayor Edad con Diabetes Tipo 2

The University of Texas Health Science Center in San Antonio
University Health Center-Downtown
and
The University of Texas at Austin

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- La satisfacción de Ud. en cuanto a cada miembro familiar;
- Las cosas que a veces lo hacen difícil seguir sus actividades relacionadas a la diabetes;
- Preguntas generales sobre la diabetes, el tratamiento, y otro problemas médicos que resultan de la diabetes;
- Cómo Ud. se ha sentido reciéntamente; y
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The University of Texas Health Science Center in San Antonio (210) 567-2351

Profesor Clarke Burnham (512) 232-4383
CHAIR OF THE UNIVERSITY OF TEXAS AT AUSTIN INSTITUTIONAL REVIEW BOARD

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_________________________________ _______________________________________
Firma del participante Firma del testigo

____________________/____________ _______________________________________
Fecha Hora Firma de la person que consigue el consentimiento

____
Nombre de letra y título de la persona que consigue el consentimiento Página 2 de 2

APPENDIX B

INTRODUCTORY LETTERS

(English and Spanish)

Introductory Letter- English

Dear Patient:

Taking care of one's diabetes can be very difficult to do at times because with diabetes one must make lifestyle changes such as eating the right foods, exercising, checking your blood sugars and sometimes taking oral medication or taking insulin shots. There are many different factors that affect the way one takes care of their diabetes. It has been found that the family plays a very important role in young children and adolescents with diabetes. There have not been many studies done in the older adults. The purpose of this study is to learn how the family and other factors can affect self-care behaviors.

A trained interviewer will ask you information about yourself, your family environment, the way you live, and the things you do at home to take care of yourself. A bilingual interviewer is available if you prefer Spanish. The interview will take about 45 minutes to an hour to complete. The results from this study will be used to help develop programs in order to help diabetics and their family better take care of their diabetes.

Participation in this study is completely voluntary and confidential. Your decision to participate in this study will not affect the care that you receive from the clinic or the physicians. Your responses will be kept completely confidential. This information will not be placed in your medical record.

As a token of our appreciation for your assistance in this study, you will receive a copy of the book <u>101 Medication Tips for People with Diabetes</u> or if you prefer, <u>Diabetes from A to Z,</u> Spanish edition.

Thank you for your assistance.

Sincerely,

Lonnie Wen, M.S.
Doctoral Candidate
Pharmacy Administration Division
College of Pharmacy
University of Texas at Austin

Marv Shepherd, Ph.D.
Director
Pharmacy Administration Division
College of Pharmacy
University of Texas at Austin

Michael Parchman, M.D., M.P.H.
Associate Professor
Department of Family Practice,
University of Texas Health Science Center -San Antonio

Introductory Letter- Spanish

Estimado Paciente:

Cuidarse de la diabetes pueda ser muy difícil a veces porque al padecer de la diabetes hay que hacer cambios en la vida tales como comer comidas buenas, hacer ejercicios, revisar el nivel de azúcar en la sangre, y a veces tomar la medicina o hacerle inyecciones de la insulina. Hay muchos factores que afectan como uno se cuida de la diabetes. Se sabe que el papel de la familia en cuidar a los niños y los adolescentes con diabetes es muy importante. No han hecho muchas investigaciones sobre las personas de mayor edad. La meta de esta investigación es aprender cómo la familia y otros factores puedan afectar el cuidado que Ud. realiza en cuanto a su diabetes.

Una persona entrenada en hacer entrevistas va a preguntarle información de Ud. mismo(a), de su familia, de su modo de vivir y de las cosas que Ud. hace en casa para cuidarse. Si Ud. prefiere hablar español, tenemos un entrevistador bilingüe disponible. La entrevista toma unos 45 minutos a un hora para completar. Se utilizarán los resultados de este estudio para ayudar en el desarrollo de programas que ayudan a los diabéticos y a sus familias a mejor cuidarles de su diabetes.

La participación en esta investigación es completamente voluntaria y confidencial. La decisión de participar o no no afectará la asistencia que Ud. recibe de la clínica o de los médicos. Se mantendrán confidencial todas las respuestas de Ud. No se incluirá esta información en su expediente médico.

Para mostrar nuestro agradecimiento por su participación en esta investigación, Ud. va a recibir la edición en español de 101 Medication Tips for People with Diabetes o, si Ud. prefiere, Diabetes from A to Z.

Gracias por su ayuda.

Sinceramente,

Lonnie Wen, M.S.
Candidata doctoral
Pharmacy Administration Division
College of Pharmacy
University of Texas at Austin

Marv Sheperd, Ph.D.
Director
Pharmacy Administration Division
College of Pharmacy
University of Texas at Austin

Michael Parchman, M.D., M.P.H.
Profesor Asociado
Department of Family Practice
University of Texas Health Science Center -San Antonio

APPENDIX C

QUESTIONNAIRE

(English)

INSTRUMENT

Background Information

Today's Date____________________	Clinic
Study Id #______________________	________ Geriatrics [1]
Birth date* _____________________	________ Family Practice West [2]
Sex _____Male ____ Female	________ Family Practice East [3]

*Diabetes- Related Comorbidities
Check all comorbidities listed in clinical records (medical history)

____ cardiovascular disease	_____ retinopathy
_____cerebral vascular disease	_____ nephropathy
_____peripheral neuropathy	_____ sexual dysfunction
_____peripheral vascular disease	_____ urinary incontinence
_____ renal failure	_____ foot problems

Other comorbidities:

__________________________ __________________________

__________________________ __________________________

__________________________ __________________________

__________________________ __________________________

HbA1C* ______________ Date of HbA1C __________________
(most recent)

*Researcher to obtain from clinical records

Study ID #__________

The survey includes questions in the following areas:

1.) family and non-family support with diabetes related activities;
2.) satisfaction with your family;
3.) the things that can sometimes make it more difficult for you to follow your diabetes self-care routine;
4.) your confidence in your ability to carry out the diabetes related routine;
5.) your understanding of the disease, its management and complications;
6.) the things you do to take care of your diabetes such as diet, exercise, monitoring your glucose and taking medication(s);
7.) how you have been feeling and behaving recently; and
8.) the language(s) you speak and your preferences;

In addition, there are a few questions that check your concentration and memory.

Before we begin, please tell us a little bit about yourself and your family environment.

1. What is your current marital status?

____ Married [1] ____Separated [3] ____ Never Married [5]

____Widowed [2] ____ Divorced [4]

2. What is your household status?

____lives with spouse or significant other [1]

____lives with spouse or significant other and children [2]

____lives with children [3]

____lives with relatives and friends [4]

____ other [5]

3. How long have you been diagnosed with diabetes? ________ years

Section I. Diabetes Self-Care Recommendations

Next, could you please tell me a little bit more about how you have been advised to take care of your diabetes?

Diet

1. I am going to read to you a list of recommendations about your diet that your health care team (doctor, nurse, dietitian, or diabetes educator) may have advise you to do. Please let me know which ones apply to you. There may be more than one.

____ a. Follow a low-fat eating plan

_____b. Follow a complex carbohydrate diet such as fruits, vegetables and cereals

_____ c. Reduce the number of calories you eat to lose weight

_____d. Eat lots of food high in dietary fiber

_____e. Eat lots (at least 5 servings per day) of fruits and vegetables

_____f. Eat very few sweets (for example: desserts, non-diet sodas, candy bars)

_____g. Other

_____h. I have not been given any advice about my diet by my health care team.

Exercise

2. The following are recommendations about exercise. Please let me know which ones apply to you. There may be more than one.

_____ a. Get low level exercise (such as walking) on a daily basis

_____ b. Exercise continuously for at least 20 minutes at least 3 times per week

_____ c. Fit exercise into your daily routine (for example, take stairs instead of elevators, park a block away and walk, etc…)

_____ d. Engage in a specific amount, type, duration and level of exercise

_____ e. Other (specify)

_____f. I have not been given any advice about exercise by my health care team

Blood Glucose Monitoring

3. The following are recommendations about monitoring your blood glucose. Please let me know which ones apply to you. There may be more than one.

___a. Test you blood sugar using a drop of blood from your finger and a color chart.

___b. Test your blood sugar using a machine to read the results.

___c. Test your urine for sugar.

___d. Other (specify)

SECTION II. Cognitive Function

Clock Drawing Task

In this next section, I am going to have you draw a couple of clocks.

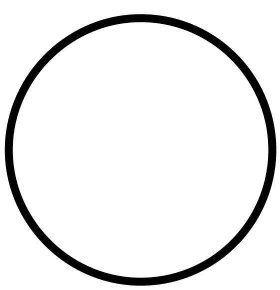
CLOX: An Executive Clock Drawing Task©

STEP 1: Turn this form over on a light colored surface so that the circle below is visible. Have the subject draw a clock on the back. Instruct him or her to **"Draw me a clock that says 1:45. Set the hands and numbers on the face so that a child could read them."** Repeat the instructions until they are clearly understood. Once the subject begins to draw no further assistance is allowed. Rate his clock (CLOX 1).

STEP 2: return to this side and let the subject observe you draw a clock in the circle below. Place 12, 6, 3 &9 first. Set the hands again to "1:45". Make the hands into arrows. Invite the subject to copy your clock in the lower right corner. Score this clock (CLOX 2).

RATING

Organizational Elements	**Point Value**	**CLOX 1**	**CLOX 2**
Does figure resemble a clock?	**1**		
Outer Circle Present?	**1**		
Diameter > 1 inch?	**1**		
All numbers inside the circle?	**1**		
12, 6, 3 & 9 placed first?	**1**		
Spacing intact? (Symmetry on either side of the 12-6 axis) If "yes" skip next.	**2**		
If spacing errors are present, are there signs of correction or erasure?	**1**		
Only Arabic numerals?	**1**		
Only numbers 1-12 among the Arrabic numerals present?	**1**		
Sequence 1-12 intact? No omissions or intrusions.	**1**		
Only two hands present?	**1**		
All hands represented as arrows?	**1**		
Hour hand between 1 and 2'oclock?	**1**		
Minute hand longer than hours?	**1**		
None of the following 1.) hand pointing to 4 or 5 o'clock?	**1**		
2.) "1:45" present?	**1**		
3.) intrusions from "hand" or "face" present?	**1**		
4.) any letters, words or pictures?	**1**		
5.) any intrusions from circle below?	**1**		



SECTION III. DIABETES FAMILY BEHAVIOR CHECKLIST II

We want to know how often family members do several things related to your daily self-care activities. Rate the family member with whom you generally have the most contact. Just let me know what happens at home - there are no right or wrong answers.

