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An Evaluation of the Relationship Between Stress, Depression, and Glycemic Control in Low-Income Patients with Type 2 Diabetes

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by

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of the requirements for the degree of
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Dedication

I would like to honor the people who have inspired and encouraged me to create, implement, and document this project. First and foremost, I would like to honor my mother, Carol Sarnese, who has been supportive of me during the entire doctoral degree. She was a tremendous resource for me during this process. I would also like to dedicate this dissertation to my four grandparents, John and Rose Adams and Donald and Jane Wells, who have been instrumental in supporting my entire education, including my doctoral degree. I would like to thank John Kauffman for his love and patience over the past two years. I also appreciate the support provided by my extended family: Holly Wells, Michael Wells, Al Sarnese, Heidi Sarnese, and David and Heather Hettesheimer. I would also like to honor my advisor, Dr. William Sacco, who provided important feedback and encouragement. In addition, I want to thank the other members of my committee for encouraging me to keep my project realistic and providing many helpful suggestions: Drs. Thomas Brandon, Paul Jacobsen, Frances Sahebzamani, and Kristen Salomon.

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An Evaluation of the Relationship Between Stress, Depression, and Glycemic Control in Low-Income Patients with Type 2 Diabetes

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ABSTRACT

People in low socioeconomic status groups are at increased risk for diabetes mellitus, a group of diseases associated with high levels of blood glucose. High rates of depression have been found in people with diabetes. The study examined the relationship between stress, depression, and glycemic control in low-income type 2 diabetes patients. Participants were recruited at two community health centers that provide free medical care. The following hypotheses were examined: (1) experiencing stressful life events is positively correlated with blood glucose level; (2) negative stressful events have a greater association with glucose level than positive stressful events; (3) depression mediates the relationship between negative stressful events and glucose level (mediation model); (4) the effect of experiencing both negative stressful events and depression is predictive of glucose level (additive model); (5) the interaction between negative stressful events and depression is predictive of glucose level (interactive model); and (6) perceptions of control moderates the relationship between stress and depression.

Stressful life events and depression were not related to blood glucose levels in bivariate correlations. The data did not support any of the three models of the relationship between stress, depression, and glycemic control. The strongest predictor of

glycemic control was Hispanic ethnicity, however, income and education appear to confound this relationship.

Depression was positively correlated with the total number of stressful events and negative stressful events and negatively correlated with perceptions of control. Participants in the study with less than a high school education had the highest amount of depression. In post-hoc analyses, four variables (education, perceptions of control, stressful life events, blood glucose) predicted 58% of the variance in depression, and education and perceptions of control were the strongest predictors. Perceptions of control was a significant partial mediator of the relationship between education and depression and also partially mediated the relationship between stress and depression.

The results of the study indicate that decreasing stressful life events and increasing perceptions of control is important in reducing low-income diabetes patients' level of depression.

Chapter 1—Introduction

Socioeconomic Status and Illness

It is estimated that in 2001, 32.9 million people lived below the poverty level in the United States (Proctor & Dalaker, 2002). Many studies have documented increased mortality rates for people in low-income groups (Backlund, Sorlie, & Johnson, 1999; Lantz et al., 1998). A number of psychological, environmental, and social factors may contribute to socioeconomic disparities in health. Low socioeconomic status is associated with lack of access to social assets, such as income and education, as well as lack of access to goods, services, such as health care, and knowledge (Gallo & Matthews, 2003). People with a low socioeconomic status may live in communities that are stressful because of crime and overcrowding (Adler et al., 1993). These stressful environments can decrease the development of positive social networks. People with a low socioeconomic status may also live in neighborhoods that lack resources that promote health, such as recreation facilities (Gallo & Matthews, 2003). Research has shown that people in low socioeconomic status groups do not use preventive health services (such as screening) as frequently as people who have more resources (Adler, Boyce, Chesney, Folkman, & Syme, 1993). In addition, people with fewer resources are more likely to engage in risky health behaviors, such as smoking (Adler et al., 1993; Bailis, Segall, Mahon, Chipperfield, & Dunn, 2001; Connolly & Kesson, 1996) and increased alcohol consumption (Bailis et al., 2001), and less likely to engage in healthy behaviors, such as good eating habits and exercise (Adler et al., 1993). People with low

socioeconomic status are more likely to experience psychopathology (Kohn, Dohrenwend, & Mirotznik, 1998). People who have fewer resources are also more frequently exposed to pathogens and carcinogens (Adler et al., 1993). Research using the Americans' Changing Lives survey found that after controlling for demographic variables (age, race, urbanicity, gender, and education), income was the most significant predictor of mortality seven and a half years after the survey. In fact, income remained a significant predictor of mortality for low-and middle-income groups when four health behaviors were included as predictors in the model (smoking, alcohol consumption, body mass index, and physical activity; Lantz et al., 1998). Thus, it is important to examine factors in the lives of low-income patients that increase their risk for disease and disease complications.

Diabetes Mellitus

Diabetes mellitus refers to a group of diseases that is associated with high levels of blood glucose (CDC, 2004). It is estimated that 20.8 million people in the United States have either diagnosed or undiagnosed diabetes (National Institute of Diabetes and Digestive and Kidney Diseases, 2005). There are three types of diabetes: type 1, type 2, and gestational diabetes. Type 1 diabetes, also known as insulin-dependent diabetes mellitus (IDDM) and juvenile-onset diabetes, is usually diagnosed in children and young adults and accounts for approximately 5% to 10% of diagnosed cases of diabetes. In type 1 diabetes, the body's immune system destroys pancreatic beta cells, which make the hormone insulin that regulates blood glucose. Type 2 diabetes, also known as non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, accounts for approximately 90% to 95% of diagnosed cases of diabetes. Type 2 diabetes differs from

type 1 diabetes in its onset and course. Type 2 diabetes typically begins with insulin resistance, where cells do not use insulin properly. As the body's need for insulin increases, the pancreas is less able to produce insulin. Some people with type 2 diabetes can achieve adequate glycemic control through diet and exercise. However, many people with type 2 diabetes are also prescribed one or more oral agents, insulin, or a combination of both to control their blood glucose. A third type of diabetes is gestational diabetes, which is diagnosed during pregnancy, but accounts for a small percentage of the diagnosed cases of diabetes. It is a form of glucose intolerance that requires treatment to avoid complications in pregnancy (CDC, 2004).

Diabetes is a serious threat to the health of the population as it is one of the leading causes of morbidity and mortality. In 1990, diabetes mellitus was the 10th leading cause of death worldwide in developed countries (Murray & Lopez, 1996). In 2002, diabetes was the 6th leading cause of death listed on U.S. death certificates (National Institute of Diabetes and Digestive and Kidney Diseases, 2005). In less than a decade, the prevalence of diabetes has increased 33% (Mokdad et al., 2000). Diabetes is associated with a number of medical complications including heart disease, stroke, high blood pressure, blindness, kidney disease, nervous system disease, amputations, dental disease, complications of pregnancy, pneumonia, influenza, diabetic ketoacidosis, and hyperosmolar coma (CDC, 2004). The United Kingdom Prospective Diabetes Study has found that high blood glucose, or hyperglycemia, is associated with retinopathy, nephropathy, and neuropathy in patients with type 2 diabetes [American Diabetes Association (ADA), 2003]. Results of the United Kingdom Prospective Diabetes Study have demonstrated that lowering glycosylated hemoglobin (HbA1c; a measurement of a

patient's average blood glucose control over the past 2-3 months) one percentage point is associated with a 35% reduction in risk for these complications (ADA, 2003).

Diabetes is an extremely costly disease. An ADA study estimated that diabetes cost $132 billion in total 2002 costs. The estimate included $92 billion in direct costs, such as the cost of medical care and services, as well as $40 billion in indirect costs, such as work loss, disability, and premature mortality (CDC, 2004).

Socioeconomic Status and Diabetes Mellitus

Population-based studies have found that people with low socioeconomic status are at an increased risk for diabetes mellitus and its complications (Brown et al., 2004; CDC, 2003). Data collected in 2000 using the Behavioral Risk Factor Surveillance System found that women who reported having diabetes were two times more likely to live in households with incomes less than $25,000 (CDC, 2003). Furthermore, women with diabetes were much less likely to have completed high school (CDC, 2003). Research using a British sample found that people with diabetes in the lowest socioeconomic status groups had mortality that was twice as high as people with diabetes in the highest socioeconomic status groups, primarily due to increased rates of smoking and high blood pressure (Chaturvedi, Jarrett, Shipley, & Fuller, 1998). Additional research has found that Glasgow, U.K. residents with diabetes who belonged to socioeconomic groups classified as more "deprived" had more cardiovascular risk factors than diabetes patients in higher socioeconomic groups. The participants in the lowest socioeconomic groups had higher rates of obesity and hypertension and were more likely to smoke (Connolly & Kesson, 1996).

Many reasons have been cited for the higher risk of diabetes and its complications in people with low socioeconomic status. Research suggests that low-income diabetes patients frequently do not receive diabetes care that is recommended by the ADA, such as routine HbA1c and lipid testing, nephropathy assessments, dilated eye examinations, or complete foot examinations (Bell et al., 2001; Brown et al., 2004; Chin, Zhang, & Merrell, 1998). A qualitative study of health-care providers in the Lower Rio Grande Valley of the United States provides some insight into the reasons why low-income patients may not receive diabetes care according to medical guidelines (Larme & Pugh, 2001). The health care providers who were interviewed reported that low-income patients frequently could not afford home glucose monitoring supplies, health care visits, medicines, or diabetes education. Furthermore, in addition to lack of access to care, physicians mentioned that low reimbursement for diabetes services from state and federal programs was a disincentive to treating low-income patients. Also, many government and insurance programs do not cover prevention services (Larme & Pugh, 2001). A survey of diabetes educators cited lack of insurance coverage as an important barrier explaining why type 2 diabetes patients do not complete diabetes education classes (Sprague, Shultz, Branen, Lambeth, & Hillers, 1999). Diabetes patients with low incomes may be more likely to engage in negative health behaviors, such as smoking, and less likely to engage in positive health behaviors, such as exercise (Brown et al., 2004). Diabetes patients with low socioeconomic status may also have difficulty communicating with medical providers, inadequate health literacy, language barriers, difficulty accessing healthy foods, difficulty accessing places to exercise, and lack access to transportation (Brown et al., 2004).

There may be additional psychosocial risks that diabetes patients with low socioeconomic status face. People in low socioeconomic status groups may be at higher risk for type 2 diabetes and diabetes complications because they are frequently exposed to stressful situations (Brown et al., 2004). Research has shown that a low status on the socioeconomic hierarchy is associated with greater exposure to stressful life events and decreased emotional adjustment (Adler et al., 1993; Brown et al., 2004). In addition, people with fewer resources may believe they have less control over their environment and fewer resources to cope with stress (Adler et al., 1993; Gallo & Matthews, 2003).

Stress and Diabetes Mellitus

Several researchers have hypothesized that stress has a major role in the development and control of diabetes mellitus. Lazarus and Folkman (1984) define psychological stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (p. 19). Stressors are demands made by the internal or external environment that can affect physical or psychological well-being (Lazarus & Cohen, 1977). The body's response to stress includes both physical and emotional consequences, but it differs depending on whether the stressor is acute (life threatening) or chronic, such as ongoing work or relationship difficulties. When exposed to stressors, the body uses physiological systems designed to cope with threats and diverts resources from body systems that are not needed (Kemeny, 2003). When the stressor is acute, the hypothalamus sends signals to the sympathetic nervous system that stimulate the adrenal medulla to send norepinephrine and epinephrine (adrenaline) into the body (Kemeny, 2003). The process of sympathetic nervous system activation increases heart rate, blood

pressure, respiration, and muscle tension, and decreases stomach muscle movements, and constricts blood vessels (Huffman, 2004). This response to acute stressors can be activated within seconds (Kemeny, 2003).

The HPA axis (Hypothalamus, Pituitary gland, and Adrenal Cortex System) is the system that responds to less acute and chronic stressors. In the case of less acute or chronic stress, the hypothalamus releases cotropin-releasing hormone, which activates the pituitary gland. The pituitary gland releases adrenocorticotropic hormone, which stimulates the adrenal cortext to release cortisol, a stress hormone (Huffman, 2004). This process takes minutes to occur (Kemeny, 2003).

Research from both human and animal studies indicates that type 2 diabetes is associated with altered adrenergic sensitivity in the pancreas and other sites which can lead individuals with type 2 diabetes to have an increased sensitivity to stressful stimuli (Surwit, Schneider, & Feinglos, 1992). In a review of the role of stress in diabetes, Surwit, Schneider, and Feinglos (1992) indicate that animal studies provide evidence that stress can worsen glycemic control in type 2 diabetes. More recent research (Björntorp, Holm, & Rosmond, 1999) found that low variability in cortisol values measured over the course of a day was associated with elevations in body mass index (BMI), fasting glucose, total cholesterol, triglycerides, LDL cholesterol, blood pressure, and heart rate. Björntorp, Holm, & Rosmond (1999) suggest that prolonged stress leads to disturbances in the HPA axis. If these disturbances become chronic, "the regulatory mechanisms become disturbed, resulting in abnormal, proximal input in to the hypothalamic regulatory centers combined with a deficient feedback inhibition by central glucocorticoid receptors" (Björntorp, Holm, & Rosmond, 1999, p. 377). The experience

of chronic stress also appears to dysregulate the immune system by suppressing some immune responses and activating other immune responses (Robles, Glaser, & Kiecolt-Glaser, 2005). The immune system has two types of cytokines that regulate the inflammatory response to injury or infection. The proinflammatory cytokines "attract immune cells to the site of infection or injury, priming them to become activated or respond" (Kiecolt-Glaser & Glaser, 2002, p. 873). The anti-inflammatory cytokines decrease the immune response. Chronic stress increases the production of proinflammatory cytokines. A chronically high level of one proinflammatory cytokine, interleukin 6 (IL-6), has been linked to the development of a number of conditions, including type 2 diabetes (Robles, Glaser, & Kiecolt-Glaser, 2005).

Depression

Research has documented that depression is a mental disorder associated with both stress and diabetes. Major Depressive Disorder is a serious mood disorder characterized by a number of symptoms that can include depressed mood, diminished interest or pleasure in activities, significant weight loss or weight gain, decreased or increased appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or inappropriate guilt, diminished ability to think or concentrate, and thoughts of death or suicidal ideation. Severe Major Depressive Disorder is associated with increased mortality due to suicide (American Psychiatric Association, 2000). Depression is also associated with increased morbidity and mortality in patients with cardiovascular disease (Musselman, Evans, & Nemeroff, 1998; Wulsin, Vaillant, & Wells, 1999). According to *The Global Burden of Disease* (Murray & Lopez, 1996), unipolar major depression was cited as the leading cause of

disability in the world in 1990, and the 4th leading cause of disability in developing countries.

Depression is costly to individuals and society. Research comparing work productivity in workers with and without depression has found that workers who met DSM-III-R criteria for depression had significantly more lost productive time than workers who did not meet criteria for depression (Stewart, Ricci, Chee, Hahn, & Morganstein, 2003). Estimates of the cost of this lost productivity due to health were $13 billion per year for people without depression compared to $44 billion for people with depression, and the majority of this lost productivity was due to decreased productivity while working, rather than absenteeism (Stewart et al., 2003).

Estimates of the prevalence of Major Depressive Disorder and Dysthymia are based on two large-scale epidemiological studies conducted in the United States that utilized structured clinical interviews based on DSM-III-R criteria (Kessler et al., 1994; Regier, Narrow, Rae, Manderscheid, Locke, & Goodwin, 1993). The Epidemiologic Catchment Area (ECA) study was conducted between 1980 and 1985 and used the Diagnostic Interview Schedule (DIS) to diagnose mental disorders. The ECA collected data from institutionalized and non-institutionalized participants who were 18 years of age or over. The ECA reported that the one-year prevalence of affective disorders was 9.5 per 100 persons. The one-year prevalence of unipolar major depression was 5.0 per 100 persons, and the one-year prevalence of Dysthymia was 5.4 per 100 persons (Regier et al., 1993). Between 1990 and 1992, the National Comorbidity Study examined noninstitutionalized people between the ages of 15 and 54 in the United States using the Composite International Diagnostic Interview (CIDI). The lifetime and 12-month

prevalence of having any affective disorder was 19.3% and 11.3%, respectively. The lifetime prevalence of having a major depressive episode was 17.1%, and the 12-month prevalence was 10.3%. Research has also shown that women are at a higher risk for Major Depressive Disorder than men (American Psychiatric Association, 2000; Nolen-Hoeksema, 2002). In fact, the prevalence of depression is twice as high for women in comparison to men.

Socioeconomic Status and Depression

A consistent inverse relationship has been found between socioeconomic status and psychopathology, regardless of the way in which the prevalence of psychopathology and socioeconomic status have been measured (Kohn, Dohrenwend, & Mirotznik, 1998). A meta-analytic review indicates that people with low socioeconomic status had higher odds of being depressed, having a new episode of depression, and having persistent depression (Lorant, Deliege, Weaton, Philippot, & Ansseau, 2003). The risk for depression decreased with increased education as well as increased income (Lorant et al., 2003).