1. Family member you are rating (circle one):

a. Husband [1]	c. Partner [3]	e. Child [5]
b. Wife [2]	d. Sibling [4]	f. Other (specify) _________[6]

2. How much time do you spend with this person on a typical day? (count only waking hours) ___________________hours

3. How much does this person know about diabetes?

Hardly Anything		A Moderate Amount			A Great Deal	
1	2	3	4	5	6	7

For the next set of questions, we will use a scale from 1 to 5 with 1 meaning "never" and 5 "at least once a day". You can choose any number in between.
[show cards]

How often does he/she:	**Never**	**Once A Month**	**Once A Week**	**Several Times A Week**	**At Least Once A Day**	
4. Praise you for following your diet?	1	2	3	4	5	
5. Nag you about testing your glucose level?	1	2	3	4	5	n/a
6. Suggest things that might help you take your diabetes medication on time?	1	2	3	4	5	
7. Criticize you for not exercising regularly?	1	2	3	4	5	n/a

DFBC II continued

How often does he/she:	Never	Once A Month	Once A Week	Several Times A Week	At Least Once A Day	
8. Help you decide if changes should be made based on glucose testing results?	1	2	3	4	5	n/a
9. Nag you about not following your diet?	1	2	3	4	5	
10. Argue with you about your diabetes self-care activities?	1	2	3	4	5	
11. Encourage you to participate in sports activities?	1	2	3	4	5	n/a
12. Plan family activities so that they will fit in with your diabetes self-care schedule?	1	2	3	4	5	
13. Congratulate you for sticking to your diabetes self-care schedule?	1	2	3	4	5	
14. Criticize you for not recording the results of glucose test?	1	2	3	4	5	n/a
15. Eat at the same time that you do?						
16. Exercise with you?	1	2	3	4	5	n/a
17. Let you sleep late rather than getting up to take your diabetes medication?	1	2	3	4	5	
18. Buy you things containing sugar to carry with you in case of a hypoglycemic reaction?	1	2	3	4	5	
19 Eat foods that are not part of your diabetic diet?	1	2	3	4	5	
20. Other supportive or nonsupportive things he/she does:						
______________________________	1	2	3	4	5	
______________________________	1	2	3	4	5	

Non-Family Support

The next set of questions asks about the support that you receive from your friends.
We will use a scale from 1 to 5 with 1 meaning “strongly disagree” and 5 “strongly agree”.
You can choose any number in between.
[show cards]

21. My friends:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. accept me and my diabetes.	1	2	3	4	5
b. feel uncomfortable about me because of my diabetes.	1	2	3	4	5
c. encourage or reassure me about my diabetes.	1	2	3	4	5
d. discourage or upset me about my diabetes.	1	2	3	4	5
e. listen to me when I want to talk about my diabetes.	1	2	3	4	5
f. nag me about my diabetes.	1	2	3	4	5

Study ID #___________

Family APGAR (**have 1 form for each family member)

Please rate each family member.
Please substitute the family member name for my family* in each of the following sentences.

We will use a scale from 1 to 5 with 1 meaning "never" and 5 "always".
You can choose any number in between.

Family Member Rated_________________ Relationship____________ Age_____ Sex____

For coding:

a. Husband [1] c. Partner [3] e. Daughter [5] g. other _________ [7]

b. Wife [2] d. Sibling [4] f. Son [6]

	Never	**Hardly ever**	**Some of the time**	**Almost always**	**Always**
I am satisfied with the help that I receive from my family* when something is troubling me.	1	2	3	4	5
I am satisfied with the way my family* discusses items of common interest and shares problem-solving with me.	1	2	3	4	5
I find that my family* accepts my wishes to take on new activities or make changes in my life-style.	1	2	3	4	5
I am satisfied with the way my family* expresses affection and responds to my feelings such as anger, sorrow, and love.	1	2	3	4	5
I am satisfied with the amount of time my family* and I spend together.	1	2	3	4	5

SECTION IV. Barriers to Self-Care

I have a list of a number of things that can sometimes make it more difficult to follow one's self-care routine. For each one, please indicate how often that situation generally occurs for you. using the scale below.

We will use a scale from 1 to 7 with 1 meaning "very rarely or never" and 7 "daily".
You can choose any number in between.
[show cards]

If the particular self-care behavior does not apply to you, just let me know.

	1 Very rarely or never	**2** Once per month	**3** Twice per month	**4** Once per week	**5** Twice per week	**6** More than twice weekly	**7** Daily	**0** Does not apply to me
How often do each of the following happen to you?								
1. I am not at home and it is time to test my blood glucose level.	1	2	3	4	5	6	7	0 I don't test
2. I am not at home when it is time to take my diabetes medication (oral or insulin).	1	2	3	4	5	6	7	0
3. I am not in a convenient location when it is time to exercise.	1	2	3	4	5	6	7	0
4. I am at a restaurant or someone else's house at meal times.	1	2	3	4	5	6	7	0
5. The weather is bad when I would like to exercise.	1	2	3	4	5	6	7	0
6. I am unsure about the amount of sugar in one or more food items I consume.	1	2	3	4	5	6	7	0
7. I'll say to myself that it won't matter if I don't exercise.	1	2	3	4	5	6	7	0

Barriers continued

	1 Very rarely or never	2 Once per month	3 Twice per month	4 Once per week	5 Twice per week	6 More than twice weekly	7 Daily	0 Does not apply to me
How often do each of the following happen to you?								
8. I'll say to myself that it won't matter if I don't take my diabetes medication.	1	2	3	4	5	6	7	0
9. I'll say to myself that it won't matter if I don't follow my diet.	1	2	3	4	5	6	7	0
10. I'll say to myself that it won't matter if I don't check my glucose level.	1	2	3	4	5	6	7	0
11. I am extremely busy.	1	2	3	4	5	6	7	0
12. I don't have the necessary material or equipment with me when it is time to take my diabetes medication.	1	2	3	4	5	6	7	0
13. I don't have the necessary material or equipment with me when it is time to exercise.	1	2	3	4	5	6	7	0
14. I don't have the necessary material or equipment with me when it is time to test my glucose level.	1	2	3	4	5	6	7	0
15. I still feel hungry after finishing a meal.	1	2	3	4	5	6	7	0
16. I feel sore and stiff.	1	2	3	4	5	6	7	0
17. I think about how much time it takes to prepare foods the way I should.	1	2	3	4	5	6	7	0

Barriers continued

How often do each of the following happen to you?	1 Very rarely or never	2 Once per month	3 Twice per month	4 Once per week	5 Twice per week	6 More than twice weekly	7 Daily	0 Does not apply to me
18. I think about how much time it takes to take my diabetes medication.	1	2	3	4	5	6	7	0
19. I think about how much time it takes to test my glucose level.	1	2	3	4	5	6	7	0
20. I think about how much time it takes to exercise.	1	2	3	4	5	6	7	0
21. I have visitors staying with me	1	2	3	4	5	6	7	0
22. I am still in bed when it is time to take my medication.	1	2	3	4	5	6	7	0
23. I am still in bed when it is time to test my glucose level.	1	2	3	4	5	6	7	0
24. I feel awkward with other people around when it is time to test my glucose level.	1	2	3	4	5	6	7	0
25. I feel awkward with other people around when it is time to take my medication.	1	2	3	4	5	6	7	0
26. I don't feel well.	1	2	3	4	5	6	7	0
27. I am around people who are eating or drinking things I shouldn't.	1	2	3	4	5	6	7	0
28. I think about the cost of my diabetes medications.	1	2	3	4	5	6	7	0

Barriers continued

	1 Very rarely or never	2 Once per month	3 Twice per month	4 Once per week	5 Twice per week	6 More than twice weekly	7 Daily	0 Does not apply to me
How often do each of the following happen to you?								
29. I think about the cost of materials for testing my blood glucose levels.	1	2	3	4	5	6	7	0
30. I think about the cost of necessary equipment or fees for exercise.	1	2	3	4	5	6	7	0
31. I think about the cost of the recommended foods to eat according to my meal plan.	1	2	3	4	5	6	7	0

SECTION V. Knowledge

Diabetes Knowledge Questionnaire (DKQ-24)
The next set of questions asks about diabetes and how to take care of your diabetes.
Please answer each question with a YES or NO. If you don't know the answer to a question, just let me know.

Questions	**Yes** [1]	**No** [2]	**I Don't Know** [3]
1. Eating too much sugar and other sweet foods is a cause of diabetes.	_____	______	______
2. The usual cause of diabetes is not having enough insulin in the body that is working as well as it should.	_____	______	______
3. Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	____	______	______
4. Kidneys produce insulin.	____	______	______

DKQ-24 continued

Questions	Yes [1]	No [2]	I Don't Know [3]
5. In untreated diabetes, the amount of sugar in the blood usually increases.	____	______	______
6. If I am diabetic, my children have a higher chance of being diabetic.	____	______	______
7. Diabetes can be cured.	____	______	______
8. A fasting blood sugar level of 210 is too high.	____	______	______
9. The best way to check my diabetes is by testing my urine.	____	______	______
10. Regular exercise will increase the need for insulin or other diabetic medication.	____	______	______
11. There are two main types of diabetes: Type 1 and Type 2 (non-insulin dependent).	____	______	______
12. An insulin reaction is caused by too much food.	____	______	______
13. Medication is more important than diet and exercise to control my diabetes.	____	______	______
14. Diabetes often causes poor circulation.	____	______	______
15. Cuts and abrasions on diabetics heal more slowly.	____	______	______
16. Diabetics should take extra care when cutting their toenails.	____	______	______
17. A person with diabetes should cleanse a cut with iodine and alcohol.	____	______	______
18. The way I prepare my food is as important as the foods I eat.	____	______	______
19. Diabetes can damage my kidneys.	____	______	______

DKQ-24 continued
Questions

Questions	Yes [1]	No [2]	I Don't Know [3]
20. Diabetes can cause loss of feeling in my hands, fingers, and feet.	____	______	______
21. Shaking and sweating are signs of high blood sugar.	____	______	______
22. Frequent urination and thirst are signs of low blood sugar.	____	______	______
23. Tight elastic socks are not bad for diabetics.	____	______	______
24. A diabetic diet consists mostly of special foods.	____	______	______

SECTION VI. Self- Efficacy

The following section asks about your confidence in your ability to carry out the diabetes related routine. We will use a scale from 1 to 5 with 1 meaning "strongly disagree" and 5 "strongly agree." You can choose any number in between.

[show cards]

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	**2**	**3**	**4**	**5**

1. I am confident in my ability to follow my diet. _____________
2. I am confident in my ability to test my blood sugar at the recommended frequency. _____________
3. I am confident in my ability to exercise regularly. _____________
4. I am confident in my ability to keep my weight under control. ____________
5. I am confident in my ability to keep my blood sugar level under control. ____________
6. I am confident in my ability to resist food temptations. ____________
7. I am confident in my ability to take my diabetes medication as directed (insulin or pills). ____________

SECTION VII. Self-Care Activities

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.

Diet

1. How many of the last SEVEN DAYS have you followed a healthful eating plan?

0 1 2 3 4 5 6 7

2. On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?

0 1 2 3 4 5 6 7

3. On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?

0 1 2 3 4 5 6 7

4. On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?

0 1 2 3 4 5 6 7

5. On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day? (for example starches such as potatoes, breads, and tortillas)

0 1 2 3 4 5 6 7

Exercise

6. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).

0 1 2 3 4 5 6 7

7. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?)

0 1 2 3 4 5 6 7

Blood Sugar Testing

8. On how many of the last SEVEN DAYS did you test your blood sugar?

0	1	2	3	4	5	6	7

9. On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?

0	1	2	3	4	5	6	7

Medication Taking

10. Please tell me what diabetic medications have been prescribed for you. Include insulin and oral medications. For each medication that you take, please answer each of the questions about the medication.

In the past SEVEN DAYS:

a. Medication name and strength	b. Directions on how to take the medication	c. How many times did you miss a dose because you forgot or purposely did not take?	d. How many times did you add an extra dose?*	e. How many times did you reduce or cut down the dose?*

*If you are adjusting your insulin dose as directed by your health care provider, items *d* and *e* may not apply.

1.____________________	________________	__________	_________	______
2.____________________	________________	__________	_________	______
3.____________________	________________	__________	_________	______
4..____________________	________________	__________	_________	______

Section VIII. Patient Health Questionnaire (PHQ-9)

I have a list of statements that describe ways you might have felt or behaved during the last 2 weeks. Please tell me how often you have felt this way during the past week. For this section, we will use a scale from 0 to 3 with 0 meaning "not at all" and 3 "nearly every day".

You can choose any number in between.
[show cards]

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself-or that you are a failure or have let yourself or your family down.	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television.	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite- being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thought that you would be better off dead or of hurting yourself in some way	0	1	2	3
(For coding) Total Score _____ =		_____ +	______ +	______

Section IX. Acculturation Scale

We are almost at the end of the survey. This next section asks about the language(s) that you speak and your preferences.

1. What language you prefer to speak when you are here at the clinic?

______________English [1]
______________Spanish [2]
______________Both Equally [3]

2. What language is most often spoken in your home?

_____________English [1]
_____________Spanish [2]
_____________Both Equally [3]

3. What is your first language as a child?

_____________English [1]
_____________Spanish [2]

4. Many of the patients have difficulty reading in either English or Spanish. Do you read any English?

_____________yes, anything [1]
_____________some [3]
_______________ very little [2]
_______________ none [4]

Section X. Demographics

This is the last section of the survey. Please answer a few more questions about yourself.

1. What is your race or ethnic origin?

____ White (Non-Hispanic) [1] ____ Black [2] ____ Hispanic [3]
____ Native American [4] ____ Asian or Pacific Islander [5] ____ Other [6]

Demographics continued

2. What is your monthly income from all sources before taxes? Please include the income from your earnings and all other members in your family.

_______ less than $500	______ $2501 - $3000
_______ $501 - $1000	______ $3001 - $4000
_______ $1001 - $1500	______ $4001 - $5000
_______ $1501 - $2000	______ $5001 - $6000
_______ $2001 - $2500	______ over $6000

3. How much schooling have you had?

______ 8 or less years [1]

______ 9-11 years [2]

______ 12 years (high school graduate) [3]

______ some college or associates degree [4]

______ bachelors degree [5]

______ advanced degree [6]

4. Are you currently employed?

_________ yes [1] ___________ no [2] ___________ retired [3]

_________ other [4]

If you are employed, what is your present occupation?

____

Thank you very much for your time.

APPENDIX D

QUESTIONNAIRE

(Spanish)

INSTRUMENTO*

Background Information

Today's Date____________________   Clinic   __________ Geriatrics [1]

Study Id #______________________   __________ Family Practice West [2]

Birth date* _____________________   __________ Family Practice East [3]

Sex _____Male ____ Female

*Diabetes- Related Comorbidities
Check all comorbidities listed in clinical records (medical history)

____ cardiovascular disease   _____ retinopathy

_____cerebral vascular disease   _____ nephropathy

_____peripheral neuropathy   _____ sexual dysfunction

_____peripheral vascular disease   _____ urinary incontinence

_____ renal failure   _____ foot problems

Other comorbidities:

__________________________   __________________________

__________________________   __________________________

__________________________   __________________________

__________________________   __________________________

HbA1C* _____________   Date of HbA1C _________________
(most recent)

*Researcher to obtain from clinical records

Study ID #_________

Esta encuesta incluye preguntas de la categorías siguientes:

1.) El apoyo de los familiares y de los amigos en relación a sus actividades relacionadas con la diabetes;
2.) La satisfación que Ud. siente con su familia;
3.) Las cosas que a veces le hacen difícil seguir su rutina en cuanto al cuidado de la diabetes;
4.) La confianza que Ud. tiene en su capacidad de realizar la rutina asociada con el cuidado de la diabetes;
5.) Los conocimientos de Ud. acerca de su enfermedad, el manejo, y las complicaciones;
6.) Las cosas que Ud. hace para cuidarse de la diabetes tales como seguir la dieta, hacer ejercicios, revisar el nivel de azúcar en la sangre, y tomar las medicinas.
7.) Cómo Ud. se ha sentido y comportado reciéntemente; y
8.) El idioma que Ud. habla y su preferencias.

En adición, hay algunas preguntas que examinan la concentración y la memoria.

Antes de empezar, favor de contarnos un poco de Ud. y de su ambiente familiar.

1. ¿Cuál es estado civil?

_______ Casado(a) _____ Separado(a) _______ Nunca casado(a)

_______ Viudo(a) _____ Divorciado

2. ¿Con quién vive Ud.?

____ vivo con mi esposa(o) (u otra persona importante en mi vida)

____ vivo con mi esposa(o) (u otra persona importante en mi vida) y con los hijos

____ vivo con mis hijos

_____ vivo con familiares y amigos

_____ otro

3. ¿En qué año le diagnosticaron por primera vez con la diabetes? _________

SECCIÓN I. Recomendaciones Para La Diabetes

Por favor, podria decirme un poco más sobre las recomendaciones que se le han dado para cuidar su diabetes.

La dieta

1. Voy a leerle a Ud. una lista de recomendaciones sobre su dieta que sus consejeros médicos (el médico, la enfermera, la dietista, o asistente médico) probablemente le hayan aconsejado que Ud. haga. Por favor, avíseme lo que le han recomendado al poner una X al lado de la oraciónes que le aplique. Es posible que haya más de una respuesta que le aplique.

____ a. Seguir un régimen de comidas bajas en grasa.

____ b. Seguir un régimen de comidas de carbohidratas complejas como frutas, vegetales y cereales.

____ c. Reducir el número de calorías que consumo para bajar de peso.

____ d. Comer muchas comidas que tienen mucha fibra.

____ e. Comer muchos frutas y vegetales (por lo menos 5 porciones al día).

____ f. Comer muy pocos dulces (postres, refrescos no dietéticos, chocolates).

____ g. Otras recomendaciones.

____ h. No me han dado dado ningún consejo.

Ejercicios

2. Las siguientes son recomendaciones sobre los ejercicios. Por favor, permiteme saber cuales le aplican. Puede haber más de una.

_____ a. Hacer ejercicios suaves (como caminar) cada día.

_____ b. Hacer ejercicios seguidos por lo menos 20 minutos por lo menos 3 veces a la semana.

_____ c. Incorporar ejercicios en mi rutina diaria (por ejemplo, usar las escaleras en vez de los ascensores, estacionar el coche más lejos para poder caminar, etc.)

_____ d. Hacer una cantidad, tipo, duración, y nivel específico de ejercicios.

_____ e. Otro (favor de especificar)

_____ f. No me han recomendado nada acerca de los ejercicios.

Revisión del Azúcar en la Sangre

3. Las siguientes son recomendaciones sobre la revisión del azúcar en la sangre. Por favor, permiteme saber cuales le aplican. Puede haber más de una.

_____a. Revisó Ud. el azúcar en la sangre al usar una gota de sangre del dedo y una tabla de color.

_____ b. Revisó Ud. el azúcar en la sangre al usar una máquina para leer los resultados.

______c. Revisó Ud. la orina para el azúcar.

_____ d. Otro (favor de especificar).

SECCIÓN II. Función Cognitiva

Tarea de Dibujar Relojes

En esta sección le voy a pedir a Ud. que dibuje unos relojes.

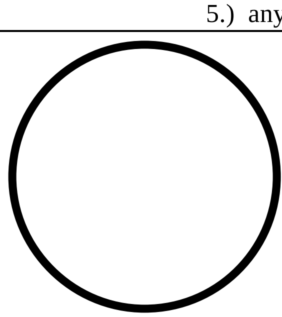
CLOX: An Executive Clock Drawing Task©

STEP 1: Turn this form over on a light colored surface so that the circle below is visible. Have the subject draw a clock on the back. Instruct him or her to **"Favor de dibujar un reloj que muestra la hora 1:45. Dibuja las manos y los números del reloj de manera que un niño podría leerlos."**
Repeat the instructions until they are clearly understood. Once the subject begins to draw no further assistance is allowed. Rate his clock (CLOX 1).

STEP 2: return to this side and let the subject observe you draw a clock in the circle below. Place 12, 6, 3 & 9 first. Set the hands again to "1:45". Make the hands into arrows. Invite the subject to copy your clock in the lower right corner. Score this clock (CLOX 2).
"Favor de copiar mi reloj aquí en este papel".

RATING

Organizational Elements	**Point Value**	**CLOX 1**	**CLOX 2**
Does figure resemble a clock?	**1**		
Outer Circle Present?	**1**		
Diameter > 1 inch?	**1**		
All numbers inside the circle?	**1**		
12, 6, 3 & 9 placed first?	**1**		
Spacing intact? (Symmetry on either side of the 12-6 axis) If "yes" skip next.	**2**		
If spacing errors are present, are there signs of correction or erasure?	**1**		
Only Arabic numerals?	**1**		
Only numbers 1-12 among the Arrabic numerals present?	**1**		
Sequence 1-12 intact? No omissions or intrusions.	**1**		
Only two hands present?	**1**		
All hands represented as arrows?	**1**		
Hour hand between 1 and 2'oclock?	**1**		
Minute hand longer than hours?	**1**		
None of the following 1.) hand pointing to 4 or 5 o'clock?	**1**		
2.) "1:45" present?	**1**		
3.) intrusions from "hand" or "face" present?	**1**		
4.) any letters, words or pictures?	**1**		
5.) any intrusions from circle below?	**1**		



SECCIÓN III. COMPORTAMIENTO FAMILIAR EN CUANTO A LA DIABETES LISTA II

Queremos saber con qué frequencia los miembros de la familia de Ud. hacen varias cosas relacionadas a sus actividades diarias que tienen que ver con el cuidado de su diabetes. Clasifique al pariente con quien Ud. Tiene mayor contacto. Quiero saber lo que pasa en la casa. No hay respuesta correcta ni incorrecta.

1. Pariente que Ud. clasifica (traze un círculo alrededor de esta persona):

a. Esposo	c. Compañero	e. Hijo
b. Esposa	d. Hermano(a)	f. Otro (¿quién?)_____________

2. ¿Cuánto tiempo pasa Ud. con esta persona en un día típico?
   (cuente solamente las horas despiertas) _____________________horas.

3. ¿Cuánto sabe esta persona de la diabetes?

Casi nada			Un poco			Mucho
1	**2**	**3**	**4**	**5**	**6**	**7**

Para el grupo de preguntas siguientes, vamos a emplear una escala de 1 a 5. 1 significa "nunca" y 5 significa "una vez al día por lo menos". Ud. puede eligir cualquier número que corresponde.

¿Con qué frequencia….?	**Nunca**	**Una vez al mes**	**Una vez por semana**	**Muchas veces por semana**	**Por lo menos una vez al día**	
4. Le da alabanzas por seguir la dieta?	1	2	3	4	5	
4.) Le pide que chequee el nivel de azúcar en la sangre?	1	2	3	4	5	n/a
6. Le sugiere cosas que ayude a Ud. a tomar los medicamentos para la diabetes a tiempo?	1	2	3	4	5	
7. Le critica para no hacer ejercicios con regularidad?	1	2	3	4	5	n/a

DFBC II (contininued)

¿Con qué frequencia….?	Nunca	Una vez al mes	Una vez por semana	Muchas veces por semana	Por lo menos una vez al día	
8. Ayuda a Ud. a decidir si debe hacer cambios basados en los resultados de los examenes de azúcar?	1	2	3	4	5	n/a
9. Le regaña por no seguir la dieta?	1	2	3	4	5	
10. Discute con Ud. de sus actividades relacionadas con el cuido de su diabetes?	1	2	3	4	5	
11. Le anima participar en actividades deportistas?	1	2	3	4	5	n/a
12. Planea actividades familiares que coordinen con el horario de su cuido de su diabetes?	1	2	3	4	5	
13. Le felicita por seguir su horario de cuidado de la diabetes?	1	2	3	4	5	
14. Le critica por no apuntar los resultados de la revisión del nivel de azúcar?	1	2	3	4	5	
15. Come a la misma hora que Ud.?	1	2	3	4	5	
16. Hace ejercicios con Ud.?	1	2	3	4	5	n/a
17. Le permite dormir más en vez de levantarse para tomar las medicinas?	1	2	3	4	5	
18. Le compra cosas con azúcar para llevar con Ud. en caso de una reacción debida a bajo azúcar?	1	2	3	4	5	
19. Come cosas que no son parte de la dieta diabetica de Ud.?	1	2	3	4	5	

DFBC II (contininued)

¿Con qué frequencia….?	Nunca	Una vez al mes	Una vez por semana	Muchas veces por semana	Por lo menos una vez al día
20. Otras cosas apoyantes o no apoyantes que hacen esta persona? ______________________ ______________________	1	2	3	4	5

Apoyo de personas que no son parientes

El grupo siguiente de preguntas pregunta del apoyo que Ud. recibe de sus amigos. Vamos a usar una escala de números de 1 a 5. 1 significa que Ud. no está de acuerdo en absoluto y 5 significa que Ud. está de acuerdo completemente. Ud. también puede escoger cualquier número entre 1 a 5 que muestra su acuerdo con la oración.
[show cards]

No estoy de acuerdo en absoluto	No estoy de acuerdo	Neutral	Estoy de acuerdo	Estoy muy de acuerdo
1	**2**	**3**	**4**	**5**

Mis amigos:					
a. me aceptan y mi diabetes.	1	2	3	4	5
b. se sienten incomodos de mi diabetes	1	2	3	4	5
c. me animan y me tranquilizan acerca de mi diabetes.	1	2	3	4	5
d. me desaniman acerca de mi diabetes.	1	2	3	4	5
e. me escuchan cuando quiero hablar de mi diabetes.	1	2	3	4	5
f. me reniegan acerca de mi diabetes.	1	2	3	4	5

Study ID# ________

Family APGAR (**have 1 form for each family member)

Favor de calificar a cada miembro de la familia.
Favor de sustituir el miembro de la familia donde dice mi familia* en cada una de las oraciones siguientes.