Stress and Depression

Exposure to stressful events is strongly associated with subsequent depression (Dolan, Calloway, Fonagy, DeSouza, & Wakeling, 1985; Kessler, 1997; Mazure, 1998). Recent research has demonstrated that exposure to some psychological stressors can lead to increased levels of cytokines which can induce negative mood and change cognitions (Kemeny, 2003). Negative stressful events are more likely to be associated with poor mental health outcomes than positive stressful events (Kessler, 1997). In addition, it has been found that severely aversive experiences are more predictive of depression as

compared to less severe stressors (Brown & Harris, 1989; Kessler, 1997). However, research has found that this association may be due to the fact that there are ongoing stressors associated with several severe life events (Kessler, 1997). For instance, the death of a spouse may be stressful due to an ongoing lack of social support. Thus, it appears that particular types of environmental stressors may be important in initiating a psychological and biological response that results in depression (Monroe & Hadjiyannakis, 2002). In addition, recovery from depression can take longer when a person continues to experience stressful life events (Kessler, 1997). Kessler (1997) points out that people with a history of depression report experiencing more stressful events, even when they are not depressed, so it is possible that the experience of being depressed can cause some stressful life events.

A diathesis-stress model of depression accounts for the fact that while many people experience stressful and traumatic events, only some of those people subsequently experience depression (Caspi et al., 2003). A diathesis-stress model of depression predicts that depression occurs when a person has both vulnerability to depression and then experiences stressful events so that stress activates or interacts the vulnerability to depression resulting in the experience of depression (Monroe & Hadjiyannakis, 2002). Research examining genetic vulnerability to depression has found that "a functional polymorphism in the promoter region of the serotonin transporter (5-HTT) gene moderated the relationship between stressful life events and depression (Caspi et al., 2003). Individuals with a short allele who reported stressful life events after their 21st birthday had more depressive symptoms than those who were l/l homozygotes (Caspi et al., 2003).

Depression and Diabetes

Many studies have documented an increased rate of depression in patients with diabetes when compared to people without diabetes. A meta-analysis of seven studies found that the odds of depression for people with type 2 diabetes were two times higher than the odds of depression for nondiabetic samples (Anderson et al., 2001). Another review of research found that the prevalence of current depression in people with diabetes as diagnosed by a structured interview ranged from 8.5% to 27.3% with a mean of 14.0% (Gavard, Lustman, & Clouse, 1993). When assessed by self-report questionnaires, the average prevalence of comorbid depression and diabetes was 31% (Anderson et al., 2001). When compared to population-based studies of the incidence and prevalence of mental illness conducted in the United States, it is clear that people with diabetes have an increased rate of depression.

Research has shown that comorbid depression and diabetes is associated with a number of adverse health behaviors and health outcomes. Meta-analytic research indicates that in both type 1 and type 2 diabetes, depression is associated with a variety of diabetes complications with a moderate weighted effect size (de Groot, Anderson, Freedland, Clouse, & Lustman, 2001). A study evaluating the relationship between diabetes, major depression, and quality of life compared the health-related quality of life for participants who were depressed and not depressed (Lustman et al., 1999). A diagnosis of major depression was given to participants who met DSM-III-R criteria and had a score on the BDI that was greater than 14. On all eight subscales of the Medical Outcomes Study Short Form (SF-36; bodily pain, general health, general mental health, physical function, role limits—emotional, role limits—physical, social function, and

vitality), the depressed group scored significantly lower (indicating worse functioning) than the non-depressed group (Lustman et al., 1999).

Research has also demonstrated that patients with comorbid diabetes and depression utilize more health care services and incur more health care costs (Ciechanowski, Katon, & Russo, 2000; Egede, Zheng, & Simpson, 2002). Research in a health maintenance organization found that patients who were in the highest tertile of depression severity had a significantly higher probability of having emergency department, primary care, specialty care, medical inpatient, and mental health care costs as compared to patients in the lowest tertile of depression severity (when controlling for demographics, medical comorbidity, and diabetes severity; Ciechanowski, Katon, & Russo, 2000). Population-based research using the 1996 Medical Expenditure Panel Survey found that patients with diagnoses of both clinical depression and diabetes have higher prescription and total health care expenditures when compared to patients with diabetes who did not have a diagnosis of depression (Egede, Zheng, & Simpson, 2002). Furthermore, patients with comorbid diabetes and depression had more ambulatory visits and more prescriptions filled when compared to patients with diabetes alone (Egede, Zheng, & Simpson, 2002).

A number of hypotheses have been put forth to describe the initial occurrence or recurrence of depression in people with diabetes. Talbot and Nouwen (2000) describe two dominant hypotheses: (1) depression "results from biochemical changes directly due to the illness or [diabetes] treatment;" and (2) depression "results from the psychosocial demands or psychological factors related to the illness or its treatment" (p. 1556). Other research has examined whether depression causes diabetes or whether there is some other

factor, such as a genetic predisposition or an environmentally caused vulnerability, that puts people at risk for both depression and diabetes (Eaton, 2002).

Indeed, there may be physiological aspects of depression, such as changes in the immune or vascular system, that increase diabetes risk (Eaton, 2000). Kiecolt-Glaser and Glaser (2002) review the literature linking depression and immune function. Similar to chronic stress, depression has been shown to increase the production of proinflammatory cytokines, including the cytokine IL-6 (Kiecolt-Glaser & Glaser, 2002; Robles, Glaser, & Kiecolt-Glaser, 2005). The overproduction of these proinflammatory cytokines can lead to negative immune and endocrine changes. Specifically, IL-6 stimulates corticotropin-releasing hormone production, which can cause increased HPA axis activity, increased levels of ACTH, and increased levels of plasma cortisol. Some research suggests that elevated cortisol levels can "initiate, perpetuate, or aggravate symdromal depression, depression-like behaviors, and depressive symptoms such as anxiety, insomnia, and poor memory" (Kiecolt-Glaser & Glaser, 2002, p. 874; Tsigos & Chrousos, 2002). Elevations in proinflammatory cytokines can lead to a slower immune response to pathogens, like the common cold (Kiecolt-Glaser & Glaser, 2002). The proinflammatory cytokine IL-6 promotes the production of C-reactive protein, and both IL-6 and C-reactive protein are risk factors for type 2 diabetes (Kiecolt-Glaser & Glaser, 2002; Pradhan, Manson, Rifai, Buring, & Ridker, 2001). Another physiological hypothesis suggests that glucose intolerance or insulin resistance may change the neuroendocrine system and lead to changes in perceptions of stress or moods (Grandinetti, Kaholokula, & Chang, 2000).

Furthermore, having depression may exacerbate diabetes complications through changes in behavior or treatment of depression. People who are depressed may be less

likely to comply with weight loss recommendations (Marcus, Wing, Guare, Blair, & Jawad, 1992), dietary recommendations (Ciechanowski, Katon, & Russo, 2000), and medical treatment (DiMatteo, Lepper, & Croghan, 2000). In addition, it has been noted that some medications used to treat depression lead to weight gain, a risk factor for diabetes and its complications (Golden et al., 2004).

Research examining depression and type 1 diabetes suggests that the diagnosis of diabetes typically precedes a diagnosis of depression (Eaton, 2002). In the case of type 2 diabetes, three epidemiological studies indicate that Major Depressive Disorder precedes the onset of diabetes. Research conducted by Eaton, Armenian, Gallo, Pratt, and Ford (1996) using data from the Epidemiologic Catchment Area study found that a DSM-III diagnosis of Major Depressive Disorder in 1981 using the DIS predicted self-reported diabetes onset in 1993-1994 [Relative Risk = 2.23, Confidence Interval (CI) = 0.90-5.55] when controlling for race, gender, BMI, and age. The study conducted logistic regression analyses using other types of psychopathology, as well as less severe depression, as predictors of diabetes onset, but found that these models were much less predictive than a diagnosis of Major Depressive Disorder by structured interview (Eaton, Armenian, Gallo, Pratt, & Ford, 1996). While the use of a structured interview to diagnose Major Depressive Disorder is a strength of the study conducted by Eaton et al. (1996), one limitation in this study is that the diagnosis of diabetes was based on the participant's self-report, which may be inaccurate and may have underestimated the prevalence of diabetes.

Another prospective study conducted with Japanese males provided information regarding the temporal sequence of depression and diabetes (Kawakami, Takatsuka,

Shimizu, & Ishibashi, 1999). The study measured depression in 1984 using the Japanese version of the Zung Self-Rating Depression Scale and, participants were screened for diabetes annually through 1992 using urine tests, fasting plasma glucose, and 75-g oral glucose tests (based on the World Health Organization criteria for diagnosing diabetes). Results of the study indicate that participants who were experiencing moderate to severe depression symptoms (a score of 48 or more on the Zung Self-Rating Depression Scale) in 1984 displayed an age-adjusted hazard ratio of 2.32 (CI: 1.06-5.08) for being diagnosed with type 2 diabetes by 1992. The study also concluded that the relationship between depressive symptoms and the diagnosis of type 2 diabetes was not related to obesity, tobacco use, drinking alcohol, leisure-time physical activity, chronic medical conditions at baseline, or family history of diabetes (Kawakami et al., 1999). The study conducted by Kawakami et al. (1999) was an improvement on the Eaton et al. (1996) study because it used accepted medical guidelines in diagnosing diabetes at follow-up. However, the study was limited because it only included Japanese males and did not obtain a medical diagnosis of diabetes at baseline, but relied on patient self-report to ascertain diabetes status.

A third prospective study evaluated symptoms of depression as a risk factor for the diagnosis of type 2 diabetes over a six-year period in 11,615 non-diabetic adults (Golden et al., 2004). The study found that participants who scored in the highest quartile of a measure of vital exhaustion were more likely (63% increased risk) to be diagnosed with diabetes at one of two follow-up visits. When several demographic, metabolic, and lifestyle factors were included in the analysis, the risk for type 2 diabetes decreased, but still remained significant. The study conducted by Golden et al. (2004) is

limited by the way in which depression was measured, through the use of a vital exhaustion measure, rather than a standardized measure of depression.

Stress and Glycemic Control

Proper control of blood glucose is imperative to avoid complications of diabetes. As mentioned previously, the United Kingdom Prospective Diabetes Study found that lowering blood glucose decreases the risk for three complications of diabetes: retinopathy, nephropathy, and neuropathy (ADA, 2003). A number of studies have documented a link between exposure to stressors and glycemic control in type 1 diabetes, however, the relationship between exposure to stressors and glycemic control in type 2 diabetes patients is less clear. In general, two theories have been offered to explain the relationship between stress and glycemic control (Lloyd, Smith, & Weinger, 2005). The first theory posits that exposure to stressful life events and the experience of chronic psychological stress are directly associated with deficits in the neuroendocrine system. As mentioned before, chronic stress activates cortisol which increases blood glucose (Huffman, 2004). The second theory posits that exposure to stressful events indirectly affects glycemic control through changes in behaviors (self-care, alcohol use).

Only a few studies have examined the relationship between stress and glycemic control in people with type 2 diabetes. One study examined psychosocial predictors of blood glucose and self-care behaviors in patients with type 2 diabetes who were primarily Caucasian and of average socioeconomic status (Wilson, Ary, Biglan, Glasgow, Toobert, & Campbell, 1986). The researchers found that stress and glycemic control were uncorrelated. However, the life events checklist used in the study measured both positive and negative stressors, and participants generally reported very few negative stressors [*M*:

17.53 (*SD*: 18.71) out of 420] and twice as many positive stressors [*M*: 47.61 (*SD*: 37.75) out of 420]. The authors combined the positive and negative events into one total score, making it difficult to interpret the results. Life events were found to be positively correlated with dietary self-care behaviors, exercise self-care behaviors, and medication-taking. The direction of these correlations was related to the high number of life events rated as positive. Another study found that displaced survivors of war in Croatia with type 2 diabetes had levels of glycemic control that were similar to survivors who did not lose their homes (Pibernik-Okanovic, Roglic, Prasek, & Metelko, 1993). However, the study was limited in its lack of a standardized measure of stressful life events.

In contrast, other studies have found a relationship between glycemic control and exposure to stressful events in patients with type 2 diabetes or patients at risk for type 2 diabetes. Research conducted by Surwit, McCubbin, Feinglos, Esposito-Del Peunte, and Lillioja (1990; Surwit, Schneider, & Feinglos, 1992) found that Pima Indians, who have a genetic predisposition for developing type 2 diabetes, have an exaggerated glycemic reactivity to behavioral stress. Surwit et al. (1990) compared the blood glucose of Pima Indians to Caucasian participants after all participants engaged in a 10-minute mental arithmetic activity. The researchers found that ten of the thirteen Pima Indians had a small rise in blood glucose after the mental arithmetic activity whereas only one of eight Caucasian participants showed such an increase (Surwit et al., 1990; Surwit, Schneider & Feinglos, 1992). Another study evaluated the relationship between glycemic control and stress due to the catastrophic 1995 earthquake in Kobe, Japan in both type 1 and type 2 diabetes patients (Inui et al., 1998). The researchers compared the HbA1c levels of Kobe diabetes patients before and two months after the earthquake and found a significant

increase in blood glucose. Furthermore, increases in HbA1c and General Health Questionnaire scores (a measure of psychological distress and altered behavior) were more pronounced in participants who reported more severe negative stressors, such as severe damage to their homes, injuries experienced by family members, or the deaths of family members due to the earthquake. The authors reported that the results did not differ by type of diabetes (Inui et al., 1998).

Depression and Glycemic Control

Many studies have found a link between depression and glycemic control in people with diabetes. A meta-analysis published in 2000 reviewed 24 cross-sectional studies that investigated the relationship between depression and glycemic control (Lustman et al., 2000). The meta-analysis concluded that increased levels of depression were significantly related to hyperglycemia with a small to moderate effect size. There were no statistically significant differences in effect sizes between the studies that examined people with type 1 diabetes and the studies that examined people with type 2 diabetes. However, the effect sizes were larger in studies that used standardized interviews and diagnostic criteria rather than self-report questionnaires.

Stress, Depression, and Glycemic Control

Exposure to stressful events can also lead to increased risk for depression and diabetes, both through the HPA axis and the immune system, which work together. As mentioned previously, in the case of less acute or chronic stress, the hypothalamus releases cotropin-releasing hormone, which activates the pituitary gland. The pituitary gland releases adrenocorticotropic hormone, which stimulates the adrenal cortext to release cortisol (Huffman, 2004). If these disturbances become chronic, “the regulatory

mechanisms become disturbed, resulting in abnormal, proximal input in to the hypothalamic regulatory centers combined with a deficient feedback inhibition by central glucocorticoid receptors" (Björntorp, Holm, & Rosmond, 1999, p. 377). Exposure to physical and psychological stress and depression also increases proinflammatory cytokines, which have been linked to the development of type 2 diabetes (Robles, Glaser, & Kiecolt-Glaser, 2005).

Very few studies have examined the relationship between stress, depression, and glycemic control in patients with type 2 diabetes. The studies that have evaluated these variables tend to use diabetes status or exposure to stress as predictors of depression. One study evaluated several predictors of depression in Latino American and European American patients with type 2 diabetes, including demographic, disease status, and family stress (Fisher, Chesla, Mullan, Skaff, & Kanter, 2001). When all the predictors were entered into a multiple regression predicting depression, the results indicated that low education, high functional impact of diabetes, and high financial stress significantly predicted CES-D scores for Latino participants, accounting for 54% of the variance in CES-D scores. For European-American participants, low education, high functional impact of diabetes, high financial stress, and poor spouse conflict resolution significantly predicted CES-D scores and explained 55% of the variance in CES-D scores. Neither HbA1c nor BMI were significant predictors of depression when included in this regression (Fisher et al., 2001). While this study contributed to the literature by predicting depression in diabetic patients using measures of stress, the measures of stress were not well defined, as lack of family closeness and spouse conflict resolution were

considered measures of stress. In addition, the study did not include a wide range of stressors that may have been important.

There is a lack of research examining the relationship between stress, depression, and diabetes in low-income patients. One study of obese African-American women who were at increased risk for developing type 2 diabetes found that 40% had a clinically significant level of depression, as measured by a CES-D score of 16 or greater (de Groot, Auslander, Williams, Sherraden, & Haire-Joshu, 2003). In addition, several indicators of poverty (lack of home ownership, low appraisal of one's recent economic situation, unemployment), low self-esteem, and increased numbers of stressful life events were associated with increased depression as measured by the CES-D (de Groot et al., 2003).

Factors that Modify the Effects of Stress

While many people are exposed to stressful life events, not all people exposed to stressors experience depression or are diagnosed with diabetes indicating that stress does not affect everyone in the same way. As previously mentioned, there is a physiological reaction that occurs when people are experiencing stress. In addition, people tend to change their behaviors when under stress. Lazarus and Folkman (1984) have described a transactional framework that attempts to explain why stress affects each individual differently. The Transactional Model of Stress and Coping employs several levels of analysis (causal antecedents, mediating processes, immediate effects, and long-term effects). The transactional framework recognizes the importance of the meaning of the stressor to the perceiver (Wenzel, Glanz, & Lerman, 2002). In other words, the perception of how stressful an event or situation is to the perceiver is important in determining its impact on a person. The model can be used to predict impaired

physiological functioning by measuring casual antecedents, such as socioeconomic status and environmental demands, and mediating processes, such as coping and cognitive appraisal. Furthermore, this model includes the immediate effects of the interaction between the antecedents and mediating processes, such as positive and negative feelings. The long-term effects of stress can include chronic illness and impaired physiological functioning.

Lazarus and Folkman (1984) indicate that there are two factors (coping factors and cognitive appraisal) that mediate the relationship between stressors and psychological distress. Lazurus and Folkman (1984) define cognitive appraisal as "the unique and changing relationship taking place between a person with certain distinctive characteristics (values, commitments, styles of perceiving and thinking) and an environment whose characteristics must be predicted and interpreted" (p. 24). Cognitive appraisal is further divided into primary appraisal and secondary appraisal. Primary appraisal refers to a person's evaluation of whether an encounter with the environment affects his or her well-being, either positively or adversely. Secondary appraisal is an evaluation of "what might and can be done," (Lazurus & Folkman, 1984, p. 35) and can include perceived control over outcomes and emotions, as well as self-efficacy (Wenzel, Glanz, & Lerman, 2002).