Vamos a usar una escala de 1 a 5. 1 significa "nunca" y 5 significa "siempre". Se puede escoger cualquier número entre 1 y 5.

Nombre del familiar calificado ____________________________

Relación ______________________ Edad ___________________Hombre/mujer_____________

	Nunca	**Casi nunca**	**A veces**	**Casi siempre**	**Siempre**
Estoy satisfecho(a) con la ayuda que recibo de mi familia* cuando algo me molesta.	1	2	3	4	5
Estoy satisfecho(a) con cómo mi familia* consulta conmigo en resolver problemas y cómo nos hablamos de cosas de interés común.	1	2	3	4	5
Veo que mi familia* acepta mis deseos de empezar nuevas actividades o de hacer cambios en mi modo de vivir.	1	2	3	4	5
Estoy satisfecho(a) con cómo mi familia* demuestra su cariño y responde a mis emociones de enojo, tristeza, y amor.	1	2	3	4	5
Estoy satisfecho(a) con la cantidad de tiempo que mi familia* y yo pasamos juntos.	1	2	3	4	5

SECCIÓN IV. Barreras al Cuidado

Tengo una lista de algunas cosas que a veces lo hace más difícil seguir la rutina del cuidado. Para cada una, por favor indique con qué frequencia esta situación le pasa a Ud.

Vamos a usar una escala de 1 a 7. 1 significa “casi nunca o nunca” y 7 significa “cada día”. Se puede escoger cualquier número entre 1 y 7.

Si la situación no le aplica a Ud., marque la columna 0.

¿Con qué frequencia le pasa a Ud. lo de abajo?	**1** Casi nunca o Nunca	**2** Una ves al mes	**3** Dos veces al mes	**4** Una ves por semana	**5** Dos veces por semana	**6** Más de dos veces por semana	**7** Cada dia	**0** No aplica
1. No estoy en casa y es la hora de revisar el examen de nivel de azucar en la sangre.	1	2	3	4	5	6	7	0
2. No estoy en casa cuando me toca tomar mis medicinas para la diabetes (oral o insulina)	1	2	3	4	5	6	7	0
3. No estoy en un lugar conveniente cuando es hora de hacer ejercicios.	1	2	3	4	5	6	7	0
4. Estoy en un restaraunte o en casa de otra persona a la hora de comer.	1	2	3	4	5	6	7	0
5. Hace mal tiempo cuando quiero hacer ejercicios.	1	2	3	4	5	6	7	0
6. No estoy seguro(a) de la cantidad de comida que como.	1	2	3	4	5	6	7	0

Barreras al Cuidado

	1 Casi nunca o Nunca	2 Una ves al mes	3 Dos veces al mes	4 Una ves por semana	5 Dos veces por semana	6 Más de dos veces por semana	7 Cada dia	0 No aplica
7. Me digo que no importa si no hago los ejercicios.	1	2	3	4	5	6	7	0
8. Me digo que no importa si no tomo la medicina para la diabetes.	1	2	3	4	5	6	7	0
9. Me digo que no importa si no sigo la dieta.	1	2	3	4	5	6	7	0
10. Me digo que no importa si no reviso el nivel de azúcar en la sangre.	1	2	3	4	5	6	7	0
11. Estoy muy ocupado(a).	1	2	3	4	5	6	7	0
12. No tengo conmigo las cosas o equipo que necesito cuando es hora de tomar la medicina para la diabetes.	1	2	3	4	5	6	7	0
13. No tengo conmigo las cosas o equipo que necesito cuando es hora de hacer los ejercicios.	1	2	3	4	5	6	7	0
14. No tengo conmigo las cosas o equipo que necesito cuando es hora de revisar el nivel de azúcar en la sangre.	1	2	3	4	5	6	7	0
15. Estoy con hambre después de comer.	1	2	3	4	5	6	7	0
16. Estoy adolorecido(a) y entumecido(a).	1	2	3	4	5	6	7	0
17. Pienso en cuanto tiempo me toma para preparar la comida como debo hacerlo.	1	2	3	4	5	6	7	0

Barreras al Cuidado

	1 Casi nunca o Nunca	2 Una ves al mes	3 Dos veces al mes	4 Una ves por semana	5 Dos veces por semana	6 Más de dos veces por semana	7 Cada dia	0 No aplica
18. Pienso en el tiempo necesario para tomar mi medicina para la diabetes.	1	2	3	4	5	6	7	0
19. Pienso en el tiempo que toma para revisar el nivel deazúcar en la sangre.	1	2	3	4	5	6	7	0
20. Pienso en el tiempo que toma para hacer los ejercicios.	1	2	3	4	5	6	7	0
21. Tengo visitas que se quedan en la casa conmigo.	1	2	3	4	5	6	7	0
22. Estoy todavía en cama cuando es hora de tomar mi medicina.	1	2	3	4	5	6	7	0
23. Estoy todavía en cama cuando es hora de revisar el nivel de azúcar en la sangre.	1	2	3	4	5	6	7	0
24. Me siento incomodo(a) con otras personas cuando es hora de revisar el nivel de azúcar en la sangre.	1	2	3	4	5	6	7	0
25. Me siento imcomodo(a) con otras personas cuando es hora de tomar la medicina.	1	2	3	4	5	6	7	0
26. No me siento bien.	1	2	3	4	5	6	7	0
27. Estoy con gente que está comiendo o bebiendo cosas que yo no debo.	1	2	3	4	5	6	7	0
28. Pienso en el costo de la medicina para mi diabetes.	1	2	3	4	5	6	7	0

Barreras al Cuidado

	1 Casi nunca o Nunca	2 Una ves al mes	3 Dos veces al mes	4 Una ves por semana	5 Dos veces por semana	6 Más de dos veces por semana	7 Cada dia	0 No aplica
29. Pienso en el costo de las cosas que necesito para revisar el nivel de azúcar en la sangre.	1	2	3	4	5	6	7	0
30. Pienso en el costo de lo que necesito para hacer ejercicios.	1	2	3	4	5	6	7	0
31. Peinso en el costo de las comidas que necesito para la dieta.	1	2	3	4	5	6	7	0

SECCIÓN V. Conocimiento (DKQ-24)

El siguiente grupo de preguntas es relacionado con diabetes y como tomar cuidado de ella. Por favor conteste cada pregunta con un si o no, si no sabe la contestación a la pregunta, permitanos saber.

	Sí	No	No sé
1. El comer mucha azúcar y otras comidas dulces es una cause de la diabetes.	_____	______	______
2. La causa común de la diabetes es la falta de insulina efectiva en el cuerpo.	_____	______	______
3. La diabetes es causada porque los riñones no pueden mantener el azúcar fuera del a orina.	_____	______	______
4. Los riñones producen la insulina.	_____	______	______
5. En la diabetes que no se está tratando, la cantidad de azúcar en la sangre usualmente sube.	_____	______	______
6. Si yo soy diabético, mis hijos tendrán más riesgo de ser diábeticos.	_____	______	______

Conocimiento (DKQ -24)

	Sí	No	No sé
7 Se puede curar la diabetes.	_____	______	______
8. Un nivel de azúcar de 210 en prueba de sangre hecha en ayunas es muy alto.	_____	______	______
9. La mejor manera de checar mi diabetes es haciendo pruebas de orina.	_____	______	______
10. El ejercicio regular aumentará la necesidad de insulina u otro medicamento para la diabetes.	_____	______	______
11. Hay dos tipos principales de diabetes: tipo 1 (dependiente de insulina) y tipo 2 (no-depen diente de insulina).	_____	______	______
12. Una reacción de insulina es causada por mucha comida.	_____	______	______
13. La medicina es más importante que la dieta y el ejercicio pare controlar mi diabetes.	_____	______	______
14. La diabetes frecuentemente causa mala circulación.	_____	______	______
15. Cortaduras y rasguños cicatrizan más despacio en diabéticos.	_____	______	______
16. Los diabéticos deberían poner cuidado extra al cortarse las uñas de los dedos de los pies.	_____	______	______
17. Una persona con diabetes debería limpiar una cortadura con yodo y alcohol.	_____	______	______
18. La manera en que preparo mi comida es igual de importante que las comidas que como.	_____	______	______
19. La diabetes puede dañar mis riñones.	_____	______	______
20. La diabetes puede causer que no sienta en mis manos, dedos y pies.	_____	______	______
21. El temblar y sudar son señales de azúcar alta en la sangre.	_____	______	______
22. El orinar seguido y la sed son señales de azúcar baja en la sange.	_____	______	______

Conocimiento (DKQ -24)

	Sí	No	No sé
23. Los calcetines y las medias elásticas apretadas no son malos para los diabéticos diabéticos.	_____	______	______
24. Una dieta diabética consiste principalmente de comidas especiales.	____	______	______

SECCIÓN VI. Eficacia

La sección siguiente trata de su confianza en sus capacidades de lograr en seguir la rutina asociada con el cuido de su diabetes. Vamos a usar una escala de 1 a 5. 1 significa que Ud. no está de acuerdo en absoluto y 5 significa que está muy de acuerdo. Escriba el número que muestra su acuerdo con las oraciones.

No estoy de acuerdo en absoluto	No estoy de acuerdo	Neutral	Estoy de acuerdo	Estoy muy de acuerdo
1	**2**	**3**	**4**	**5**

1. Tengo confianza en que puedo seguir mi dieta. ____________

2. Tengo confianza en que puedo revisar el nivel del azúcar en la sangre tanto como me recomiendan. ____________

3. Tengo confianza en mi capacidad de hacer ejerercicios con regularidad. ____________

4. Tengo confianza en que puedo controlar mi peso. ____________

5. Tengo confianza en que puedo controlar el nivel de azúcar en la sangre. ____________

6. Tengo confianza en que puedo resistir la tentación de comer comidas que no son buenas para mí. ____________

7. Tengo confianza en que puedo tomar la medicina para la diabetes como me recomiendan (píldoras o insulina). ____________

SECCIÓN VII. Actividades para Cuidarse

Las preguntas abajo le preguntan de sus actividades en cuanto al cuidado de la diabetes durante los últimos 7 días. Si Ud. estaba enfermo(a) durante los últimos 7 días, por favor conteste según los últimos 7 días que no estabas enfermo(a).

La dieta

1. ¿Cuántos días de los últimos SIETE DÍAS siguió Ud. una dieta saludable?

0 1 2 3 4 5 6 7

2. Como promedio durante el último mes, ¿cuántos DÍAS POR SEMANA siguió Ud. su dieta?

0 1 2 3 4 5 6 7

3. ¿Cuántos días de los últimos SIETE DÍAS comió Ud. cinco o más porciones de frutas o vegetales?

0 1 2 3 4 5 6 7

4. ¿Cuántos días de los últimos SIETE DÍAS comió Ud. comidas altas en grasa tales como carne de res o productos lácteos con mucha grasa?

0 1 2 3 4 5 6 7

5. ¿Cuántos días de los últimos SIETE DÍAS distribuyó de manera igual, durante el día los carbohidratos como papas, pan, y tortillas?

0 1 2 3 4 5 6 7

Ejercicios

6. ¿Cuántos de los últimos SIETE DÍAS hizo Ud. por lo menos 30 minutos de ejercicios (30 minutos de actividad continua, incluye caminar).

0 1 2 3 4 5 6 7

7. ¿Cuántos de los últimos SIETE DÍAS participó Ud. en una sessión específica de ejercicios (tal como nadar, caminar, montar en bicicleta) fuera de lo que hace Ud. en la casa o como parte de su trabajo?

0 1 2 3 4 5 6 7

Revisión del Azúcar en la Sangre

8. ¿Cuántos de los últimos SIETE DÍAS revisó Ud. el azúcar en la sangre?

0 1 2 3 4 5 6 7

9. ¿Cuántos de los últimos SIETE DÍAS revisó Ud. el azúcar en la sangre todas las veces que recomendó su médico?

0 1 2 3 4 5 6 7

La Medicina

10. Por favor, cuénteme cuáles medicinas le han recetado, incluyendo la insulina y medicina para tomar por la boca. Para cada medicina que toma, por favor, conteste cada pregunta sobre la medicina.

Durante los últimos SIETE DÍAS

a. Nombre de medicina	**b.** Como debe tomar la medicina (instrucciones)	**c.** ¿Cuántas veces no tomó Ud. una dosis porque se le olvidó o porque no quiso?	**d.** Cuántas veces tomó una dosis adicional?*	**e.** C uántas veces la redujo Ud. la dosis?*
1. ___________________	__________________	________	________	_________
2. ___________________	__________________	________	________	__________
3. ___________________	__________________	________	________	__________
4. ___________________	__________________	________	________	__________

* Si Ud. no está modificando la dosis de la insulina como le han recomendado, es posible que las categorías **d** y **e** no se puedan aplicar a la situación de Ud.

Sección VIII. Encuesta sobre la Salud del Paciente (PHQ-9)

Tengo una lista de declaraciones que puedan describir cómo Ud. se ha sentido o comportado duranto los 2 últimas semanas. Por favor, cuentéme con qué frequencia Ud. se ha sentido así durante las últimas 2 semanas. Para esta sección vamos a usar una escala de 0 a 3. 0 significa que Ud. no se sintió así y 3 significa que Ud. se sintió así casi todos los días. Se puede escojer cualquier número entre 0 y 3.

Durante las últimas 2 semanas, ¿con qué frequencia le ha molestado los problemas siguientes?

	Nunca	**Muchos días**	**Más de la mitad de los días**	**Casi todos los días**
1. Poco interés o placer en hacer cosas	0	1	2	3
2. Sentir deprimido(a) o sin esperanza	0	1	2	3
3. Problemas al dormirme o quedarme dormido(a), o dormir demasiado	0	1	2	3
4.Sentirme cansado(a) o con poca energía	0	1	2	3
5. Sin ganas de comer o comer demasiado	0	1	2	3
6. Sentirme mal de mi mismo o como que no les doy lo que se esperan de mí	0	1	2	3
7. Tener problemas al concentrarme en algo, como leer el periódico o mirar la television	0	1	2	3
8. Moverme or hablar tan despacio que las otras personas se dieron cuenta. O al contrario, estar inquieto(a) o moverme más rápidamente que lo normal.	0	1	2	3
9. Pensar que sería mejor estar muerto(a) o querer hacerme daño.	0	1	2	3
(Para codificar) Total _______ =		_______	+ ________	+ ______

Sección IX. Escala de Aculturación

Casi terminamos con la encuesta. Esta sección le hace preguntas sobre el idioma que Ud. habla y lo que Ud. prefiere hablar.

1. Algunos de nuestros pacientes hablan tanto el inglés como el español, muchos hablan o el uno o el otro. Para mejorar nuestra comunicación con Ud. en el futuro, quisiéramos saber cuál idioma Ud. prefiere hablar.

________ inglés
________ español
________ cualquier de los dos

2. ¿Cuál es el idioma que Uds. usan más en la casa?

________ inglés
________ español
________ cualquier de los dos

3. Cuando niño, ¿cuál era el idioma que hablaba Ud.?
________ inglés
________ español
________ cualquier de los dos

4. Muchos de nuestros pacientes tienen problemas al leer o el inglés o el español. ¿Lee Ud. el inglés?

_________ Sí, bien   ______ Muy poco
_________ Algo   ______ Nada

Sección X. Demografía

Esta es la última sección de la encuesta. Por favor, conteste algunas preguntas más acerca de usted.

1. ¿Cuál es su raza o origen?

____ Anglo(no hispánico)   _____ Negro   ____ hispano

____ Indio americano   _____ Asiático o de las Islas Pacíficas   ____ Otro

2. ¿Cuáles son los ingresos mensuales de Ud. y de todos los otros miembros de su familia que viven en su casa antes de que quiten los impuestos?

_____ menos de $500

_____ $501-$1000

____ $1001-$1500

_____ $1501-$2000

_____ $2001-$2500

_____ $2501-$3000

_____ $3001-$4000

_____ $4001-$5000

_____ $5001-$6000

_____ más de $6000

3. ¿Cuántos años de escuela completó Ud.?

_____ 8 años o menos

_____ 9-11 años

_____ 12 años (graduado(a) de la escuela secundaria)

_____ algunos años de la universidad o diploma de asociado

_____ licenciado

_____ maestría o doctorado

4. ¿Está Ud. trabajando actualmente?

_____ Sí _____ No _____ Jubilado(a) _____ Otro

Si Ud. está trabajando, ¿en qué trabaja?

____

Muchas gracias por su tiempo.

PPENDIX E

SAMPLE RESPONSE FORMAT SHEETS

(English and Spanish)

Never	Once A Month	Once A Week	Several Times A Week	At Least Once A Day
1	2	3	4	5

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Nunca	Una vez al mes	Una vez por semana	Muchas veces por semana	Por lo menos una vez al día
1	2	3	4	5

No estoy de acuerdo en absoluto	No estoy de acuerdo	Neutral	Estoy de acuerdo	Estoy muy de acuerdo
1	2	3	4	5

APPENDIX F

HISTOGRAMS AND NORMAL P-P PLOTS OF REGRESSION STANDARDIZED RESIDUALS FOR:

FAMILY DIABETES SUPPORT-DIET AND EXERCISE,
FAMILY FUNCTION,
BARRIERS TO DIET,
BARRIERS TO EXERCISE,
KNOWLEDGE,
SELF-EFFICACY,
DIET, AND EXERCISE SCORES

Figure F.1 Histogram of Family Diabetes Support-Diet

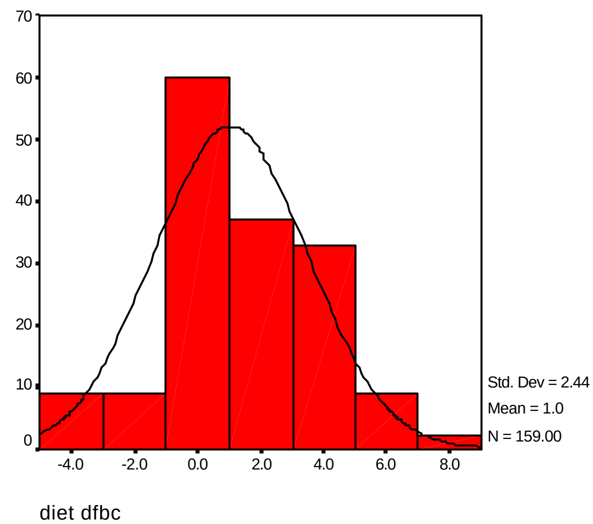


Figure F.2 Normal Probability Plot of Regression Standardized Residual
Dependent Variable: Family Diabetes Support-Diet

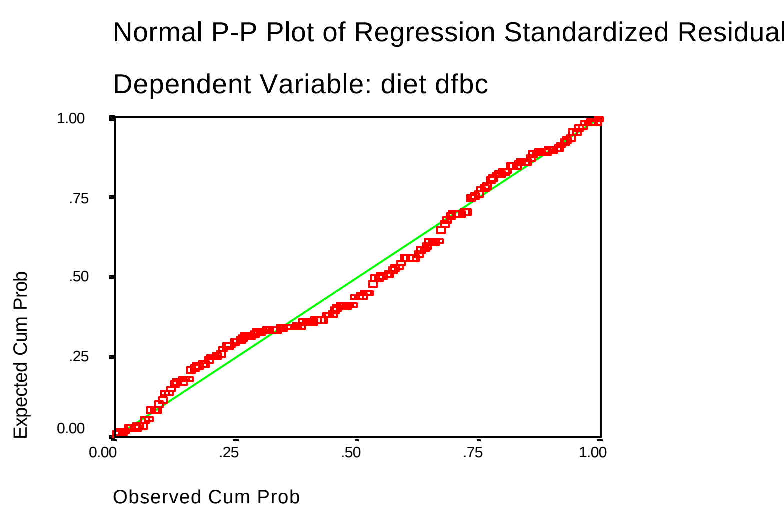


Figure F.3 Histogram of Family Diabetes Support- Exercise

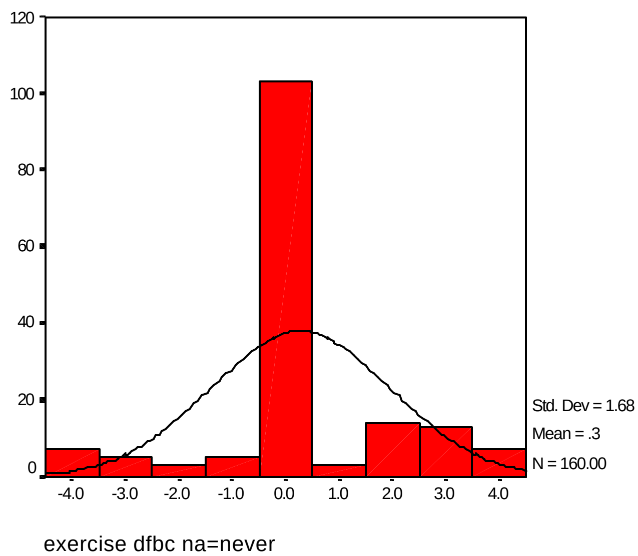


**Figure F.4 Normal Probability Plot of Regression Standardized Residual
Dependent Variable: Family Diabetes Support-Exercise**