Perceptions of Control

One construct that has been studied extensively as a process that either mediates or moderates the relationship between exposure to stressors and adverse mental and physical health outcomes is perceptions of control. Brim (1974) defines perceptions of control as a self-theory and notes that "one's sense of personal control is in fact a system

of belief, i.e., a theory about oneself in relation to one's environment, and a concern with causality, whether outcomes are a consequence of one's own behavior or tend to occur independently of that behavior" (p. 243). A person's perceptions of control can shape whether a person initiates a response and can affect a person's effort. Skinner (1995) notes that "perceived control influences whether people actively test hypotheses and strategies, seek information, and plan or instead lapse into passivity, confusion, avoidance, rumination, and anxiety" (xvii). People who perceive they have control behave in ways that make success more likely which confirms the high expectations of control (Skinner, 1995). Folkman (1984) discusses two ways in which control can be considered. Control is conceptualized as secondary appraisal when it is considered an appraisal of the possibility for control in a specific stressful situation (Folkman, 1984). When perceptions of control are situation-specific, the concept is considered a mediator of the relationship between the stressor and the coping effort exerted.

Another way to consider control is as a generalized belief about whether an individual can control important outcomes (Folkman, 1984). The generalized beliefs that people have about controlling events in their lives influence primary appraisal, or whether a person believes that a stressor will affect his or her well-being (Folkman, 1984). This dispositional perception of control may moderate the effect of stress on health or mental health outcomes. In other words, people who believe they have a lot of control over the outcomes in their lives will probably exert more effort in changing or reducing the stressor and therefore would have better health or mental health outcomes. People who believe that they have less control over their lives may be less likely to take actions to reduce or actively cope with stressors they experience, and as a result,

experience more adverse health and mental health outcomes. Research examining perceptions of control in population-based samples found that people in low socioeconomic groups had less of a sense of perceived control when compared to people in high socioeconomic groups (Bailis et al., 2001; Lachman & Weaver, 1998). In addition, participants' perceptions of control mediated the contribution of socioeconomic status on self-rated health status (Bailis et al., 2001).

A cross-sectional study conducted by Macrodimitris and Endler (2001) examined the relationship between coping, perceptions of control over diabetes, glycemic control, and depression in a sample of Canadian participants with type 2 diabetes. The majority of the participants were Caucasian and married. Unfortunately, no information was provided about the socioeconomic status of the participants who were recruited from diabetes education classes, diabetes support and information groups, and from advertisements in the Canadian Diabetes Association publications. Instrumental coping and perceptions of control over diabetes were negatively correlated with depression. Perceptions of control over diabetes were also negatively correlated with HbA1c. The study found that perceptions of control over diabetes moderated the relationship between instrumental coping and depression (Macrodimitris & Endler, 2001). The moderator analysis showed that participants reporting high perceived control over their diabetes generally had less depression, regardless of their level of instrumental coping (Macrodimitris & Endler, 2001). In comparison, participants who reported low perceived control over their diabetes and low instrumental coping reported higher levels of depression than participants who reported low perceived control over diabetes and high instrumental coping. Macrodimitris & Endler (2001) also found that perceived control

over diabetes also moderated the relationship between emotional preoccupation coping and HbA1c. HbA1c remained consistently higher for participants who reported low perceived control over their diabetes as compared to participants with high perceptions of control, regardless of their level of emotional preoccupation coping. The HbA1c of participants with high perceived control over their diabetes and low emotional preoccupation coping was significantly lower when compared to participants who perceived they had a lot of control over their diabetes and who also reported high emotional coping processing (Macrodimitris and Endler, 2001). Furthermore emotional preoccupation coping mediated the relationship between perceived control over diabetes and depression (Macrodimitris and Endler, 2001). Although substantial information regarding the relationship between perceived control of diabetes, coping, and HbA1c was provided by this study, it is limited by the fact that it did not measure stress.

A second study evaluated perceptions of control as a mediator of the relationship between chronic diabetes strains and depression in a highly educated sample of both type 1 and type 2 diabetes patients who were treated with insulin (Bailey, 1996). The study found no significant relationship between depression and glycemic control, but found that perceptions of control was negatively correlated with HbA1c. The results of the study were difficult to interpret as there was only one multiple regression evaluating whether four predictors (complications, regimen demands, effect on daily life, general social support) of depression were mediated by two variables (self-esteem and perceptions of control). However, with all these variables included in the analysis, mastery, self esteem, and the effect of diabetes on daily life remained significant predictors, explaining 53% of the variance in depression, as measured by the CES-D (Bailey, 1996). Taken together,

the results of these studies show that evaluating perceptions of control is important in the study of depression and glycemic control in diabetes patients.

Study Rationale

Similar to many chronic diseases, the development and maintenance of diabetes are related to physiological, psychosocial, and behavioral processes. Evidence suggests that it is important to evaluate the effect of life stressors on health and mental health outcomes in type 2 diabetes patients. The study was designed to: (1) evaluate the relationship between exposure to stressors and blood glucose in type 2 diabetes patients; (2) evaluate three alternate models of how stressful life events and current depression impact blood glucose in type 2 diabetes patients; and (3) determine if perceptions of control moderate the relationship between stress and depression in type 2 diabetes patients.

As mentioned previously, past research investigating the effects of stressful events on glycemic control has provided mixed results (Inui et al., 1998; Pibernik-Okanovic et al., 1993; Wilson et al., 1986). A study examining a combination of positive and negative stressors did not find a relationship between stress and glycemic control (Wilson et al., 1986), whereas another study found that the experience of adverse stressors was associated with poor glycemic control (Inui et al., 1998), which is consistent with the Transactional Model of Stress and Coping. Thus, the present study examined whether there is a relationship between exposure to stressful life events and blood glucose in a low-income population. It also evaluated whether the nature of the stressor (positive versus negative) is a critical predictor of blood glucose, a question that has not been addressed in previous research.

Despite the literature linking exposure to stressful events and depression (Dolan et al., 1985; Kessler, 1997; Mazure, 1998), exposure to stressful events and glycemic control (Inui et al., 1998; Pibernik-Okanovic et al., 1993; Surwit, Schneider, & Feinglos, 1992), and depression and glycemic control (Lustman et al., 2000) very few studies have examined the relationship among these three variables. The studies that do exist have primarily evaluated how stress and other variables, including HbA1c, predict depression in type 2 diabetes patients (de Groot et al., 2003; Fisher et al., 2001). No study has described various models that evaluate how stress and depression predict blood glucose levels. In the present study, three models evaluated how exposure to stressors and depression predict blood glucose levels. All of the models are supported by the fact that depression is a strong predictor of glycemic control (Lustman et al., 2000) and exposure to stressors is predictive of depression (Dolan et al., 1985; Kessler, 1997; Mazure, 1998), but the literature is inconclusive about whether exposure to stressful situations is predictive of glycemic control.

The first model (mediation) evaluated whether depression mediated the relationship between stress and blood glucose. This model posits that stress and depression are dependent factors predicting blood glucose. In other words, when a person is exposed to stressful events, he or she will experience symptoms of depression, and the depression will then lead to high blood glucose. According to this model, depression is the most proximal predictor of blood glucose and accounts for any relationship between stress and blood glucose. There is no known research evaluating whether exposure to stressful situations is predictive of glycemic control by virtue of the impact of stress on depression.

The second model (additive) examined whether exposure to stressful events and depression explains significant variance in blood glucose. In other words, it was hypothesized that stress would predict blood glucose when controlling for depression, and depression would predict blood glucose when controlling for stress. However, the combination of having both high stress and high depression was predicted to have an additive effect on glycemic control. This model posits that when a person is already depressed and then exposed to stress, it will lead to high blood glucose. Alternatively, this model also predicted that when a person is experiencing an increased amount of stress and then becomes depressed, it would result in high blood glucose.

The third model (interactive) examined whether the interaction between stress and depression explained significant variance in blood glucose. An interaction occurs when two factors (exposure to stressful events and depression) work together and produce an effect that is more than the effect of the individual factors (Thorne & Giesen, 2000). This model would be supported if the results indicated that the effect of stress on blood glucose differs for different levels of depression. In other words, the effect of the impact of stress on blood glucose would depend on the level of depression reported.

As a secondary hypothesis, this study examined whether perceptions of control moderated the relationship between stress and depression. Perceptions of control was measured using a general scale, i.e., perceptions of control over participants' lives, rather than control over a specific situation in their lives, like diabetes. Since the measure of perceptions of control is more trait-like, a moderator analysis was conducted. It was anticipated that people who report low levels of stress would also report low levels of depression, regardless of whether their perceptions of control were high or low. It was

expected that people who reported having high control over their lives and high exposure to stressful events would also have lower levels of depression. In contrast, people who reported high levels of exposure to stressors and low levels of perceived control would have the highest level of depression.

In summary, research to date on patients with type 2 diabetes has not been conclusive regarding whether exposure to stressful life events is associated with glycemic control and whether the nature of stressors (negative versus positive) is critical in predicting blood glucose. There are no known studies comparing different models to explain the relationship between stress, depression, and blood glucose in type 2 diabetes patients. In addition, there are no known studies that have examined whether perceptions of control moderate the relationship between stress and depression in type 2 diabetes patients. It is important to examine in more detail the relationship between stress, depression, and glycemic control in low-income patients because of the high prevalence of diabetes and depression in people who have a low income and the strong correlation between depression and type 2 diabetes.

Chapter 2—Method

Design

The study used a cross-sectional design. Data were collected by interview, survey, and medical record review.

Participants

The study participants were recruited from June 21, 2004, to December 15, 2005, using a convenience sample from two health care centers (Judeo Christian Health Clinic and Brandon Outreach Clinic) that treat patients whose income is too high to qualify for government assistance but is also too low to afford private health care or health insurance. Thus, patients are not in the lowest income brackets, but are still unable to afford necessary health care. For instance, to qualify for services at the Judeo Christian Health Clinic, a single person's annual income must be between $8,980 and $22,450, with adjustments made depending on the size of the family.

Participants met the following inclusion criteria to participate in the study: (1) were diagnosed with type 2 diabetes mellitus by self-report; (2) were able to speak and read either Spanish or English; (3) had at least a 6^{th} grade education; and (4) were between the ages of 18 and 70 years. Potential participants were excluded if they had a physical, cognitive, or mental disability that precluded participation in the study (i.e., recent head injury, schizophrenia, dementia). Participants without a working telephone were also excluded.

At Judeo Christian Health Clinic, a total of 3,904 people were approached and 393 (10%) disclosed that they had type 2 diabetes. Thirty-five type 2 diabetes patients from Brandon Outreach were sent letters requesting participation in the survey, leaving a possible diabetic sample of 428. Of these 428 participants, 49 (11%) personally declined to participate in the study at the Judeo Christian Health Clinic, and 27 participants (6%) did not return a form indicating their interest in participating at Brandon Outreach Clinic. Of this sample of 352 potential participants, 182 (43% of possible diabetic sample) did not meet inclusion criteria. Of the excluded participants, 126 (69%) were not clinic patients, 21 (12%) did not speak or read either English or Spanish, 18 (10%) were not between the ages of 18 and 70, 11 (6%) had less than a 6^{th} grade education, four (2%) had a cognitive impairment, and two (1%) had a hearing impairment.

Of the 170 remaining participants, one participant was included in the pilot test, but not included in the final sample. Twenty-four participants did not return the surveys or complete the interview. Thus, 145 participants (85%) completed the survey and interview and were included in the final sample. Medical records were available for 120 of these 145 (83%) participants, and glycemic control was available for 93 of the 120 participants (78%) with medical records. In the final total sample, seven participants (5%) were recruited from Brandon Outreach Clinic, and 138 participants were recruited from Judeo Christian Health Clinic.

When compared to participants who completed the study, participants who did not complete the surveys or interview did not differ in gender, language spoken at home, or HbA1c. Participants who did not complete the study were younger ($M = 47$, $SD = 11$) than participants who completed the study [$M = 52$, $SD = 9$;t (134) = 1.94, $p = .055$].

The study participants ranged in age from 25 to 70 years (*M* = 51 years, *SD* = 10), and completed an average of 12 years of education (*SD* = 3). The majority of participants were female (68%), currently married (51%), Hispanic (53%), and at least a high school graduate (71%; Table 1). Most participants (59%) did not work for pay outside of the home. Participants reported being diagnosed with diabetes for an average of nine years (*SD* = 8) and having an average monthly income of $903 (*SD* = $677). Forty-six percent of participants reported that they spoke English at home, 43% of participants spoke Spanish at home, and 10% spoke both English and Spanish at home. The majority of participants (56%) reported that they were born outside the continental United States. Of the 81 people who reported immigrating to the continental United States, the majority of participants were born in Cuba (23%), Colombia (14%), Mexico (12%), Puerto Rico (12%), and Honduras (9%).

As mentioned previously, medical record data were available for 120 participants and type of diabetes treatment was only available for 115 participants (79%). Of these 120 participants, 8% of participants did not receive any treatment for diabetes, 64% of participants were prescribed an oral agent only, 12% of participants were prescribed insulin only, and 16% were prescribed both insulin and an oral agent. Height and weight were available in the medical records of 98 patients. These participants had a mean body mass index (BMI) of 33.8 (*SD* = 7.4), which is classified as obese (CDC, 2006).

Power Analysis

Sample size was estimated using Cohen's (1992) guidelines for power analyses. A total of three correlation analyses were conducted (hypothesis 1). The sample size required for a correlation with α set at .05 and a medium effect size is 85 participants.

The sample size required for a multiple regression with α of .05, a medium effect size, and three independent variables is 76 participants (hypothesis 2). Two regression analyses with two variables were conducted (hypotheses 3 and 4). The sample size required for a multiple regression with α of .05, a medium effect size, and two independent variables is 67 participants. In order to conduct both the interaction analysis (hypothesis 5) and the moderation analysis (hypothesis 6), which both include two independent variables and an interaction, 150 participants were required (with α of .05 and a medium effect size).

Measures

Glycemic Control

Glycosylated hemoglobin (HbA1c) was used to measure glycemic control. HbA1c provides a measurement of a patient's average blood glucose control over the past 2-3 months (ADA, 2003). The ADA recommends that health care providers measure HbA1c in patients with diabetes every three months and patients maintain an HbA1c level under 7.0% (ADA, 2006). Lower levels of HbA1c reduce several types of microvascular and neuropathic complications and reduce the risk of myocardial infarction and cardiovascular death (ADA, 2003). A total of 93 participants' HbA1c values were collected from the clinic medical records, but only 71 participants (49% of total sample) had HbA1c measured three months before or three months after the survey data were collected.

Center for Epidemiologic Studies Depression Scale

The Center for Epidemiologic Studies Depression (CES-D) scale was used to measure current level of depression symptomatology (Radloff, 1977; Appendix A). The

CES-D contains 20 items assessing depressive symptomatology over the past week. Items are measured on a four-point Likert scale [0=Rarely or none of the time (Less than 1 day); 1=Some or a Little of the Time (1-2 Days); 2=Occasionally or a Moderate Amount of Time (3-4 Days); 3 = Most or All of the Time (5-7 Days)]. The total score is calculated by summing the item responses with a possible range of 0 to 60. The Flesch-Kincaid grade level scores of items ranged from 0.0 to 9.1, with an overall level of 1.7. In the initial validation study, internal consistency estimates, as measured by coefficient alpha, were 0.85 for a household sample and 0.90 for a sample of psychiatric patients (Radloff, 1977). There is evidence that the CES-D has adequate discriminant validity as statistically significantly higher scores were found in a sample of psychiatric patients when compared to a sample of household members. The CES-D has been used in several studies of patients with diabetes (Bailey, 1996; Black, 1999; Fisher et al., 2001; Friis & Nanjundappa, 1986; Murrell, Himmelfarb, & Wright, 1983; Pennix, van Tilburg, Boeke, Deeg, Kriegsman, & van Eijk, 1998; Peyrot & Rubin, 1997; Zhang, Markides, & Lee, 1991).

The CES-D has been translated into Spanish and backtranslated (Perczek, Carver, Price, & Pozo-Kaderman, 2000; Appendix B). A high positive correlation was found between the English and Spanish versions of the scale (r = .88) when bilingual research participants completed both versions. In the Perczek et al. (2000) study, both the English and Spanish versions demonstrated high internal validity (Cronbach's alpha = .92 and .89, respectively).

Crisis in Family Systems—Revised

The Crisis in Family Systems—Revised (Berry, Shalowitz, Quinn, & Wolf, 2001; Appendix A) was used to measure a variety of different stressors. The Crisis in Family Systems—Revised is an in-depth interview measuring contemporary life stressors that was developed for use with residents of inner-city neighborhoods. The Crisis in Family Systems—Revised consists of a checklist of 64 stressors, which include both daily hassles and life events. The Crisis in Family Systems—Revised includes a Difficulty scale, where the stressor is rated on a four-point Likert scale (not at all, a little bit, medium, a lot). In addition, the Crisis in Family Systems—Revised includes a Valence scale where each of the stressors listed are rated as either positive, negative, or neutral by the participant. The Crisis in Family Systems—Revised also includes a Chronicity scale where the stressor is rated as resolved or ongoing (Berry et al., 2001). Although the Chronicity and Difficulty scales were administered, the data from these scales were not included in the study analyses.

When participants completed the Crisis in Family Systems—Revised, they were instructed to recall stressors that occurred in the past four months. A total score on the Crisis in Family Systems—Revised was calculated by summing the number of stressors reported. The number of positive stressful events was calculated by summing the number of stressful events rated as positive on the Valence Scale. The number of negative stressful events was calculated by summing the number of stressful events rated as negative on the Valence scale. Thus, the total score for the number of stressful events, the number of positive stressful events, and the number of negative stressful events had a possible range from 0 to 64.