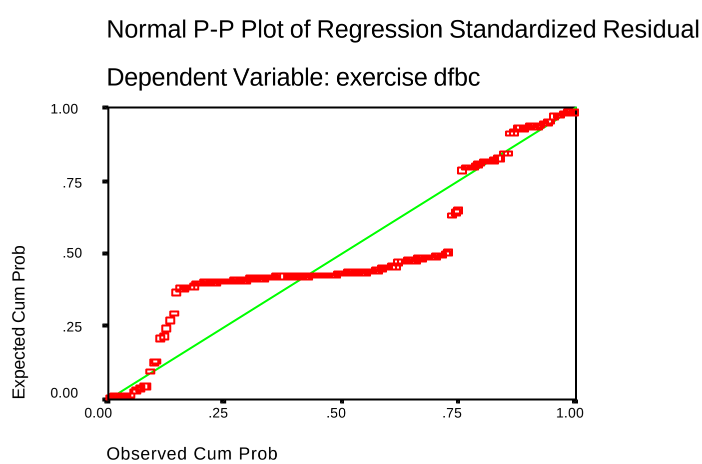


Figure F.5 Histogram of Family Function

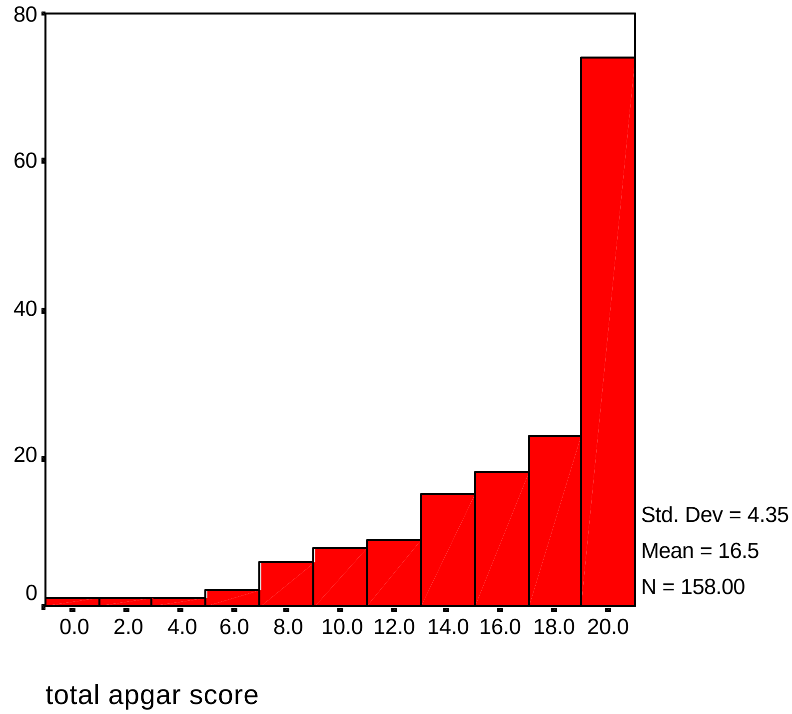


Figure F.6 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Family Function

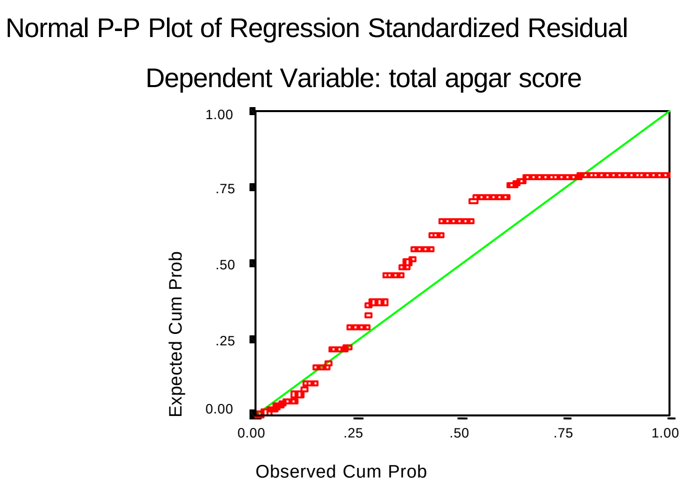


Figure F.7 Histogram of Barriers to Diet

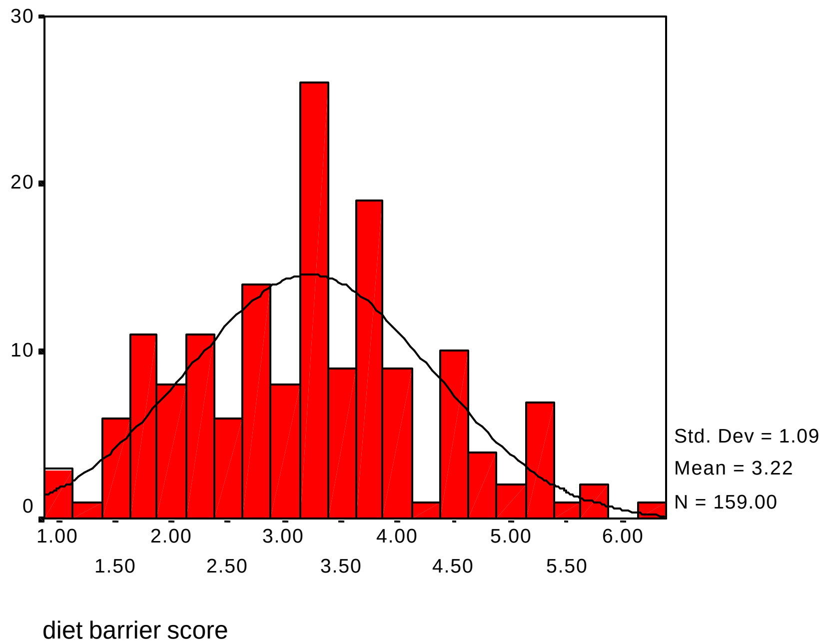


Figure F.8 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Barriers to Diet

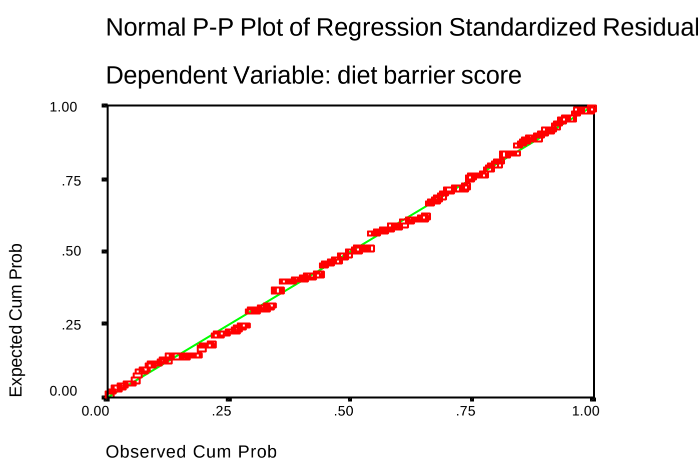


Figure F.9 Histogram of Barriers to Exercise

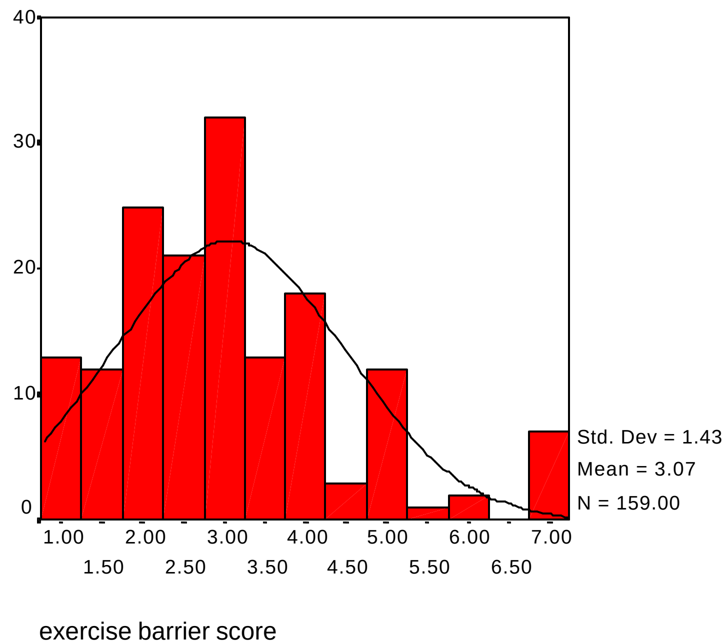


Figure F.10 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Barriers to Exercise

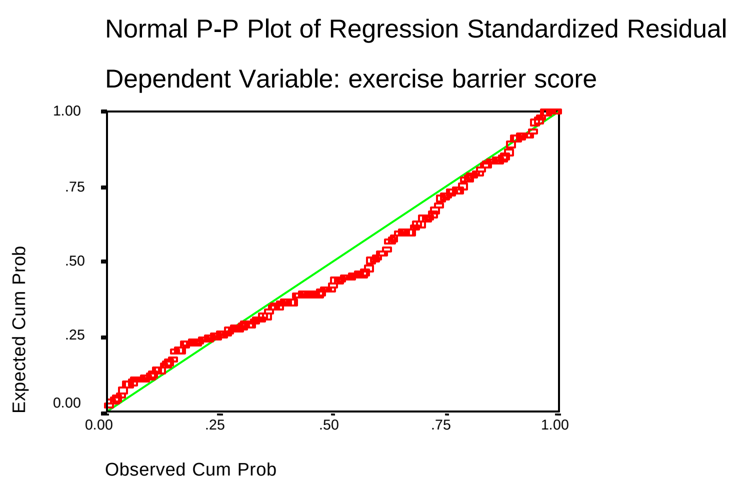


Figure F.11 Histogram of Knowledge Scores

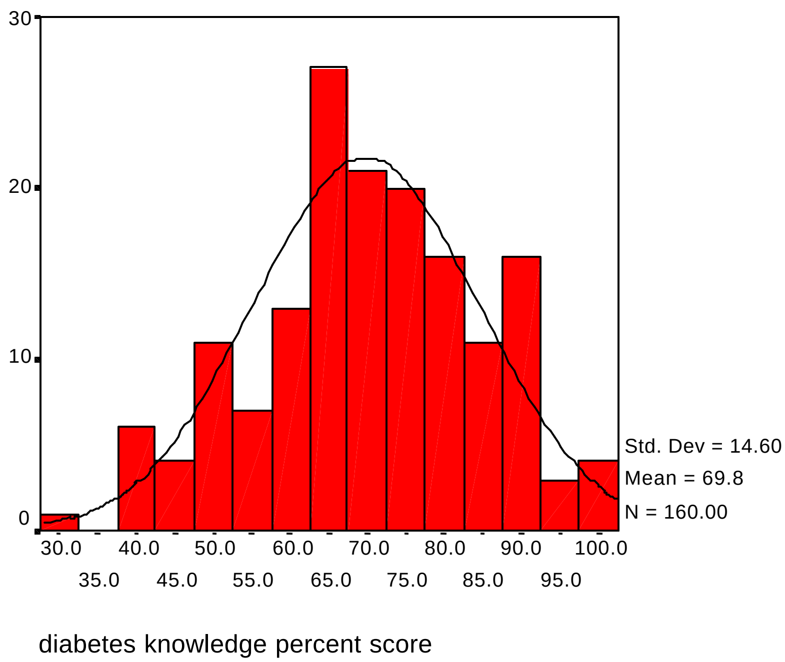


Figure F.12 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Knowledge Scores

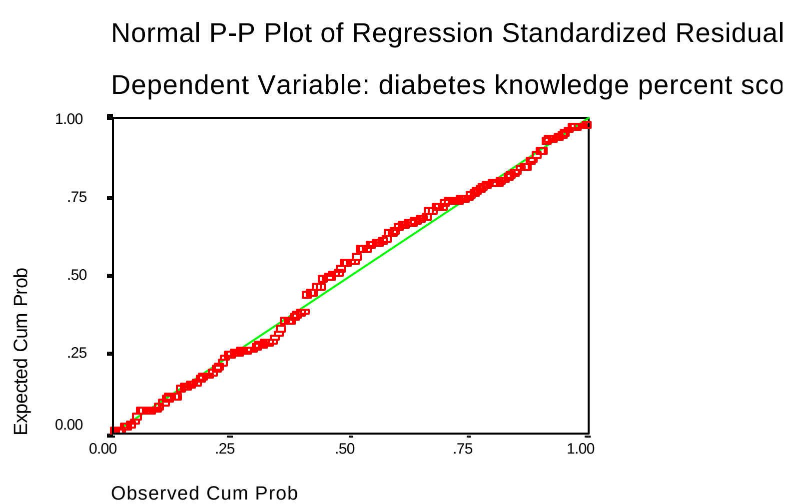


Figure F.13 Histogram of Self-Efficacy- Exercise

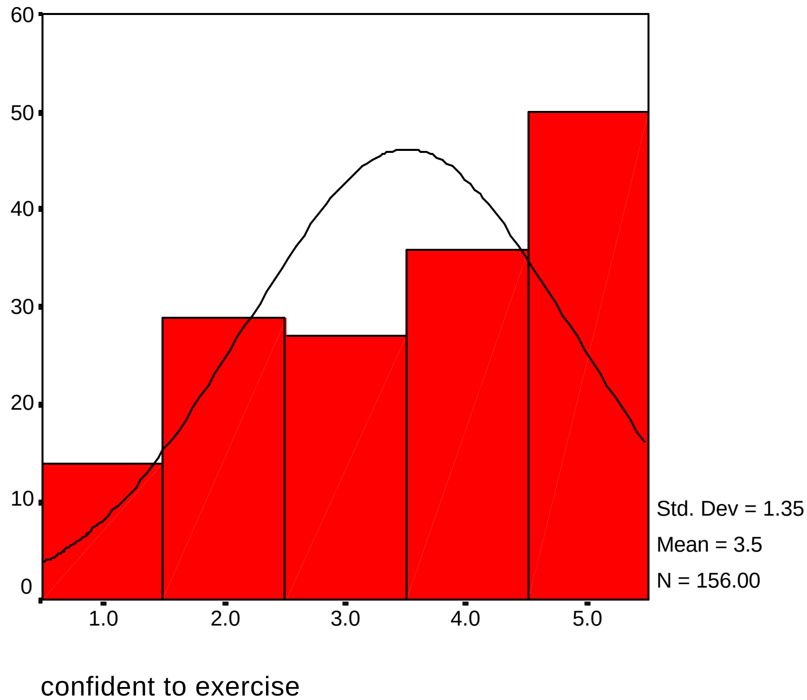


Figure F.14 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Self-Efficacy -Exercise

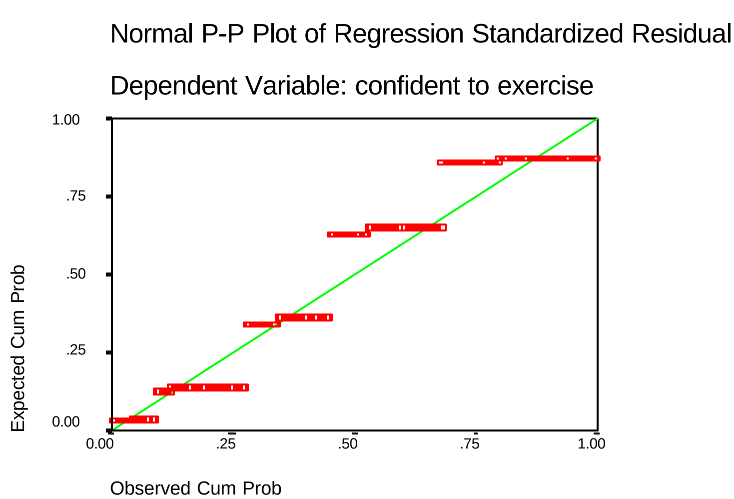


Figure F.15 Histogram of General Diet Self-Care

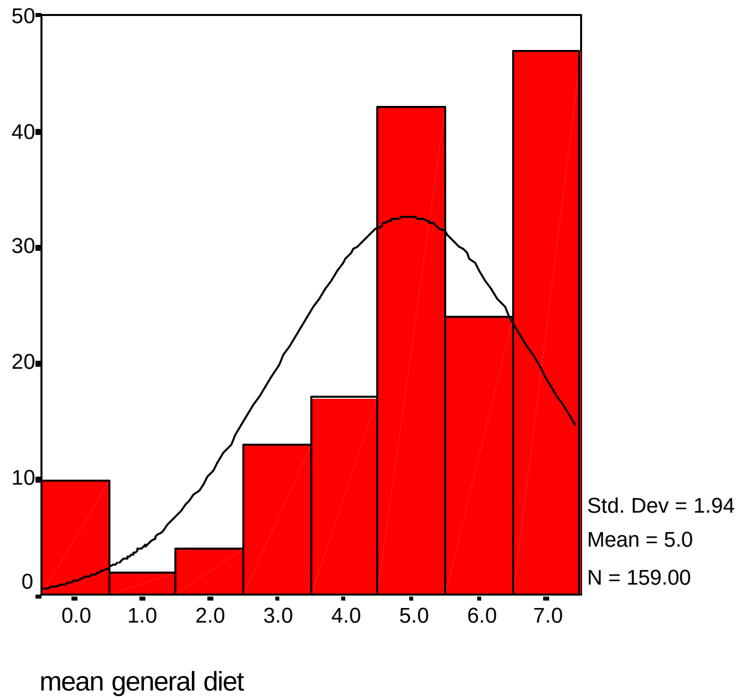


Figure F.16 Normal Probability Plot of Regression Standardized Residual Dependent Variable: General Diet Self-Care

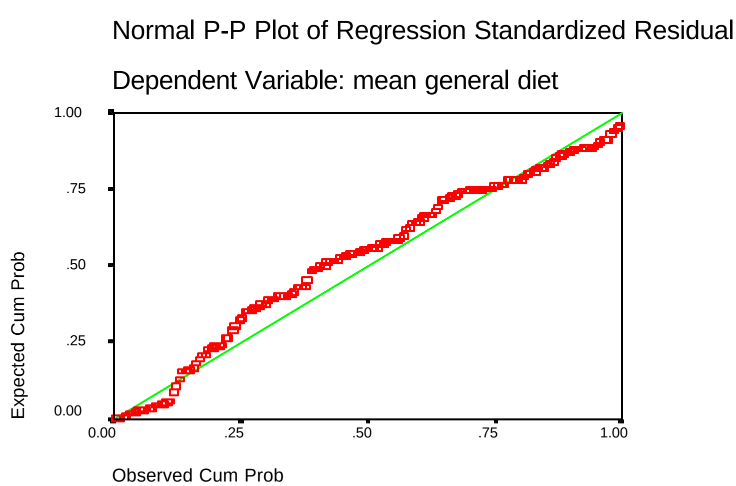


Figure F.17 Histogram of Exercise Self-Care

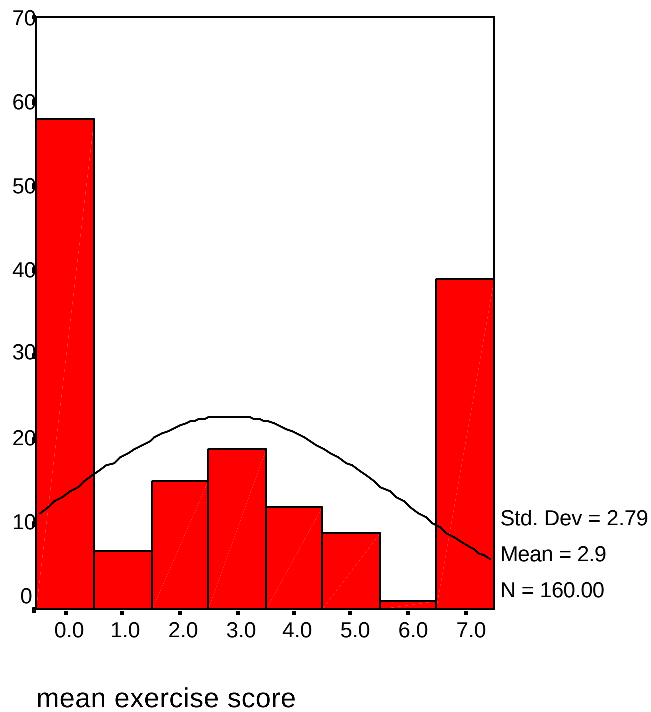
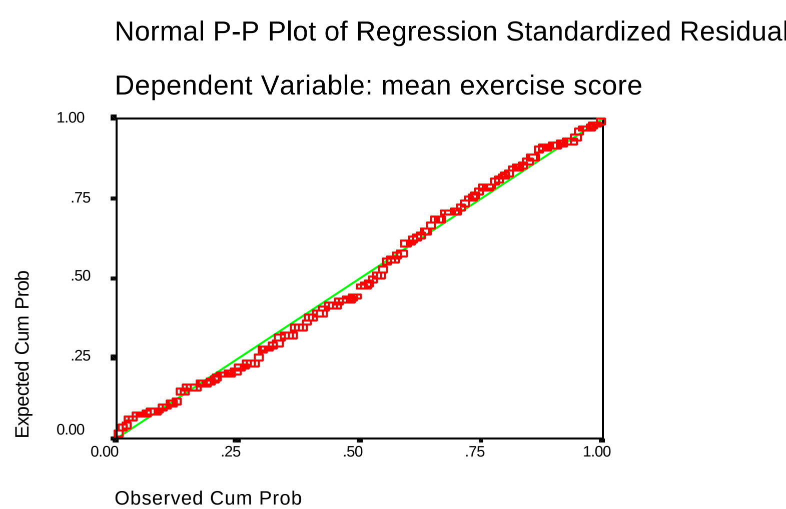


Figure F.18 Normal Probability Plot of Regression Standardized Residual Dependent Variable: Exercise Self-Care



APPENDIX G

SCATTERPLOTS OF RESIDUALS VS PREDCITED VALUES OF DEPENDENT VARIABLES FOR:

FAMILY DIABETES SUPPORT-DIET,
BARRIERS TO DIET,
FAMILY FUNCTION,
KNOWLEDGE,
GENERAL DIET SELF-CARE,
FAMILY DIABETES SUPPORT- EXERCISE,
BARRIERS TO EXERCISE,
SELF-EFFICACY-EXERCISE, AND
EXERCISE SELF- CARE

Figure G.1 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Family Diabetes Support-Diet