In the development of the Crisis in Family Systems—Revised, items were obtained from existing measures and from two discussion groups of community-based case managers whose clients were members of low-income families. The scale was administered to two samples of primary caregivers of children with chronic illness or disability, one of which was obtained from an inner-city hospital, and revisions were made to items following sample administration. The majority of participants in the hospital validation study were single, female, African-American, and high school educated. The results of the hospital validation study found a significant positive correlation between scores on the CES-D and total scores on the original Crisis in Family Systems ($r = .47$, $p < .001$). Two-week test-retest reliability was high with a correlation of .88 ($p < .001$) between the number of events reported at two administrations. The developers of the original Crisis in Family Systems did not calculate internal consistency due to the fact that many items contained in each subscale would preclude one another (Shalowitz, Berry, Rasinski, & Dannhausen-Brun, 1998).

When the scale was revised, it was administered to 102 participants who had children with asthma. The Crisis in Family Systems—Revised total score was highly correlated with CES-D scores ($r = .44$, $p < .001$). The number of stressors rated as negative was also strongly correlated with CES-D scores ($r = .58$, $p < .001$), while the number of positive stressors was not significantly correlated with CES-D scores. In addition, participants who were Medicaid recipients reported significantly more stressors than participants who did not receive Medicaid indicating the scale's appropriateness for low-income populations (Berry et al., 2001). According to the authors of the Crisis in Family Systems—Revised, the Spanish version was developed by a professional

translator (Appendix B). Items were translated into Spanish and then backtranslated, but psychometric data regarding the translation were not available from the study authors.

City Stress Inventory

The City Stress Inventory was designed to measure urban stressors related to neighborhood disorder and exposure to violence (Ewart & Suchday, 2002; Appendix A). The City Stress Inventory includes eighteen items that comprise two scales, Neighborhood Disorder and Exposure to Violence. The items listed on the Neighborhood Disorder scale evaluate neighborhood-level incivility and physical decay (e.g., "I saw adults arguing loudly on my street," "Someone I knew was arrested or went to jail." One item "I saw or heard a 'shooting gallery' near my home" was revised to "I saw or heard a 'crack house' near my home" due to differences in terminology in the Tampa area. Two additional items, "How many neighbors receive food stamps in the past year?" and "How many houses or buildings in your neighborhood were vacant or unoccupied during the past year?", were changed to reflect occurrences in the past four months in order to be consistent with the other measure of stressors in the study. The items on the Exposure to Violence scale measure the degree of exposure to physical violence (e.g., "A family member was stabbed or shot," "A family member was attacked or beaten"). All items were scored on a four-point Likert scale (Never, Once, A Few Times, Often) or (None, Some, About Half, Most) depending on the nature of the question. All items on the City Stress Inventory have a Fleish-Kincaid reading level of 9^{th} grade or less, and the total reading level of the scale is 4.9. The items in the two subscales were summed to obtain a "Neighborhood Disorder" score (possible range = 10 to 40) and an "Exposure to Violence" score (possible range = 7 to 28).

The City Stress Inventory was developed using a sample of high school students. Internal consistency reliability of the two subscales was found to be good (α = .88 and .85 for Neighborhood Disorder and the Exposure to Violence scales, respectively; Ewart & Suchday, 2002). In addition, test-retest reliability for one year provided evidence of temporal stability (r = .82 for Neighborhood Disorder, and r =.75 for Exposure to Violence). Both scales of the City Stress Inventory were significantly negatively correlated with census reports of per capita income and significantly positively correlated with percentage of people unemployed. In addition, for female students, level of depression and negative affect, as measured by a combination of items from the Children's Depression Inventory and Children's Trait Anxiety Inventory, were positively correlated with the Exposure to Violence and Neighborhood Disorder scales (Ewart & Suchday, 2002).

A professional translator translated the City Stress Inventory for the purpose of this study, and items were revised by native Spanish speakers (Appendix B). Back-translation was conducted by native Spanish speakers representing several Spanish dialects. A brief evaluation of the psychometric properties of the Spanish version of the CSI was conducted.[1]

Mastery Scale

The Mastery scale, developed by Pearlin and Schooler (1978), measured perceptions of control (Appendix A). The Mastery scale was designed to measure "the extent to which one regards one's life-chances as being under one's own control in contrast to being fatalistically ruled" (Pearlin & Schooler, 1978, p. 5). The entire 7-item scale was translated into Spanish by a professional translator and backtranslated by a

professional translator (Rini, Dunkel-Schetter, Wadhua, & Sandman, 1999; Appendix B). Revisions were made by a team of bilingual interviewers with different Latin backgrounds after pretesting was conducted (Rini et al., 1999).

The Mastery Scale has been used in research with low-income participants (Rini et al., 1999). Participants in the study were asked to rate each item on a 5-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). A total score was calculated by taking the mean of the responses to the seven items, so the total score ranged from 1 to 5. A five-item version of the scale demonstrated adequate internal reliability in both English ($\alpha = .81$) and Spanish ($\alpha = .74$) forms.

Demographics

Seventeen questions assessed the following demographic variables: date of birth, gender, race/ethnicity, education, number of children, occupation, employment status, income, housing and living arrangements, marital status, year diagnosed with diabetes, country of origin, and primary language.

Settings

Data were collected from two health centers: the Judeo Christian Health Clinic and Brandon Outreach. The Judeo Christian Health Clinic is located in Tampa, Florida and provides free medical care to Tampa Bay residents who do not qualify for public assistance, but cannot afford health insurance. The clinic is staffed by health care providers, medical students, and nurse practitioner students from the University of South Florida Department of Family Medicine as well as nurses, physicians, pharmacists, dieticians, and others who volunteer their time. The Judeo Christian Health Clinic provides general medical care as well as specialty care in pediatrics, gynecology, eye

care, dermatology, podiatry, and dental care. Brandon Outreach is located in Brandon, Florida and provides medical care to Brandon and Mango residents who cannot afford health care. The clinic is staffed by health care providers, medical students, and nurse practitioners from the University of South Florida Department of Family Medicine as well as other community volunteers.

Procedure

A team of 15 undergraduate research assistants assisted in the implementation of the project. Research assistants recruited potential research participants in the clinic, contacted study participants over the phone, and administered the Crisis in Family Systems—Revised over the phone.

Pilot Study

During the pilot study, in-depth interviews were conducted with approximately ten diabetes patients recruited from both of the study sites to evaluate the readability, comprehensiveness, and presentation of the study materials. The pilot study participants were asked to evaluate whether the study surveys assessed relevant stressors and reported whether study materials were easy to understand and complete. In addition, the pilot study was used to evaluate the feasibility of conducting the study as planned. All participants reported that materials were easy to read and understand. Questionnaires were reviewed for missing data, and the format of the CES-D was changed based on suggestions from pilot study participants. In addition, the inclusion criteria of the study were revised so that participants who had above a fifth grade education would be included. Following the pilot study, participant recruitment at Brandon Outreach Clinic

was discontinued because of low response and difficulties identifying diabetes patients. All but one of the pilot study participants was included in the final data set.

Data Collection

Prior to data collection, the University of South Florida (USF) Institutional Review Board and the Directors of the two health clinics reviewed and approved the project. The recruitment of patients differed in the two sites. Information was collected at both sites regarding how many patients were approached to participate, how many patients declined or did not participate for other reasons, and how many participants had missing data that precluded their participation. At the Judeo-Christian Health Clinic, participants were recruited as they waited to receive health care services in the clinic. A bilingual research assistant approached each potential participant in the clinic waiting room and, using an informal interview, assessed whether the patient had type 2 diabetes. The research assistant explained the purpose of the study to patients who stated they had type 2 diabetes and requested that the potential participant agree to take part in the study and sign an informed consent form. Participants were asked to complete the following measures as they waited for their clinic visit: demographics, CES-D, the Pearlin Mastery Scale, and the City Stress Inventory. The order of measures was counterbalanced. The instruments were printed in the participants' primary language, either English or Spanish. Participants who were unable to complete the measures in the clinic were provided with a postage-paid envelope to return the surveys.

At Brandon Outreach, a list of potential participants was generated using a search of computerized records of patients who received treatment for diabetes. A letter of introduction was sent to each identified patient from the clinic director informing them

about the purpose of the study and requesting their participation. Patients were asked to return a form indicating their interest in participating. After providing permission to be contacted, potential participants were contacted via telephone to introduce the study and describe the requirements for participation, the limits of confidentiality, and incentives provided for participation. For patients who met inclusion criteria, the research team mailed a standardized letter of introduction in the patient's primary language describing the study, informed consent agreements, the study surveys, and a postage-paid envelope to enable participants to return the surveys through the mail.

Participants who did not return the materials mailed or given to them in the clinic after ten to fourteen days were contacted via telephone. The principal investigator or undergraduate assistants attempted to contact study participants at least five times by telephone at various days and times. After three weeks passed without a participant's response, a letter was sent to the participant requesting that the participant return the questionnaires and providing contact information for the study team.

After the research team received the packet of questionnaires and the informed consent, an undergraduate research assistant or the principal investigator contacted the participant and administered the Crisis in Family Systems—Revised over the telephone using the participant's primary language. Participants were mailed $20 for completing the questionnaires and interview.

Upon receipt of the signed informed consent from participants at both clinics, the medical records of each participant were reviewed to obtain the following data from the most recent visits: height, weight, blood pressure, date of birth, HbA1c, type and dose of diabetes medications, type and dose of insulin used, if any, type and dose of other current

medications, other physical or mental comorbid conditions, and most recent lipid measurements. The diagnosis of type 2 diabetes was also confirmed with medical record data.

Data Analyses

All study data were entered into an SPSS® database for analysis (SPSS, 1999). All data were verified by the principal investigator. If more than 10% of the items from a questionnaire were missing, the questionnaire data for that individual were excluded. In all other cases, missing values were replaced by the average score of all respondents on each individual item. Data were examined to determine whether participant demographic characteristics (marital status, gender, race/ethnicity, education) were associated with differences in stressful life events, mastery, HbA1c, and depression. In addition, data were reviewed for normality and collinearity when multiple regressions were conducted.

Hypotheses

As previously described, the study: (1) examined the relationship between stress and blood glucose; (2) examined the relative contributions of stress and depression in predicting blood glucose; and (3) evaluated whether perceptions of control moderated the relationship between stress and depression. The following hypotheses were examined:

Hypothesis 1. Experiencing stressful life events is positively correlated with blood glucose level.

Hypothesis 2. Negative stressful events have a greater association with glucose level than positive stressful events.

Hypothesis 3. Depression mediates the relationship between negative stressful life events and glucose level.

Hypothesis 4. The effect of experiencing both negative stressful events and depression is predictive of glucose level.

Hypothesis 5. The interaction between negative stressful events and depression is predictive of glucose level.

Hypothesis 6. Perceptions of control will moderate the relationship between stress and depression.

Chapter 3—Results

Descriptive Characteristics of Study Variables

The mean, standard deviation, and range of participants' scores on the CES-D are reported in Table 2. The average score on the CES-D, was relatively high at 22.2. In fact, 62.8% of participants scored 16 or greater on the CES-D, which is a frequently cited cutoff indicating clinically significant depression (Nezu, Nezu, McClure, & Zwick, 2002; Radloff, 1977). In the present study the CES-D data were normally distributed and had good internal consistency ($\alpha = 0.90$).

The means, standard deviations, and ranges of the number of stressful events, number of positive stressful events, and number of negative stressful events are reported in Table 2. The number of stressful events reported on the Crisis in Family Systems—Revised was normally distributed, while the distributions of the number of negative and positive stressful events were both negatively skewed. The number of negative stressful events reported had a median of 4.0 events. The number of positive stressful events reported had a median of 1.0. The internal consistency of this scale was not calculated because several of the items precluded each other (Shalowitz et al., 1998), or had the opposite meaning. For instance, the following two items assessed financial stressors: "Did your income increase by a lot?" and "Did your income decrease by a lot?" Two items that assessed relationship stressors were: "Did you get a divorce or break up with a

partner?" and "Did you get back together with a partner?" These differing items would not be expected to be internally consistent, even though each item is a possible stressor.

The means, standard deviations, and ranges on the scales of the City Stress Inventory are presented in Table 2. The Neighborhood Disorder scale data were positively skewed with a median of 13.0, indicating that the participants reported a low level of stress related to neighborhood disorder. The Neighborhood Disorder scale had adequate internal consistency ($\alpha = 0.82$) in this study. The Exposure to Violence scale data were positively skewed with a median of 7.0, indicating the participants reported a very low level of stress related to exposure to violence. The Exposure to Violence scale had poor internal consistency ($\alpha = 0.58$) in this study.[1]

Participants' responses on the Mastery scale were normally distributed, and the mean, standard deviation, and range of the scores are presented in Table 2. On average, participants perceived that they had a moderate amount of control over their lives. The scale showed adequate internal consistency ($\alpha = 0.76$) in the present study.

Medical record review indicated that the mean level of HbA1c was 8.26% (*SD* = 2.05%) for the 71 participants (49% of total sample) whose HbA1c was available and measured three months before or three months after the surveys were completed (Table 2). Only 34% of participants had an HbA1c level that was under 7.0%, the level recommended by the American Diabetes Association for adequate glycemic control (ADA, 2006). The HbA1c data were normally distributed. Since HbA1c was not available for the majority of participants, analyses were conducted to determine whether participants whose medical records contained HbA1c differed from participants who did not have HbA1c in their medical records. Participants who did not have HbA1c in their

medical records reported more stress due to neighborhood disorder [t (135) = 2.47, p = .015], more stressful life events [t (142) = 2.10, p = .038], higher levels of depression [t (138) = 1.98, p = .05], were younger [t (143) = -3.17, p = .002], and were more likely to speak English [χ^2 (1) = 4.18, p = .041]. Participants who had HbA1c measured did not differ from participants without an HbA1c in perceptions of control, stress due to exposure to violence, positive stressful events, negative stressful events, gender, education, marital status, or race/ethnicity.

Association between Demographic Characteristics and Study Variables

The data were initially reviewed to determine if demographic characteristics were significantly related to depression, stressful life events, mastery, or blood glucose. These analyses were conducted because several demographic characteristics have been found in previous research to predict depression and glycemic control, but few of these studies have been conducted in low-income populations. Demographic characteristics that were found to be associated with study variables were included in post-hoc analyses predicting glycemic control and depression.

Marital Status

For the purpose of evaluating whether marital status was associated with study dependent and independent variables, participants who indicated that they were single, engaged, separated, divorced, or widowed were considered "single" and were compared to married participants. Participants who were married reported significantly fewer stressful events [M = 6.92, SD = 3.89); t (124) = 2.27, p = .025] and negative stressful events [M = 3.70, SD = 3.71; t (124) = 3.10, p = .002] than single participants (M = 8.73, SD = 5.49; M = 6.08, SD = 5.37, respectively). In addition, married participants reported

significantly more positive stressful events [*M* = 1.46, *SD* = 2.18; t (106) = -2.58, *p* = .011] and a higher income [*M* = $1,037, *SD* = $786; t (109) = -2.26, *p* = .026] than single participants (*M* = 0.73, *SD* = 1.04; *M* = $771, *SD* = $523, respectively). There were no significant differences between married and single participants on scores on the Mastery scale, scores on the Neighborhood Disorder scale, scores on the Exposure to Violence scale, CES-D scores, age, BMI, or HbA1c.

Gender

Female participants reported significantly fewer positive stressful events (*M* = 0.81, *SD* = 1.02) when compared to male participants [*M* = 1.72, *SD* = 2.62; t (53) = -2.32, *p* = .024]. Female participants also had lower monthly income (*M* = $816, *SD* = $664) when compared to male participants [*M* = $1,083, *SD* = $677; t (127) = -2.12, *p* = .036]. Male participants had lower BMI (*M* = 31.1, *SD* = 5.04) than female participants [*M* = 35.2, *SD* = 8.06; t (93) = 3.08, *p* = .003]. There were no significant differences between female and male participants on scores on the Mastery scale, scores on the Neighborhood Disorder scale, scores on the Exposure to Violence scale, number of stressful events, number of negative stressful events, CES-D scores, age, or HbA1c.

Race and Ethnicity

For the purpose of evaluating whether ethnicity was associated with study dependent and independent variables, participants who endorsed the following race/ethnic status were compared: "African-American or Black," "Caucasian or White," and "Hispanic American, Latino, or Latina." Differences were found between the three groups in scores on the Neighborhood Disorder scale [F (2, 134) = 3.45, *p* < .034]. In post-hoc Tukey tests, Caucasian (*M* = 16.08, *SD* = 5.86) participants scored higher on the

Neighborhood Disorder scale than Hispanic (M = 13.71, SD = 3.75) or African-American participants (M = 15.17, SD = 4.57; p = .033), indicating that they perceived more neighborhood stress. Differences were also found by race/ethnicity on CES-D scores in an analysis of variance [F (2, 134) = 3.41, p = .036]. In post-hoc Tukey tests, no statistically significant differences were found between the three racial/ethnic groups of participants in CES-D scores, although Hispanic participants displayed a trend toward higher mean CES-D scores (M = 24.76, SD = 12.16) when compared to African-American (M = 19.35, SD = 10.19) and Caucasian (M = 19.36, SD = 13.19) participants. An analysis of variance indicated that there were significant differences in BMI by ethnicity [F (2, 90) = 4.36, p = .016], with Caucasian participants having higher BMI (M = 37.06, SD = 7.80) than Hispanic participants (M = 32.11, SD = 6.47) in post-hoc Tukey tests. In an analysis of variance, the three groups of participants differed by level of monthly income [F (2, 120) = 9.54, $p < .001$]. In post-hoc Tukey tests, Caucasian participants reported a higher mean monthly income (M = \$1,324, SD = \$694) when compared to Hispanic participants (M = \$715, SD = \$657), but Caucasian participants did not differ from African-American participants in monthly income (M = \$968, SD = \$474). When compared to African-American and Caucasian participants, there were significantly more Hispanic participants with less than a high school education [χ^2 (2) = 10.29, p = .006]. Twenty-five percent of Hispanic participants reported less than a high school education, compared to 6.9% of African-American participants and 3.1% of Caucasian participants. In analyses of variance, there were no significant differences by race/ethnicity on negative stressful events, positive stressful events, total number of stressful events, scores on the Mastery scale, scores on the Exposure to Violence scale,

age, or HbA1c. When Caucasian participants were compared to Hispanic participants in an independent samples t-test, Hispanic participants had higher levels of HbA1c [*M* = 8.65, *SD* = 2.06; t (54) = 2.36, *p* = 0.22] than Caucasian participants (*M* = 7.3, *SD* = 1.58). There were no significant differences between Caucasian and African American or between African American and Hispanic participants in glycemic control when evaluated by independent samples t-tests.