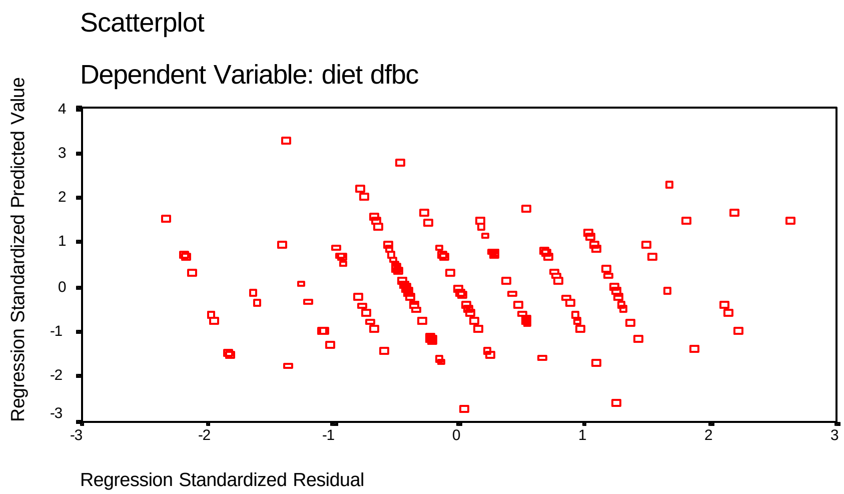


Figure G.2 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Barriers to Diet

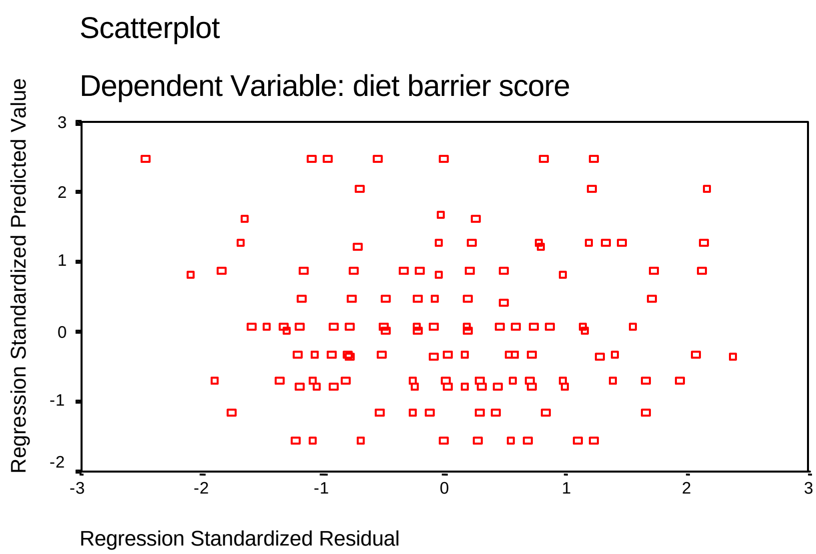


Figure G.3 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Family Function

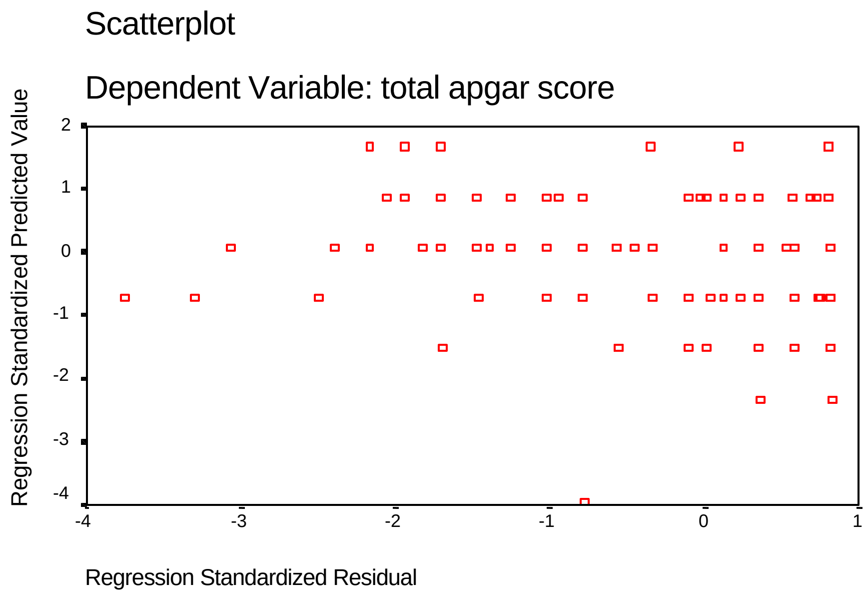


Figure G.4 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Knowledge Scores

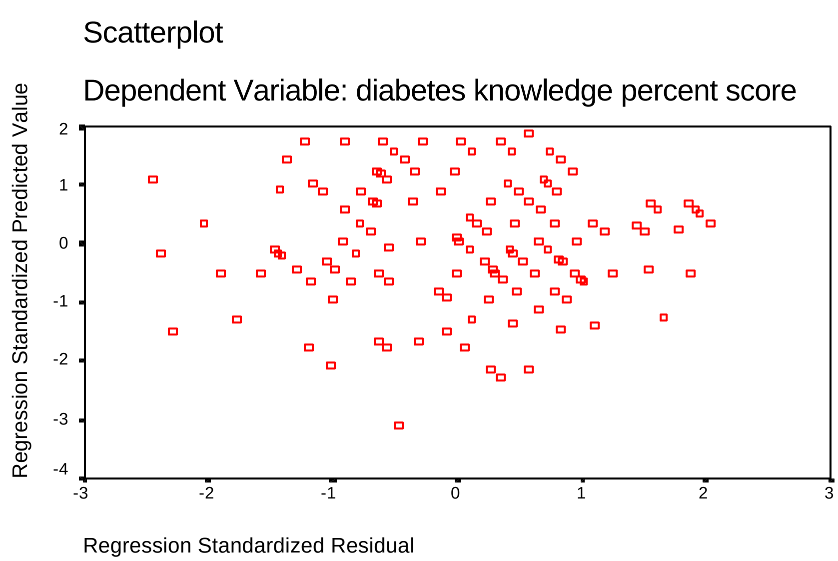


Figure G.5 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- General Diet Self-Care

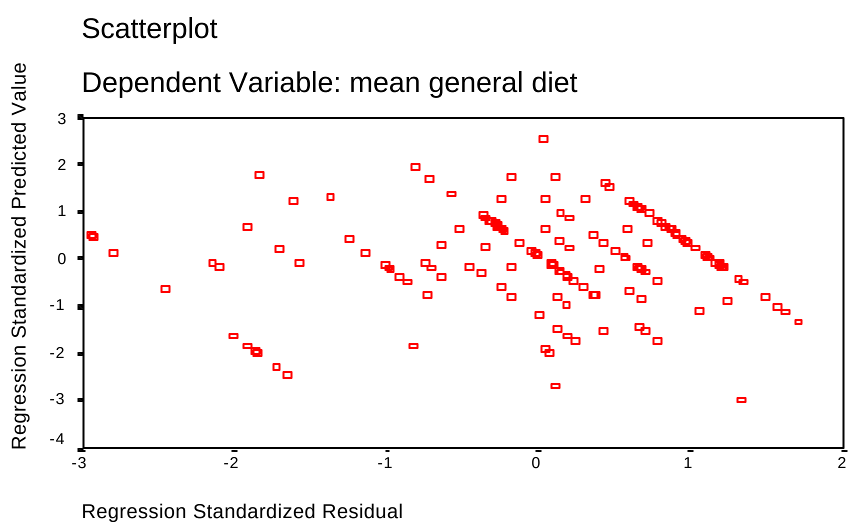


Figure G.6 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Family Diabetes Support-Exercise

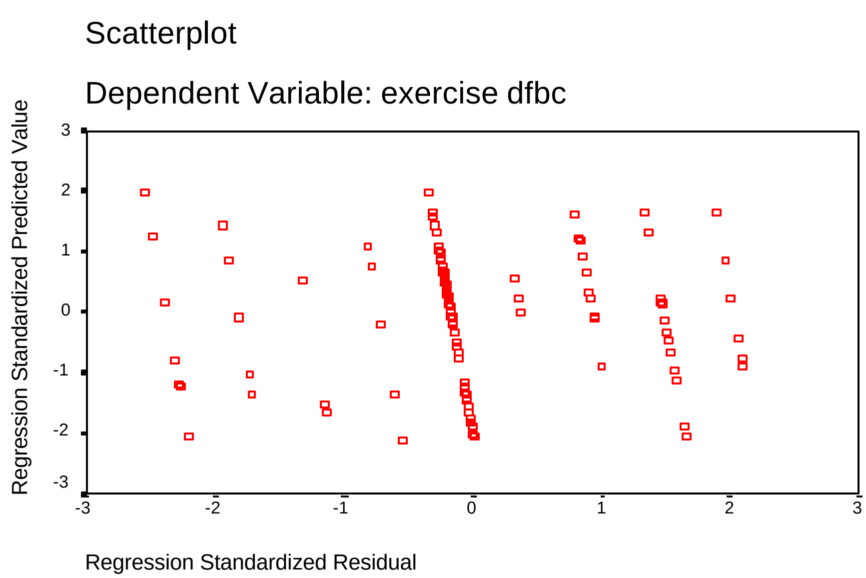


Figure G.7 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Barriers to Exercise

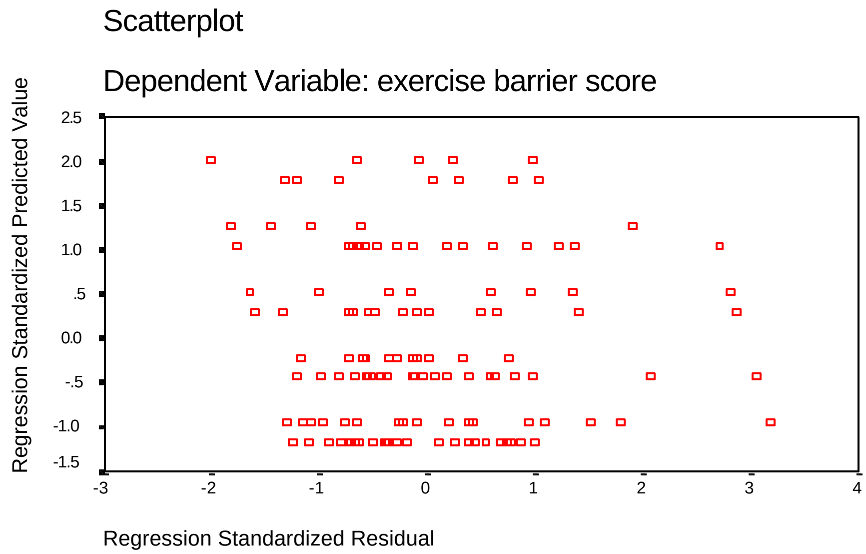


Figure G.8 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Self-Efficacy - Exercise

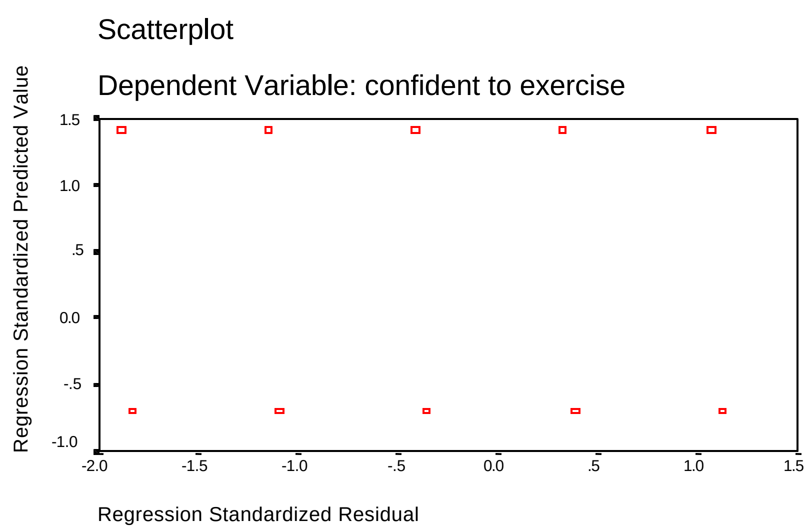
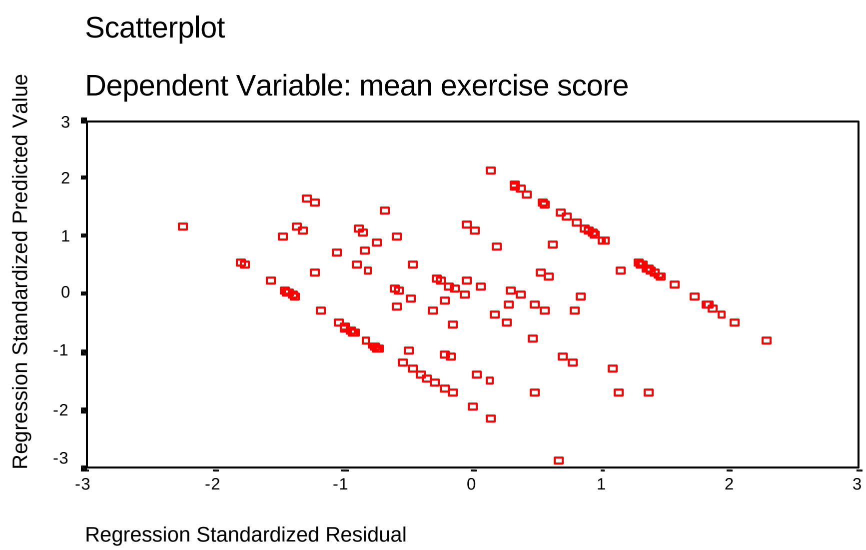


Figure G.9 Scatterplot of Regression Residuals VS Standardized Predicted Values: Dependent Variable- Exercise Self-Care



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