Education

For the purposes of comparison, participants' level of education was allocated to one of four groups (less than high school, attended or graduated from high school, attended college or technical school, attended graduate or professional school). An analysis of variance indicated that there were differences in CES-D score by level of education [F (2, 138) = 4.87, *p* = .003]. Post-hoc Tukey tests showed that participants who had less than a high school education reported more depression symptoms (*M* = 29.81, *SD* = 10.67) than participants who attended high school (*M* = 19.93, *SD* = 11.91; *p* = .005) and participants who attended graduate or professional school (*M* = 12.2, *SD* = 7.69; *p* = .016). An analysis of variance indicated that there were differences in monthly income by level of education [F (3, 123) = 3.93, *p* = .01]. Post-hoc Tukey tests indicated that participants who had less than a high school education reported less monthly income (*M* = $435, *SD* = $528) than participants with a high school education (*M* = $1,014, *SD* = $711, *p* = 005) and participants who attended college or technical school (*M* = $969, *SD* = $643, *p* = .013) Although Mastery scale scores were not significantly different by education, there was a trend showing the level of mastery increasing with each level of education [F (3, 138), = 2.37, *p* = .073]. There were no statistically significant

differences by education on scores on the Exposure to Violence or Neighborhood Disorder scales, stressful life events, negative stressful events, positive stressful events, BMI or HbA1c.

Correlations Between Study Variables

Correlations between study variables are presented in Table 3. Contrary to what was predicted, HbA1c was not significantly correlated with stressful life events, Neighborhood Disorder scale scores, Exposure to Violence scale scores, CES-D scores, or Mastery scores. In addition, BMI was positively correlated with perceptions of control ($r = .20$, $p = .048$) and negatively correlated with age ($r = -.20$, $p = .046$). Income was positively correlated with perceptions of control ($r = .18$, $p = .038$).

Hypothesis Testing

Hypotheses

Hypothesis 1. Experiencing stressful life events is positively correlated with blood glucose level.

In testing this hypothesis, it was expected that scores on the Crisis in Family Systems—Revised would be positively correlated with HbA1c, scores on the Neighborhood Disorder subscale of the City Stress Inventory would be positively correlated with HbA1c, and scores on the Exposure to Violence subscale of the City Stress Inventory would be positively correlated with HbA1c. As shown in Table 3, there were no significant correlations between scores on the Crisis in Family System—Revised (stressful life events, negative stressful events, positive stressful events) and HbA1c. In addition, no significant correlation was found between scores on either subscales of the City Stress Inventory and HbA1c.

Hypothesis 2. Negative stressful events have a greater association with glucose level than positive stressful events.

This hypothesis was evaluated by regressing HbA1c on (1) a ratio of positive stressful events to the total number of stressful events participants reported on the Crisis in Family Systems—Revised; and (2) a ratio of negative stressful events to the total number of stressful events participants reported on the Crisis in Family Systems—Revised. It was anticipated that the ratio of negative events to stressful events would be predictive of HbA1c when controlling for the effect of the ratio of positive stressful events to stressful events.

When bivariate correlations were examined, neither ratio was significantly correlated with HbA1c (ratio of negative events to stressful events: r = .03, p = .41; ratio of positive events to stressful events: r = .03, p = .39). A multiple regression using these two ratios to predict HbA1c was also not statistically significant [F (2, 68) = 0.13, p = .88].

Hypothesis 3. Depression mediates the relationship between negative stressful events and glucose level.

As shown in Table 3, neither negative stressful events nor CES-D scores was significantly correlated with HbA1c. Since a relationship between stressful events and depression was not found, the data did not support a mediation model.

Hypothesis 4. The effect of experiencing both negative stressful events and depression is predictive of glucose level.

This hypothesis was tested by conducting a multiple regression analysis. HbA1c was regressed on the number of stressful events rated as negative on the Crisis in Family

Systems—Revised and CES-D scores. Evidence supporting this hypothesis would be found if both variables were significant predictors of HbA1c.

As show in Table 3, neither negative stressful events nor depression was significantly correlated with glycemic control. When HbA1c was regressed on the number of negative stressful events and CES-D scores, the regression did not explain a significant amount of variance in HbA1c [$F(2, 68) = 1.38$, $p = .258$]. Thus, there was no evidence for the additive model indicating that experiencing both negative stressful events and depression is predictive of glycemic control.

Hypothesis 5. The interaction between negative stressful events and depression is predictive of glucose level.

This hypothesis evaluated whether the interaction of exposure to negative stressful events and experiencing depression explains additional variance in HbA1c beyond the two variables alone. As mentioned previously, an interaction occurs when the joint effect of exposure to negative stressors and experiencing depression works together to produce a larger effect on glycemic control. This hypothesis was tested by conducting a multiple regression analysis. HbA1c was regressed on the number of events rated as negative on the Crisis in Family Systems—Revised, CES-D scores, and the interaction of negative stressful events and CES-D scores. If the interaction of negative stressful events and CES-D scores was significantly predictive of HbA1c when controlling for negative stressful events and CES-D scores alone, there would be evidence supporting this hypothesis.

As shown in Table 3, neither negative stressful events nor CES-D scores was significantly correlated with HbA1c. When HbA1c was regressed on the number of

negative stressful events, CES-D scores, and the interaction of negative stressful events and CES-D scores, the regression did not explain a significant amount of variance in HbA1c [F (3, 67) = 0.93, p = .432]. Therefore, there was no evidence indicating the interaction between negative stressful events and depression was predictive of glycemic control.

Hypothesis 6. Perceptions of control will moderate the relationship between stress and depression.

The purpose of testing this hypothesis was to determine whether perceptions of control influenced the direction or strength of the relationship between stress and depression. It was anticipated that people who report low levels of stress would also report low levels of depression, regardless of whether their perceptions of control are high or low. It was expected that people who report having high control over their lives and high exposure to stressful events would have lower levels of depression. People who report high levels of stressors and low levels of perceived control were anticipated to have the highest level of depression.

The hypothesis was tested using a method described by Baron and Kenny (1986). Since the variables were highly correlated, the predictor variables (stressful events and mastery scale score) were centered by subtracting the mean of each variable from the predictor. This was done to reduce multicollinearity in the multiple regression (Aiken & West, 1991). In the first step of a hierarchical regression, CES-D scores were regressed on the Crisis in Family Systems—Revised scores and Mastery scale scores. In the second step of the regression, CES-D scores were regressed on the interaction between Mastery scale scores and Crisis in Family System—Revised scores, while controlling for

the main effects of the Crisis in Family Systems—Revised and Mastery Scale scores. According to Baron and Kenny (1986), evidence of moderation would be found if there was a significant interaction between stressful life events and perceptions of control while controlling for the main effects of stressful life events and perceptions of control.

In step one of the hierarchical regression, when CES-D scores were regressed on stressful life events and mastery scores, the regression predicted 41% of the variance in CES-D scores [F (2, 141) = 48.95, $p < .001$]. Both Mastery and the total number of stressful events were significant predictors of depression symptoms (Table 4). In step two of the regression, when CES-D scores were regressed on the interaction between Mastery scale scores and Crisis in Family Systems—Revised scores, while controlling for the main effects of Crisis in Family Systems—Revised and Mastery scale scores, the regression predicted 41% of the variance in depression [F (3, 140) = 32.41, $p < .001$; Table 4]. Evidence of moderation was not found because there was not a significant interaction between stress and perceptions of control while controlling for the main effects of stress and perceptions of control ($p = .89$).

Post-hoc Analyses

Predicting Glycemic Control

Initial analyses indicated that HbA1c, CES-D scores, and neighborhood disorder stress differed by ethnicity, with Hispanic participants having significantly lower neighborhood disorder stress and higher HbA1c. Hispanic participants also had higher depression scores than Caucasian and African American participants, although the difference was not statistically significant. A previous study comparing Hispanic participants and European Americans with type 2 diabetes in a broader income range also

found that Hispanic Americans had higher levels of depression (as measured by the CES-D) and worse glycemic control than European Americans, but did not differ on measures of financial stress, despite the fact that the Latino participants reported lower income (Fisher et al., 2001).

Initially, post-hoc analyses evaluated whether either stress due to neighborhood disorder or depression would be predictive of blood glucose when controlling for Hispanic ethnicity, as all three variables (stress due to neighborhood disorder, depression, blood glucose) differed by ethnicity in the present study, and two of these variables (blood glucose and depression) differed by ethnicity in a previous study (Fisher et al., 2001). It was hypothesized that depression and stressful life events would be related to blood glucose when ethnicity was controlled. A further analysis was conducted to evaluate the best model to predict blood glucose using Hispanic ethnicity, depression, and stress related to neighborhood disorder as predictors. It was anticipated that either depression or stress due to neighborhood disorder would contribute to the prediction of blood glucose when added to Hispanic ethnicity.

For the post-hoc analyses, ethnicity was dichotomized as "Hispanic" (n = 40) or "Caucasian" (n = 16), excluding participants of other ethnic/racial groups. Thus, the regressions were limited by the small sample size of participants who had HbA1c measured within 90 days of the survey (n = 56). Initially, HbA1c was regressed on both predictor variables (neighborhood disorder, CES-D) in separate regressions while controlling for ethnicity to determine if either variable would predict a significant amount of variance in blood glucose while controlling for ethnicity. A stepwise multiple regression predicting blood glucose was conducted to evaluate which combination of

variables (stress due to neighborhood disorder, CES-D scores, ethnicity) best predicted blood glucose.

Since the distribution of the stress due to neighborhood disorder variable was significantly skewed, the inverse of the distribution was used in the regression analyses (Tabachnick & Fidell, 1996), transforming the mean to .07 and the standard deviation to .02. When HbA1c was regressed on stress due to neighborhood disorder and ethnicity, the regression was not found to be significant [$F(2, 53) = 2.79$, $p = .07$]. When HbA1c was regressed on CES-D scores and ethnicity, the regression was significant [$F(2, 53) = 4.22$, $p = .02$], and predicted 14% of the variance in HbA1c. Of the two variables in the regression equation, only Hispanic ethnicity was a significant predictor of HbA1c ($\beta = -.38$, $p = .007$).

When HbA1c was regressed on Hispanic ethnicity, CES-D scores, and stress related to neighborhood disorder in a stepwise regression, the final model was statistically significant [$F(1, 54) = 5.56$, $p = .022$], explaining 9% of the variance in HbA1c. The final model only included Hispanic ethnicity ($\beta = -.31$, $p = .022$), and excluded depression and neighborhood disorder stress. Thus, all post-hoc analyses indicated that Hispanic ethnicity was the strongest predictor of blood glucose when the analyses were limited to Hispanic and Caucasian participants.

Since there was such a strong relationship between ethnicity and blood glucose among the Hispanic and Caucasian participants, an evaluation of the relationship between ethnicity and other possible confounding variables was conducted to determine if other demographic or medical variables may explain this relationship. An analysis of variance indicated that there were significant differences in BMI by ethnicity [$F(2, 90) = 4.36$, $p =$

.016], with Caucasian participants having higher BMI (M = 37.1, SD = 7.8) than African-American (M = 35.1, SD = 8) and Hispanic participants (M = 32.1, SD = 6.5) in post-hoc Tukey tests. When compared to African-American and Caucasian participants, there were significantly more Hispanic participants with less than a high school education [χ^2 (2) = 10.29, p = .006]. Twenty-five percent of Hispanic participants reported less than a high school education, compared to 6.9% of African-American participants and 3.1% of Caucasian participants. In an analysis of variance, the three groups of participants differed by level of monthly income [F (2, 120) = 9.54, p < .001]. In post-hoc Tukey tests, Caucasian participants reported a higher mean monthly income (M = $1,324, SD = $694) when compared to Hispanic participants (M = $715, SD = $657), but Caucasian participants did not differ from African-American participants in monthly income (M = $968, SD = $474). Participants did not differ by ethnicity in the number of years since diagnosis of diabetes.

Since Hispanic and Caucasian participants differed in income and education, two regression analyses were conducted to determine whether Hispanic ethnicity would remain a significant predictor of blood glucose when controlling for these two variables. For all post-hoc analyses, education was dichotomized as "education less than high school" and "high school or more education." When HbA1c was regressed on stressful events and income, the regression was nearly significant, explaining 12% of the variance in HbA1c [F (2, 44) = 3.02, p = .059]. Neither Hispanic ethnicity (β = -.24; p = .12) nor monthly income (β = -.17, p = .29) was a significant predictor of HbA1c, however, the sample size for this analysis was reduced to 47 Hispanic and Caucasian participants who

provided income data. When HbA1c was regressed on Hispanic ethnicity and education, the regression was no longer statistically significant [F (2, 53) = 2.75, p = .073].

Predicting Depression

Additional post-hoc analyses were conducted to further evaluate the relationship between education, stress, blood glucose, perceptions of control, and depression. Previous study analyses indicated that low education was associated with high scores on the CES-D. In addition, stressful life events and negative stressful events were significantly positively correlated with CES-D scores, whereas Mastery scale scores were significantly negatively correlated with CES-D scores. The post-hoc analyses initially focused on determining the best model to predict depression using demographic variables and the statistically significant psychological predictors of depression (stress, perceptions of control). Previous research (de Groot et al., 2003; Fisher et al., 2001) used HbA1c to predict depression, so HbA1c was also initially included in the prediction of depression. A stepwise multiple regression analysis evaluated the most effective model to predict depression using education, stressful life events, HbA1c, and perceptions of control as predictors. Based on preliminary analyses and previous research, it was anticipated that each of these variables (stress, HbA1c, perceptions of control, education) would significantly contribute to the prediction of depression.

As shown in Table 5, when four variables (education, stressful life events, HbA1c, perceptions of control) were entered into a stepwise regression predicting CES-D scores, the regression was significant [F (4, 66) = 22.96, p < .001], explaining 58% of the variance in depression. All four variables were significant predictors of depression. Education and perceptions of control were the strongest predictors (p < .001), followed

by stressful life events ($p < .001$), and HbA1c ($p = .023$). There was no evidence of multicollinearity in the final regression model.

Further analyses were conducted to determine how much additional variance was explained by psychological variables when both demographic (education and ethnicity) and psychological variables were included in a multiple regression. A hierarchical regression analysis was conducted with education and ethnicity (coded as African-American, Caucasian, and Hispanic) entered into the first step and stressful life events and perceptions of control entered into the second step. In the first step of the regression, the demographic predictors explained 9% of the variance in depression [$F (2, 133) = 6.47$, $p = .002$; Table 6], with education being the only significant predictor ($p = .005$). When the psychological variables were entered into the second step of the regression, the change in R^2 was significant ($p < .001$), and the inclusion of the psychological variables explained an additional 40% of the variance in depression. All four variables (education, ethnicity, stressful life events, perceptions of control) were significant predictors of depression (Table 6).

As Hispanic participants displayed a trend towards higher scores on the CES-D, an additional hierarchical regression analysis was conducted to predict depression scores. This analysis included Hispanic ethnicity and education as demographic predictors and stressful life events and perceptions of control as psychological predictors. The Hispanic ethnicity variable was created by dummy coding the ethnicity variable so that Hispanic participants were coded as 1 and all other participants were coded as 0. In the first step of the regression the demographic predictors explained 9% of the variance in depression [$F (2, 141) = 6.95$, $p = .001$; Table 7], with education being the only significant predictor

(p = .011). When the psychological variables were entered into the second step of the regression, the change in R^2 was significant (p < .001), and the inclusion of the psychological variables explained an additional 39% of the variance in depression. All four variables (education, Hispanic ethnicity, stressful life events, perceptions of control) were significant predictors of depression (Table 7).

Additional analyses focused on whether type of diabetes treatment influenced the relationship between HbA1c and depression. Two analyses of variance were conducted to determine whether CES-D scores and HbA1c differed by type of diabetes treatment. No significant differences were found in glycemic control [F (3, 67) = 1.77, p = .16] or CES-D scores [F (3, 111) = 0.17, p = .92] by method of diabetes treatment. An additional analysis was conducted to determine whether type of treatment moderated the relationship between depression and glycemic control. The moderation analysis was not significant [F (3, 67) = 0.92, p = .43], and none of the variables (CES-D scores, type of diabetes treatment, interaction of CES-D scores and diabetes treatment) significantly predicted HbA1c.

Perceptions of Control as a Moderator

A post-hoc analysis was conducted to determine whether perceptions of control moderated the relationship between education and depression. Previous research using a national sample found that perceptions of control moderated the relationship between economic social class differences (as defined by income) and depression (Lachman & Weaver, 1998). For people in high-income groups, psychological well-being showed less variation as a function of level of control. People who reported lower income and low perceptions of control had a higher level of distress than people who reported lower

income and high perceptions of control (Lachman & Weaver, 1998). A similar relationship was hypothesized in the current study. It was anticipated that people who reported at least a high school education would have less depression overall independent of their perceived level of control. People who reported less than a high school education and low perceptions of control were predicted to have the highest level of depression. Also, it was anticipated that people with less than a high school education who had high perceptions of control would have the lowest level of depression.

The moderation analysis was conducted using the method described by Baron and Kenny (1986). Since the variables were highly correlated, the one continuous predictor variable (mastery) was centered by subtracting the mean. This was done to reduce multicollinearity in the multiple regression (Aiken & West, 1991). In the first step of a hierarchical regression, CES-D scores were regressed on education and Mastery scale scores. In the second step of the regression, CES-D scores were regressed on the interaction between Mastery scale scores and education, while controlling for the main effects of education and Mastery Scale scores. According to Baron and Kenny (1986), evidence of moderation would be found if there was a significant interaction between education and perceptions of control while controlling for the main effects of education and perceptions of control.

In the first step of the hierarchical regression, when CES-D was regressed on education and Mastery scale scores, the regression was significant [$F(2, 142) = 35.51$, $p < .001$; Table 8], explaining 33% of the variance in depression. In the second step of the regression, when CES-D scores were regressed on the interaction between Mastery scale scores and education, while controlling for the main effects of education and Mastery

scale scores, the regression predicted 35% of the variance in depression [F (3, 141) = 25.25, $p < .001$]. Evidence of moderation was not found because there was not a significant interaction between stress and perceptions of control ($p = .064$) while controlling for the main effects of education and perceptions of control. Since the interaction between stress and perceptions of control was close to being statistically significant, the mean depression scores of participants were reviewed to determine whether they supported the predicted results. In reviewing the means, mastery scale scores were dichotomized using a median split. As expected, participants (n = 67) who reported higher than average control and at least a high school education reported the lowest level of depression ($M = 15.3$, $SD = 9.61$). Contrary to predictions, participants who reported higher than average control and had less than a high school education (n = 6) had the highest level of depression ($M = 32.12$, $SD = 6.77$). Participants who reported less than average control had similar levels of depression, independent of their level of education [less than high school education (n = 16): $M = 28.94$, $SD = 11.88$; at least high school education (n = 56): $M = 27.53$; $SD = 11.80$]. Despite the centering of the mastery variable, there was evidence of multicollinearity. The variance inflation factor scale score was 30, which is greater than the suggested value of 10, indicating collinearity. All proportions of variance were greater than .5, which also indicates collinearity. The finding that the regression has multicollinearity indicates that the predictor variables are highly correlated and the regression equation may be unstable and likely to change with different samples.

Perceptions of Control as A Mediator

Since the moderation analysis was affected by multicollinearity and did not indicate the relationship predicted, a mediation analysis was conducted to determine whether perceptions of control mediated the relationship between education and depression. The moderation analysis indicated that participants with at least a high school education and higher than average perceptions of control had the lowest level of depression. In addition, previous research using a large Canadian sample found that perceptions of control mediated the relationship between socioeconomic status (as defined by work status, income, and education) and depression (Bailis et al., 2001). It was anticipated that people with low levels of education may feel that they have little control over the events in their life, as they may be limited in terms of access to services and goods, employment opportunities, positive social networks, and opportunities to pursue further education (Brown et al., 2004; Gallo & Matthews, 2003). This lack of control can lead to depression, making perceptions of control the most proximal predictor of depression. It was expected that perceptions of control would mediate or partially mediate the relationship between education and depression.

This hypothesis was evaluated according to the method proposed by Baron and Kenny (1986). The correlation between education and CES-D was significant, indicating that a low level of education was associated with increased depression ($\beta = -.26$, $p = .002$). Second, Mastery scale scores were correlated with CES-D scores ($\beta = -.55$, $p < .001$). Finally, CES-D scores were regressed on education and scores on the Mastery scale (Table 9). There was evidence of partial mediation as the correlation between education and CES-D scores was reduced when mastery was entered into the regression

equation (β = -.16, $p < .02$). A Sobel (1982) test indicated that the mediation effect was significant (z = -2.10, $p = .04$; Preacher & Hayes, 2004).

Another mediation analysis was conducted to determine whether perceptions of control mediated the relationship between stressful life events and depression, which would be predicted by the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984; Wenzel, Glanz, & Lerman, 2002). Previous research indicated that perceptions of control mediated the relationship between stress and depression in Chinese elders (Chou & Chi, 2001) and in inner-city adolescents and children (Deardorff, Gonzales, & Sandler, 2003). In general, these studies have found that experiencing an increased amount of stress can reduce a person's perceptions of control, making perceptions of control the most proximal predictor of depression. Based on theory and previous research, it was expected that perceptions of control would mediate the relationship between stress and depression.

This hypothesis was evaluated according to the method proposed by Baron and Kenny (1986). Stressful life events and CES-D were significantly positively correlated, (β = .43, $p < .001$). Second, Mastery scale scores were significantly negatively correlated with CES-D scores (β =-.55, $p < .001$). Finally, CES-D scores were regressed on education and Mastery scale scores (Table 10). There was evidence of partial mediation as the correlation between stressful life events and CES-D was reduced when Mastery scale scores were entered into the regression equation (β = .32, $p < .001$). The Sobel (1982) test indicated that the mediation effect was significant (z = -2.38, $p = .02$; Preacher & Hayes, 2004).

Chapter 4—Discussion

Summary of Results

The present study examined the relationship between stress, depression, and glycemic control in low-income patients with type 2 diabetes. The study compared three alternative models of the relationship between stress, depression, and blood glucose—a mediation model, an additive model, and an interactive model. In addition, the study examined whether perceptions of control moderate the relationship between stress and depression. The following hypotheses were examined: (1) experiencing stressful life events is positively correlated with glucose level; (2) negative stressful events have a greater association with glucose level than positive stressful events; (3) depression mediates the relationship between negative stressful events and glucose level (mediation model); (4) the effect of experiencing both negative stressful events and depression is predictive of glucose level (additive model); (5) the interaction between negative stressful events and depression is predictive of glucose level (interactive model); and (6) perceptions of control moderate the relationship between stress and depression.

The study participants reported an average of eight stressful events with fewer events rated as either positive or negative. The participants also reported experiencing a low level of stress due to neighborhood disorder and exposure to violence. On average, study participants reported a high level of depressive symptomatology, and the majority of participants' HbA1c exceeded recommended guidelines. Contrary to what was

expected, stressful life events and depression were not related to glucose level in bivariate correlations. The data did not support any of the three models of the relationship between stress, depression, and glucose level (mediation, additive, interactive). The strongest predictor of blood glucose was Hispanic ethnicity, however, income and education appear to confound this relationship.

As expected, in bivariate correlations depression was associated with the total number of stressful life events, negative stressful events, and perceptions of control. Contrary to what was predicted, depression was not correlated with stress related to exposure to violence or neighborhood disorder. Participants in the study who reported less than high school education had more depression than participants with a high school education or with graduate or professional education. Contrary to what was hypothesized, perceptions of control did not moderate the relationship between stressful life events and depression.

In post-hoc analyses, four variables (education, perceptions of control, stressful life events, HbA1c) predicted 58% of the variance in depression, with education remaining the strongest predictor. Perceptions of control did not significantly moderate the relationship between education and depression. However, perceptions of control significantly partially mediated the relationship between education and depression. Perceptions of control also partially mediated the relationship between stress and depression.

Predicting Glycemic Control

As mentioned previously, fewer than half of the study participants had a measure of HbA1c in their medical record that was collected within three months of the survey

data. The American Diabetes Association recommends that HbA1c be tested at least twice a year in diabetes patients to monitor the effectiveness of diabetes treatment (American Diabetes Association, 2006). This lack of documented HbA1c is somewhat surprising given that the medical services provided in the clinics were free. However, there are unique circumstances that may have prevented diabetic patients from returning to the Judeo Christian Health Clinic after their initial registration and recruitment into the study. In particular, patients must wait to register on a list that is posted early in the morning for health care appointments scheduled for the next day. There are a limited number of appointments available, so many patients arrive very early in the morning. On the day of the appointment, the patients often experience a long wait to see a health care provider as well. Thus, the patients who may not have had an HbA1c in their medical record may be less able to spend so much time waiting for an appointment to see a medical provider. Participants who did not have HbA1c in their medical records reported more stress due to neighborhood disorder, more stressful life events, higher levels of depression, were younger, and were more likely to speak English. Other researchers have also found that low socioeconomic status patients are less likely to receive recommended standards of diabetes care, such as HbA1c measurement (Bell et al., 2001; Brown et al., 2004; Chin, Zhang, & Merrell, 1998). Contrary to study hypotheses, in bivariate correlations HbA1c was not associated with stressful life events, negative stressful events, positive stressful events, stress related to exposure to violence, stress related to neighborhood disorder, or depression.

The relationship between blood glucose and Hispanic ethnicity found in the present study is consistent with other research on adults in the United States diagnosed

with type 2 diabetes which found that Mexican American males and African American females experienced worse glycemic control when compared to people from other ethnic and racial groups (Harris, Eastman, Cowie, Flegal, & Eberhard, 1999). Additional research in type 2 diabetes patients has found that Hispanic Americans experienced worse glycemic control when compared to European Americans (Fisher et al., 2001). In the present study, both income and education appear to confound the relationship between Hispanic ethnicity and HbA1c, even though the study participants' incomes were generally low. The relationship between HbA1c and Hispanic ethnicity found in the current study differs from another study conducted with a low socioeconomic sample, which found that Hispanic participants had impaired glycemic control when compared to Asian participants, but had similar levels of glycemic control when compared to African American or Caucasian participants (Benoit, Fleming, Philis-Tsimikas, & Ji, 2005). The Benoit et al. (2005) study was conducted in San Diego, so the population of Hispanic participants may differ from those in the current study. The current study also did not include any Asian participants.

Hispanic patients seeking health care in the United States may face barriers that prevent them from obtaining adequate diabetes care, such as the inability to afford health care and the lack of a usual source of care (Weinick, Zuvekas, & Drilea, 1997). Hispanic Spanish-speaking diabetes patients may experience language barriers at all levels of medical care (for instance, scheduling an appointment, discussing their diabetes with a health care provider, obtaining and understanding a prescription; Brown et al., 2004; Lasater, Davidson, Steiner, & Mehler, 2001). Hispanic patients who do not speak English fluently also may not be provided with adequate diabetes education or mental

health treatment. In the present study, participants who reported speaking only Spanish at home had significantly higher levels of depression (M = 24.2, SD = 12.5), when compared to English speakers [M = 19.5, SD = 12.5;t (127) = -2.16, p = .033]. Furthermore, as shown in the present study low-income Hispanic patients may have lower education than low-income English-speaking patients, so they may also have difficulty understanding information provided in Spanish. It is important for members of the health care system to work to reduce barriers to care for Hispanic patients.

The finding that exposure to stressful life events was not associated with HbA1c was inconsistent with what would be predicted by theory and some previous research (Inui et al., 1998), but contributes to the limited research evaluating the relationship between stressful life events and blood glucose in type 2 diabetes patients. As described previously, the body's response to stress can include both direct physiological changes in the body, such as increased production of proinflammatory cytokines (Robles, Glaser, & Kecolt-Glaser, 2005), and indirect changes in health that can be caused by changes in health behaviors, such as changes in diet or sleep (Lloyd, Smith, & Weinger, 2005). There are a number of reasons that may account for the lack of observed relationship between exposure to stressful events and glycemic control in the present study. One explanation would be that there was in fact no relationship between the two variables. A review of the literature indicates that a previous study of type 2 diabetes patients in an average socioeconomic status sample found that stressful life events and HbA1c were uncorrelated (Wilson et al., 1986). A study comparing displaced survivors of war in Croatia with type 2 diabetes with type 2 diabetes patients who had survived the war but did not lose their homes found increased depression reported by the displaced patients but

no difference in HbA1c in the two groups (Pibernik-Okanovic et al., 1993). Another study of both type 1 and type 2 diabetes patients who survived an earthquake in Kobe, Japan found a significant increase in blood glucose after the earthquake (Inui et al., 1998). A review of the findings of these studies points to differences in the designs of each study. The present study and the studies conducted by Wilson et al. (1986) and Pibernik-Okanovic et al. (1993) used a cross-sectional design whereas glycemic control was measured both before and after the earthquake in the Inui et al. (1998) study. The stressors experienced by earthquake survivors were traumatic (such as the death of a family member) and may have been similar for most participants. Furthermore, the earthquake may have severely impacted the participants indirectly through changes in lifestyle, such as changes in medication regimen and diet. Therefore, more traumatic stressors, such as natural disasters, may show a greater impact on glycemic control over time because of both the physiological impact and the indirect changes to infrastructure that supports disease management. Because many studies, including the present study, evaluate both long-term and short-term stressors, it is important to study the relationship between stressful life events and glycemic control in a longitudinal study. A longitudinal study would provide information on the effect of longer lasting stressors on glycemic control.

A second reason that may account for the lack of relationship between stressful life events and HbA1c were the differences between the participants whose medical records contained a measure of HbA1c and participants whose medical records were missing a measure of HbA1c. Participants who did not have HbA1c in their medical records reported more stress due to neighborhood disorder, more stressful life events,

higher levels of depression, were younger, and were more likely to speak English. Therefore, the exclusion of participants without an HbA1c may have restricted the ranges of HbA1c and stressful life events and decreased the correlation between stress and HbA1c.

Another reason that no relationship was found between exposure to stressful events and blood glucose may have been because of unreliable or invalid measures of stressful life events and HbA1c. An evaluation of the Neighborhood Disorder and Exposure to Violence scales of the CSI indicated that both had decreased internal consistency when compared to the original validation study in adolescents (Ewart & Suchday, 2002). In the present study, the internal consistency for the Neighborhood Disorder scale was adequate ($\alpha = 0.82$), but was poor for the Exposure to Violence ($\alpha = 0.58$). Thus, a lack of relationship between stress due to exposure to violence may be accounted for by lack of reliability in the scale which may attenuate any relationship between glycemic control and stress related to exposure to violence. In addition, the psychometric properties of the Spanish form of the CSI have not been thoroughly evaluated. The other measure of stressors, the Crisis in Family Systems—Revised, was specifically designed for use in low-income samples, but had no psychometric data available for its Spanish translation. Thus, it is unknown whether the Spanish version of the Crisis in Family Systems—Revised was reliable or valid. However, in both the development study (Berry et al., 2001) and the current study, both the total number of stressful events and number of negative stressful events reported on the Crisis in Family Systems—Revised were associated with CES-D scores, providing evidence for its validity. In addition, the range of positive stressful life events was small, which would

made it unlikely that positive stressful life events would be significantly correlated with glycemic control. Furthermore, the Crisis in Family Systems—Revised was an objective measure of stress, as participants were only asked whether they had experienced a stressful event and whether that event was positive, negative, or neutral. Since each stressor may impact each person differently, a subjective measure of stress that allows participants to appraise difficulty of the stressor may have been more appropriate for evaluating the relationship between stress and blood glucose.

HbA1c was obtained through medical records. However, the measurement of HbA1c in the medial records lacked standardization. As mentioned previously, HbA1c was included in the analyses if it was measured 90 days before or 90 days after the survey data were collected, so the time of collection varied. In addition, HbA1c was measured at several laboratories, which may have differed in their methods of obtaining or processing blood samples.

Another reason that there may not have been a relationship between exposure to stressful life events and blood glucose may be the existence of moderating or mediating variables that were not evaluated, such as diet or medication adherence.

Predicting and Explaining Depression

The results of the study indicated that approximately 63% of patients had a score of 16 or more on the CES-D, which is a commonly used indicator of clinically significant depression (Nezu et al., 2002; Radloff, 1977). This level of depression is twice as high as the rate reported in a review of prevalence estimates of comorbid diabetes and depression measured by self-report (Anderson et al., 2001), and higher than other studies that have used the CES-D to measure depression in diabetes patients (Bailey, 1996; Fisher, 2001).

The level of depression measured in the present study was similar to a study of mostly low-income Mexican immigrants, which reported 59% of participants had a score of 16 or greater on the CES-D (Hovey, 2000). Thus, the severity of depression symptoms in low-income diabetes patients appears to be very high, which is consistent with previous meta-analytic research that reported that having a low income was related to increased depression (Lorant et al., 2003).

One surprising finding in the present study was that depression did not vary by gender. Although women reported higher mean depression scores (M = 22.9, SD = 12.1) than men (M = 20.7, SD = 13.0), the difference was not statistically significant. This lack of gender differences in depression contradicts a substantial amount of published research (American Psychiatric Assocation, 2000; Nolen-Hoeksema, 2002). A number of reasons have been proposed for the gender difference in depression, including biological differences, differences in biological stress reactivity, differences in interpersonal orientation, differences in rumination, differences in chronic negative or traumatic events, and poverty (American Psychiatric Association, 2000; Nolen-Hoeksema, 2002). One reason for the lack of gender difference in depression found in the present study may be the high level of poverty experienced by nearly all participants.

In a stepwise multiple regression analysis using the entire sample, the combination of four variables (education, perceptions of control, stressful life events, HbA1c) predicted 58% of the variance in depression, with education and perceptions of control remaining the strongest predictors. To date, this is the largest amount of variance predicted in depression using psychosocial and demographic predictor variables (Bailey, 1996; Fisher et al., 2001). Hierarchical regressions indicated that the two psychological

factors, perceptions of control and stressful life events, explained significantly more variance in depression then demographic variables (education and Hispanic ethnicity) alone.

Stressful Life Events and Depression

As expected by theory and previous research (Dolan et al., 1985; Kessler, 1997; Mazure, 1998), depression was significantly associated with the total number of stressful life events and negative stressful events in bivariate correlations. The results of the present study are similar to those obtained by Fisher et al. (2001) in samples of European American and Hispanic American type 2 diabetes patients. When controlling for demographic variables and disease status variables, Fisher et al. (2001) found that financial stress was a significant predictor of depression, as measured by the CES-D, in both Hispanic American and European American participants (both $p < .001$). However, this sample included participants of high and low socioeconomic status, and European Americans and Hispanic Americans differed by income, which was not controlled for in the final regression analyses. The present study represents an improvement in the Fisher et al. (2001) study because it measured a wide variety of stressful life events, instead of just financial stress. The results of the present study were also similar to a study of low-income obese African-American women who were at increased risk for developing type 2 diabetes (de Groot et al., 2003). The de Groot et al. (2003) study found that several indicators of poverty (lack of home ownership, low appraisal of one's recent economic situation, unemployment), low self-esteem, and stressful life events were associated with elevated depression as measured by the CES-D. Therefore, the relationship between stressful life events and depression that was found in the present study is similar to other

studies of diverse type 2 diabetes patients and obese patients at risk for type 2 diabetes (de Groot et al., 2003; Fisher et al., 2001).

Education and Depression

High school education is established early in life and is less susceptible than income to changes in health or mental health. Participants in the current study who reported less than high school education had more depression than participants with a high school education or with graduate or professional education. Thus, even within this low-income diverse sample, there were still differences observed in depression by level of education. Low education has been found to be a predictor of depression in diabetic (Fisher et al., 2001) and non-diabetic research participants (Lorant et al., 2003; Bailis et al., 2001).

Glycemic Control and Depression

Contrary to what was expected, depression was not associated with HbA1c in a bivariate correlation. In a stepwise multiple regression, good glycemic control predicted high levels depression while controlling for education, stressful life events, and perceptions of control. The finding that depression was not associated with HbA1c in a bivariate correlation was surprising given the meta-analytic review indicating that depression was associated with poor glycemic control with a small to moderate effect size (Lustman et al., 2000). Also, in a study that included participants that were similar to the current study participants, high depression was associated with poor glycemic control (Gross et al., 2005).

A number of reasons for this surprising finding were considered. One possibility was that there was not a relationship between HbA1c and depression in this population.

An examination of the individual studies included in the meta-analysis revealed that several studies (Bailey, 1996; Geringer, Perlmutter, Stern, & Nathan, 1986; Miyaoka, Miyaoka, Motomiya, Kitamura, & Asai, 1997; Padgett, 1993; Pibernik-Okanovic et al., 1993; Robinson, Fuller, & Edmeades, 1988) did not find a significant relationship between depression and HbA1c in type 2 diabetes patients. Another study conducted since the publication of the meta-analysis also did not find an association between HbA1c and depression (Fisher et al., 2001). The lack of relationship was frequently noted in studies that used self-report measures of depression, such as the CES-D and Beck Depression Inventory (Bailey 1996, Fisher et al., 2001; Lustman et al., 2000). In addition, recent research indicates that depression and HbA1c were correlated in type 1 diabetes patients, but not type 2 diabetes patients (Sacco & Bykowski, 2006).

As discussed previously, the lack of association between depression and blood glucose in correlation analysis may also be related to differences between the participants whose medical records contained an HbA1c measure and participants whose medical records were missing an HbA1c measure. On average, study participants reported a very high level of depression. In addition, participants who did not have HbA1c in their medical records reported higher levels of depression. Therefore, the exclusion of participants without a measure of glycemic control may have restricted the range of depression and decreased the correlation between depression and HbA1c.

Another reason for the lack of relationship found between depression and HbA1c may have been issues with the reliability or validity of the measures of depression and glycemic control. The CES-D was selected as a measure of depression because of its established reliability, validity, validated Spanish translation, and the low reading level of

the items. In the current study, the internal consistency of the CES-D was adequate, however, the results from the CES-D indicated a very high level of depression in the sample, which may have not been reflected if a structured clinical interview had been used to measure depression. As discussed previously, HbA1c was obtained from the participants' medical records and was not standardized for time that the measurement was obtained or the lab where the specimen was collected and processed.

Perceptions of Control

Perceptions of control did not significantly moderate the relationship between stress and depression or between education and depression. In the analysis evaluating whether perceptions of control moderated the relationship between education and depression, participants who reported higher than average control and at least a high school education reported the lowest level of depression. Contrary to predictions, participants who reported higher than average control and had less than a high school education had the highest level of depression. Participants who reported less than average control had similar levels of depression, independent of their level of education.

Perceptions of control was found to be a significant partial mediator of the relationship between education and depression. Thus, the association between a lack of education and a higher level of depression was partially explained by the low level of control perceived by participants. Similarly, previous research using a large Canadian sample found that perceptions of control mediated the relationship between socioeconomic status (as defined by work status, income, and education) and depression (Bailis et al., 2001). Data in the present study indicates that perceptions of control tended to increase as education increased. People with low levels of education may feel that

they have little control over the events in their lives as they may be limited in terms of access to services and goods, employment opportunities, positive social networks, and opportunities to pursue further education (Brown et al., 2004; Gallo & Matthews, 2003). This lack of control can lead to depression.

As mentioned previously, perceptions of control did not moderate the relationship between stressful life events and depression. The finding that perceptions of control partially mediated the relationship between stressful life events and depression is consistent with the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984; Wenzel, Glanz, & Lerman, 2002) and similar to results of a study conducted by Chou and Chi (2001) in Chinese elders and a study conducted by Deardorff, Gonzales, and Sandler (2003) in inner-city adolescents and children. Chou and Chi (2001) found that sense of control, as measured by self-efficacy in several areas, mediated the relationship between experiencing ten stressful life events over the past year and depression in Chinese elders. The study conducted by Deardorff, Gonzales, and Sandler (2003) found that generalized perceptions of control partially mediated the relationship between experiencing stressful events and depression in inner-city adolescents and children. The present study results indicating that perceptions of control partially mediated the relationship between stressful life events and depression is an improvement on the findings of Bailey (1996) who evaluated perceptions of control as a mediator of the relationship between chronic diabetes strains and depression in a highly educated sample of both type 1 and type 2 diabetes patients who were treated with insulin. The results of the Bailey (1996) study were difficult to interpret as only one multiple regression was used to evaluate whether four predictors (complications, regimen

demands, effect on daily life, general social support) of depression were mediated by two variables (self-esteem and perceptions of control). However, similar to the current study, when all the variables entered in the multiple regression analysis conducted for the Bailey (1996) study, perceptions of control remained a significant predictor of depression.

The results of this study and other research indicate that perceptions of control is an important mediating variable in the prediction of depression, particularly among low-income participants. There are a number of possible reasons for this finding. Hopelessness theory posits that people who are hopeless expect that "highly desired outcomes will not occur or that highly aversive outcomes will occur and that one cannot change the situation" (Abramson et al., 2002, p. 269). A high degree of hopelessness makes a person vulnerable to depression. People with low socioeconomic status may feel that they have little control over the events in their life, as they may be limited in terms of access to services and goods, employment opportunities, and opportunities to pursue further education (Gallo & Matthews, 2003). People with low socioeconomic status who have the least amount of education may have significantly fewer opportunities and choices, which reduces their perceptions of control. This trend was found in the data collected in the present study. Furthermore, people with low socioeconomic status who experience higher levels of stressful life events may perceive that they have fewer resources with which to cope with stress (Gallo & Matthews, 2003), which reduces their perceptions of control. This lack of perceived control can lead to depression, making perceptions of control the most proximal predictor of depression. A realistic lack of control over opportunities may be related to the experience of more stressful situations (e.g., missing a rent or a mortgage payment). In addition, people with lower incomes

may receive different treatment than people who have economic advantages, thus reinforcing their idea that they lack control over their lives. Thus, the experience of experiencing stressful events and having lower education diminishes people's sense of control, which partially accounts for increased depression.

Interventions

The results of this study indicate that low-income diabetes patients experience a high level of distress. Depression has been found to be a risk fact for morbidity and mortality, especially among patients with cardiovascular disease (Musselman, Evans, & Nemeroff, 1998; Wulsin, Vaillant, & Wells, 1999). In addition, people who are depressed may be less likely to comply with weight loss recommendations (Marcus, Wing, Guare, Blair, & Jawad, 1992), dietary recommendations (Ciechanowski, Katon, & Russo, 2000), and medical treatment (DiMatteo, Lepper, & Croghan, 2000). Depressed diabetes patients have more diabetic complications (de Groot et al., 2001), utilize more health care services, and incur more health care costs than non-depressed diabetes patients (Ciechanowski, Katon, & Russo, 2000; Egede, Zheng, & Simpson, 2002).

Combined with the results of other studies and psychological theory, this study suggests a number of ideas for interventions to reduce depression in low-income type 2 diabetes patients. In general, there is evidence that intensive intervention to treat depression in diabetes patients improves depression. The evidence is equivocal regarding whether psychological or psychiatric interventions for distress in diabetes patients are effective in improving glycemic control. Recent meta-analytic research of randomized control trials has found that psychological interventions, including counseling and various cognitive-behavioral techniques, have been effective in reducing distress and

improving glycemic control in diabetes patients (Ismail, Winkley, & Rabe-Hesketh, 2004; Lustman, Griffith, Freedland, Kissel, & Clouse, 1998). Two randomized controlled trials evaluating psychopharmacological treatments for depression in adults with diabetes have found that antidepressant treatment of depression leads to changes in HbA1c and depression (Lustman & Clouse, 2005; Lustman, Freedland, Griffith, & Clouse, 2000; Lustman et al., 1997). The first published study was a randomized double-blind, placebo-controlled trial that evaluated the effectiveness of eight weeks of treatment using the tricyclic antidepressant nortriptyline compared to a placebo for treating depression and controlling blood glucose (Lustman et al., 1997). Although treatment with nortriptyline was associated with increases in HbA1c, participants randomized to nortriptyline had lower BDI scores than control participants given a placebo. A randomized double-blind placebo-controlled trial evaluated the effectiveness of eight weeks of treatment using fluoxetine compared to a placebo for treating depression and controlling blood glucose for participants with either type 1 or type 2 diabetes (Lustman, Freedland, Griffith, & Clouse, 2000). Similar to the study of nortripyline, participants who were randomized to receive fluoxetine experienced significant decreases in depression symptoms. In addition, the mean HbA1c levels of participants treated with fluoxetine decreased after eight weeks, but the difference between the groups was not significantly significant (Lustman, Freedland, Griffith, & Clouse, 2000).

The majority of intervention research has been conducted using samples of diabetes patients with health insurance who may have better access to health and mental health care. The high level of depression in the present study sample indicates that these low income diabetes patients may not be receiving the psychological or psychiatric

services that they need. A recent review of research in low-income populations indicates that the poor are not provided adequate psychological care for mental health issues (Smith, 2005). Low-income diabetes patients frequently do not receive adequate diabetes care for many reasons (Bell et al., 2001; Brown et al., 2004). Psychological and public health interventions for depressed low-income type 2 diabetes patients should work to address barriers to receiving medical and mental health care and increase patients' perceptions of control, particularly for patients who have low levels of education and experience a high amount of stressful life events. Cognitive and behavioral therapy that focuses on challenging maladaptive thoughts and increasing performance accomplishments which may increase low-income participants' perceptions of control and lead to a reduction of depression (Bandura, 1986).

Strengths and Limitations

This study contributes to the literature by evaluating whether stress, depression, and glycemic control are related in a diverse low-income sample of diabetes patients. The study included both English- and Spanish-speaking patients from two different health care centers. One of the main strengths of the study is the population that was sampled—low income type 2 diabetes patients. This population is rarely studied because of the difficulty of collecting data from participants who often have educational and language barriers, as well as the high degree of transience associated with the study population. Another strength of the study was the collection of three different types of study data: mailed surveys, telephone interviews, and medical record. In addition, the study examined variables that mediate and moderate the relationship between stress and depression and between education and depression in type 2 diabetes patients, which has

never been reported in a low-income sample. The results of the analyses indicating that perceptions of control partially mediated the relationship between exposure to stressful events and between depression and education and depression are novel in the literature evaluating depression in diabetes patients and provide new information about the relationship between stress and depression as well as education and depression in low income type 2 diabetes patients.

There are a number of limitations to this study. The population sampled for the study was primarily urban patients receiving free health care at a community health center in Tampa, Florida. The participants were ethnically and racially diverse and reported a very low monthly income. People who were younger than 18 and older than 70, spoke languages other than English and Spanish, and had less than a 6^{th} grade education were excluded. Thus, the results of this study may not generalize to other populations and settings. The study used a cross-sectional design, which does not allow for prediction of future depression or glycemic control. In addition, the study used measures that were translated from English to Spanish, which may have not been equivalent, including one (City Stress Inventory) that was translated for the purpose of this study and not fully evaluated. One of the CSI scales (Exposure to Violence) did not demonstrate adequate internal consistency in either the Spanish or English versions and there were no psychometric data available for the Spanish translation of the Crisis in Family Systems—Revised. Also, a self-report measure of depression was used instead of a structured clinical interview, which limits the ability to report the prevalence or incidence of depression. The study relied on self-report of type 2 diabetes obtained from an informal interview. Type 2 diabetes status was confirmed in 120 (83%) participants

using medical record data. Thus, it is possible that a diagnosis of type 2 diabetes was inaccurate for the other 25 participants whose medical records were not available. As mentioned previously, glycemic control was only available for 71 participants, and participants who were missing a measure of glycemic control had higher depression, more stress, were younger, and were more likely to speak English. As a result, the number of participants included in bivariate correlations predicting glycemic control was low (71 instead of the 85 estimated for adequate power), and participants who were included appeared to differ from the participants whose glycemic control was missing. The limitations of the population and the lack of glycemic data may have restricted the range in study variables. Furthermore, the study did not include biological measures of stress hormones, like cortisol, or proinflammatory cytokines, such as IL-6, and glycemic control was not measured in a standardized way.

Suggestions for Future Research

The present study should be conducted in other populations to determine if study results generalize to other populations. Future research could improve on the findings of this study by measuring glycemic control in all participants at the time that study data are collected and processing HbA1c in one laboratory. In addition, future research should include biological measures of stress and proinflammatory cytokines. Having these standardized biological measurements would improve the study by providing information about the physiological process taking place in the body when participants experience chronic stress. Furthermore, a longitudinal study of this population is warranted to determine whether the experience of chronic stress over time is predictive of glycemic control. A number of other mediators and moderators of the relationship between

stressful life events and depression should be evaluated in low income populations, such as acculturation, barriers to health care, health literacy, health behaviors, coping, and different types of self-efficacy. Furthermore, other predictors of glycemic control should be evaluated, such as diet, exercise, and medication adherence. Lastly, interventions to improve glycemic control and reduce depression should be evaluated for effectiveness in low-income populations. Further research should investigate the variables that contribute to disparities in glycemic control in low-income participants, such as language barriers.

Conclusion

The study examined between the relationship between stress, depression, and glycemic control in low-income patients with type 2 diabetes. Contrary to what was expected, stressful life events and depression were not related to glycemic control in bivariate correlations. Hispanic ethnicity was found to be the strongest predictor of glycemic control, however, income and education appear to confound this relationship. Stressful life events, lack of formal education, and lack of perceived control predicted depression, and perceptions of control partially mediated the relationship between stressful life events and depression and between education and depression. These findings have important clinical implications for the mental health treatment of low-income diabetes patients with depression. It is important to identify low-income patients who have lower education and are experiencing a high level of stressful life events, as these patients may be at high risk for depression. Interventions for depressed low-income diabetes patients should focus on increasing perceptions of control and reducing stress. Future research should evaluate other factors related to glycemic control and depression in low-income type 2 diabetes patients.

Table 1

Characteristics of study participants

Characteristic	Number	Percentage
Gender (n = 145)		
Female	98	67.6
Male	47	32.4
Marital Status (n = 144)		
Currently married	74	51.4
Divorced	31	21.5
Single, never married	17	11.8
Separated	13	9.0
Widowed	8	5.6
Engaged	1	0.7
Race and Ethnicity (n = 143)		
Hispanic, Latina, or Latino	76	53.1
Caucasian or White	32	22.4
African-American or Black	29	20.3
Multi-racial	5	3.5
Native American	1	0.7
Employment (n = 143)		
Not employed	85	59.4
Employed	58	40.6

Table 1 (Continued)

Characteristics of study participants

Characteristic	Number	Percentage
Type of housing (n = 144)		
House	73	50.7
Apartment	47	32.6
Mobile home	20	13.9
Condominium	4	2.8
Home ownership (n = 138)		
Rents home	53	38.4
Owns home	51	37.0
Lives with family or friends	29	21.0
Other	5	3.6
Education (n = 143)		
Elementary school	7	4.9
Middle school	15	10.5
High school (grades 9 through 11)	19	13.3
High school graduate/GED	41	28.7
Technical or vocational school	16	11.2
One to three years of college	29	20.3
College graduate	10	7.0
Graduate or professional school	5	3.5
Other	1	0.7

Table 1 (Continued)

Characteristics of study participants

Characteristic	Number	Percentage
Language spoken at home (n = 145)		
English	67	46.2
Spanish	62	42.8
Both Spanish and English	15	10.3
Other	1	0.7
Diabetes treatment (n = 115)		
No diabetes medication treatment	9	7.8
Prescribed an oral agent only	74	64.3
Prescribed insulin only	14	12.2
Prescribed both insulin and oral agent	18	15.7

Table 2

Univariate characteristics of study variables

Study Variables	Range	Mean	Standard Deviation
CES-D depression score	0 – 54	22.22	12.41
Number of stressful events	0 – 25	7.80	4.81
Number of positive stressful events	0 – 11	1.10	1.75
Number of negative stressful events	0 – 24	4.87	4.73
Neighborhood disorder	11 – 35	14.63	4.51
Exposure to violence	7 – 15	7.60	1.36
Mastery	1 – 5	3.53	0.83
HbA1c	5.4 – 12.8	8.26	2.05

Table 3

Bivariate Correlations between Study Variables

Variable	CES-D	CRISIS-Total	CRISIS-Positive	CRISIS-Negative	CSI-EV	CSI-ND	Mastery
CES-D							
CRISIS-Total	.43***						
CRISIS-Positive	-.06	.07					
CRISIS-Negative	.44***	.88***	-.29**				
CSI—EV	.03	.20*	-.02	.14			
CSI—ND	.15	.33***	-.15	.32***	.50***		
Mastery	-.55***	-.21*	-.02	-.23**	-.02	-.07	
HbA1c	-.15	.02	-.04	.04	-.05	-.06	.04

* $p < .05$
** $p < .01$
*** $p < .001$

CES-D = Center for Epidemiologic Studies Depression Scale

CRISIS-Total = Number of stressors on Crisis in Family Systems—Revised

CRISIS-Positive = Positive stressors on Crisis in Family Systems—Revised

CRISIS-Negative = Negative stressors on Crisis in Family Systems—Revised

CSI-EV = City Stress Inventory—Exposure to Violence Scale

CSI-ND = City Stress Inventory—Neighborhood Disorder Scale

Mastery = Pearlin Mastery Scale

Table 4

Multiple regression analysis with mastery and stressful life events predicting depression

Predictor variable	β	T	*p*	Change in R^2
Step 1				.41
Stressful events	.32	4.88	<.001	
Mastery	-.49	-7.40	<.001	
Step 2				0
Mastery and stressful events interaction	-.01	-1.38	.89	

Step 2 regression: N = 144, Multiple R^2 = 0.41, F (3, 140) = 32.41, $p < .001$

Table 5

Stepwise multiple regression analysis with education, stressful life events, HbA1c, and mastery predicting depression

Predictor variable	β	T	*p*
Less than high school education	-.38	-4.64	<.001
Stressful events	.35	4.32	<.001
HbA1c	-.19	-2.33	.023
Mastery	-.38	-4.56	<.001

N = 71, Multiple R^2 = 0.58, F (4, 66) = 22.96, $p < .001$

Table 6

Hierarchical regression predicting depression with demographic and psychological variables

Predictor variable	β	t	*p*	Change in R^2
Step 1				.089
Less than high school education	-.24	-2.85	.005	
Ethnicity	.13	1.57	.120	
Step 2				.399
Less than high school education	-.19	-2.85	.005	
Ethnicity	.15	2.36	.020	
Stressful life events	.36	5.59	<.001	
Mastery	-.45	-6.93	<.001	

Step 1: N = 136, Multiple R^2 = 0.09, F (2, 133) = 6.47, p = .002

Step 2: N = 136, Multiple R^2 = 0.49, F (4, 131) = 31.23, p < .001

Table 7

Hierarchical regression predicting depression with demographic and psychological variables

Predictor variable	β	t	*p*	Change in R^2
Step 1				.001
Less than high school education	-.22	-2.57	.011	
Hispanic ethnicity	.16	1.85	.066	
Step 2				.385
Less than high school education	-.16	-2.40	.018	
Hispanic ethnicity	.17	2.58	.011	
Stressful life events	.35	5.55	<.001	
Mastery	-.45	-6.96	<.001	

Step 1: N = 144, Multiple $R^2 = 0.09$, F (2, 141) = 6.95, $p = .001$

Step 2: N = 144, Multiple $R^2 = 0.48$, F (4, 139) = 31.41, $p < .001$

Table 8

Multiple regression analysis with mastery, education, and the interaction between mastery and education predicting depression

Predictor variable	β	t	*p*	Change in R^2
Step 1				.33
Less than high school education	-.16	-2.35	.020	
Mastery	-.53	-7.53	.000	
Step 2				.02
Mastery and education interaction	-.70	-.1.87	.064	

Step 2: N = 145, Multiple $R^2 = 0.35$, $F(3, 141) = 25.25$, $p < .001$

Table 9

Multiple regression analysis with education and mastery predicting depression

Predictor variable	β	t	*p*
Less than high school education	-.16	-2.35	.02
Mastery	-.53	-7.53	<.001

N = 145, Multiple R^2 = 0.33, F (2, 142) = 35.51, $p < .001$

Table 10

Multiple regression analysis with stressful life events and mastery predicting depression

Predictor variable	β	t	*p*
Stressful life events	.32	4.88	<.001
Mastery	-.49	-7.40	<.001

N = 144, Multiple R^2 = 0.41, F (2, 141) = 48.95, $p < .001$

Figure 1. Proposed model evaluating depression as a mediator of the relationship between negative stressful events and HbA1c

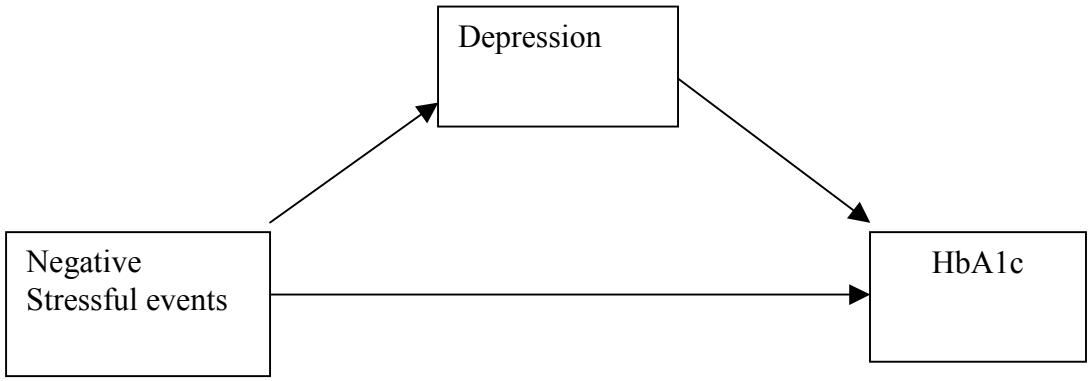


Figure 2. Proposed model evaluating the additive effect of negative stress and depression predicting HbA1c.

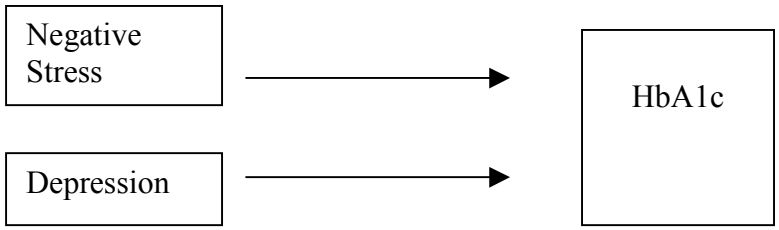
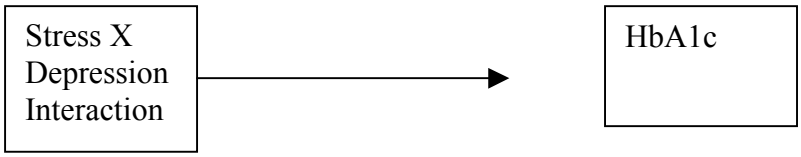


Figure 3. Proposed model of the interaction between stress and depression predicting HbA1c



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Footnote

[1]Since the CSI was translated into Spanish for the purposes of this study, a brief review of the psychometric properties of the Spanish CSI was conducted. Eighty participants completed the English version of the CSI (55%), and 65 participants completed the Spanish version. In the present study, the Spanish Neighborhood Disorder scale had the same level of internal consistency as the English Neighborhood Disorder scale ($\alpha = 0.81$). A review of the items comprising the Spanish Neighborhood Disorder scale indicated that two items may require revision. The item "Someone I knew was arrested or went to jail" had a low item-to-total correlation ($r = .01$), and the coefficient alpha of the scale could be improved to 0.83 if it was deleted. The item "How many houses or buildings in your neighborhood were vacant or unoccupied during the past four months" had a negative item-to-total correlation ($r = -.03$), and the coefficient alpha of the scale could be improved to 0.84 if the item was deleted. These items were retained in the calculation of the Neighborhood Disorder scale to maintain consistency with the English version of the scale.

In the present study, the Spanish Exposure to Violence scale had a higher level of internal consistency than the English Exposure to Violence scale ($\alpha = 0.63$ and $\alpha = 0.52$, respectively). A review of the items comprising the Spanish Exposure to Violence scale indicated that two items may require revision. The item "Someone threatened to hurt a member of my family" had a low item-to-total correlation ($r = .05$), and the coefficient alpha of the scale could be improved to 0.70 if the item was deleted. The item "A family

member was stabbed or shot" had a negative item-to-total correlation (r = -.01), and the coefficient alpha of the scale could be improved to 0.65 if the item was deleted. In the current study, these items were retained in the calculation of the Exposure to Violence scale to maintain consistency with the English version of the scale. Similar to the English form of the Neighborhood Disorder scale, the Spanish form of the Neighborhood Disorder scale was positively correlated with the Exposure to Violence scale (English: r = .38, p = .001; Spanish: r = .70, p < .001), negative stressful events (English: r = .24, p = .04; Spanish: r = .43, p < .001), and stressful events (English: r = .26, p = .02; Spanish: r = .44, p < .001). The Spanish form of the Exposure to Violence scale was positively correlated with the number of stressful events (r = .26, p = .037), which differed from the English form of the Exposure to Violence scale, which was not significantly correlated with the number of stressful events (r = .17, p = .13).

Appendices

Appendix A: English Data Collection Forms
Center for Epidemiologic Studies Depression Scale

Directions: Below is a list of ways you might have felt or behaved. Please tell me how often you have felt this way DURING THE PAST WEEK.

Please use the following scale:
Rarely or none of the time (Less than 1 day)
Some or a little of the time (1-2 days)
Occasionally or a moderate amount of time (3-4 days)
Most or all of the time (5-7 days)

	Rarely or none	**Some time**	**Occasionally**	**Most or all of the time**
During the past week:				
1. I was bothered by things that usually don't bother me.	**R**	**S**	**O**	**M**
2. I did not feel like eating; my appetite was poor.	**R**	**S**	**O**	**M**
3. I felt that I could not shake off the blues even with help from my family or friends.	**R**	**S**	**O**	**M**
4. I felt that I was just as good as other people.	**R**	**S**	**O**	**M**
5. I had trouble keeping my mind on what I was doing.	**R**	**S**	**O**	**M**
6. I felt depressed.	**R**	**S**	**O**	**M**
7. I felt that everything I did was an effort.	**R**	**S**	**O**	**M**
8. I felt hopeful about the future.	**R**	**S**	**O**	**M**
9. I thought my life had been a failure.	**R**	**S**	**O**	**M**
10. I felt fearful.	**R**	**S**	**O**	**M**

Appendix A (Continued): English Data Collection Forms
Center for Epidemiologic Studies Depression Scale

Directions: Below is a list of ways you might have felt or behaved. Please tell me how often you have felt this way DURING THE PAST WEEK.

Please use the following scale:

Rarely or none of the time (Less than 1 day)
Some or a little of the time (1-2 days)
Occasionally or a moderate amount of time (3-4 days)
Most or all of the time (5-7 days)

	Rarely or none	**Some time**	**Occasionally**	**Most or all of the time**
During the past week:				
11. My sleep was restless.	**R**	**S**	**O**	**M**
12. I was happy.	**R**	**S**	**O**	**M**
13. I talked less than usual.	**R**	**S**	**O**	**M**
14. I felt lonely.	**R**	**S**	**O**	**M**
15. People were unfriendly.	**R**	**S**	**O**	**M**
16. I enjoyed life.	**R**	**S**	**O**	**M**
17. I had crying spells.	**R**	**S**	**O**	**M**
18. I felt sad.	**R**	**S**	**O**	**M**
19. I felt that people dislike me.	**R**	**S**	**O**	**M**
20. I could not get "going."	**R**	**S**	**O**	**M**

Appendix A (Continued): English Data Collection Forms
City Stress Inventory

Directions

- Listed below are stressful things that other patients have experienced in their neighborhoods.
- We want to know about stress you have experienced in your neighborhood during the **PAST FOUR MONTHS**.
- By **NEIGHBORHOOD** we mean the streets, houses, or buildings close to your home.
- By **HOME**, we mean the house or apartment where you stay at night.
- Please tell us how often each event happened in your neighborhood by circling **ONE** answer.

IN THE PAST FOUR MONTHS….	**Never**	**Once**	**A Few Times**	**Often**
1. A family member was robbed or mugged.	Never	Once	A Few Times	Often
2. I heard neighbors complaining about crime in our neighborhood.	Never	Once	A Few Times	Often
3. A friend was robbed or mugged.	Never	Once	A Few Times	Often
4. I saw or heard about a "crack house" near my home.	Never	Once	A Few Times	Often
5. A family member was stabbed or shot.	Never	Once	A Few Times	Often
6. I saw strangers who were drunk or high hanging out near my home.	Never	Once	A Few Times	Often
7. A friend was stabbed or shot.	Never	Once	A Few Times	Often
8. There was a gang fight near my home.	Never	Once	A Few Times	Often
9. People in the neighborhood complained about being harassed by the police.	Never	Once	A Few Times	Often
10. I saw cars speeding or driving dangerously on my street.	Never	Once	A Few Times	Often

Appendix A (Continued): English Data Collection Forms
City Stress Inventory

Directions

- Listed below are stressful things that other patients have experienced in their neighborhoods.
- We want to know about stress you have experienced in your neighborhood during the **PAST FOUR MONTHS**.
- By **NEIGHBORHOOD** we mean the streets, houses, or buildings close to your home.
- By **HOME**, we mean the house or apartment where you stay at night.
- Please tell us how often each event happened in your neighborhood by circling **ONE** answer.

IN THE PAST FOUR MONTHS….	**Never**	**Once**	**A Few Times**	**Often**
11. I saw people dealing drugs near my home.	Never	Once	A Few Times	Often
12. A family member was attacked or beaten.	Never	Once	A Few Times	Often
13. A family member was stopped and questioned by the police.	Never	Once	A Few Times	Often
14. I heard adults arguing loudly on my street.	Never	Once	A Few Times	Often
15. Someone threatened to hurt a member of my family.	Never	Once	A Few Times	Often
16. Someone I knew was arrested or went to jail.	Never	Once	A Few Times	Often
17. Of the neighbors that *you know*, about how many received food stamps in the past four months?	None	Some	About half	Most
18. How many **HOUSES** or **BUILDINGS** in your neighborhood were **VACANT** or **UNOCCUPIED** during the past four months?	None	Some	About half	Most

Appendix A (Continued): English Data Collection Forms
Mastery Scale

Directions

Please circle the one response that describes how strongly you agree or disagree with these statements about yourself.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. There is really no way I can solve problems I have.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
2. Sometimes I feel that I am being pushed around in life.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
3. I have little control over the things that happen to me.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
4. I can do just about everything I set my mind to do.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
5. I often feel helpless in dealing with the problems of life.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
6. What happens to me in the future mostly depends on me.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
7. There is little I can do to change many of the important things in my life.	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree

Appendix A (Continued): English Data Collection Instruments
CRISYS - Crisis in Family Systems©

Now I would like to ask you about some things that may have happened to you or to friends or family in the last four months. So, think back to (date 4 months ago). I would like to know if any of the following events happened to you. Please answer yes or no to each event.

During the last four months (think back to *date*):

(1) **Have any of the following events happened to you?**
(INTERVIEWER: Circle appropriate response)

(2) **Overall, was ___(this event)_____ positive, negative or neutral (neither) for you?**
(INTERVIEWER: "Overall, was having your income increase by a lot positive, negative or neutral for you?" Circle appropriate response.
"Overall, was becoming pregnant positive, negative or neutral for you?" Circle the appropriate response.)

	Has this event happened to you?		Overall, was ___(this event) positive, negative or neutral for you?		
	No	Yes	Pos	Neg	Neutral (Neither)
1. Did your income increase by a lot?	0	1	+1	-1	0
2. Did you go deeply in debt?	0	1	+1	-1	0
3. Did your income decrease by a lot?	0	1	+1	-1	0
4. Did you go without food because you didn't have the money to pay for it?	0	1	+1	-1	0
5. Did you go without some clothing because you couldn't pay for it?	0	1	+1	-1	0

6. Did you miss a rent or mortgage payment because you couldn't pay for it?	0	1	+1	-1	0
7. Did the utility or phone company threaten to cut off your service because you couldn't pay the bills?	0	1	+1	-1	0
8. Was your telephone, electricity or gas turned off?	0	1	+1	-1	0
9. Did you go without furniture because you did not have the money to pay for it?	0	1	+1	-1	0
10. Did you go without appliances because you did not have the money to pay for them?	0	1	+1	-1	0
11. Did you lose your housing?	0	1	+1	-1	0
12. Did you miss an appointment or have to change your plans because you had no transportation to get there?	0	1	+1	-1	0
13. Did you have legal problems?	0	1	+1	-1	0
14. Did anyone in your family get arrested?	0	1	+1	-1	0
15. Did anyone in your family go to jail?	0	1	+1	-1	0
16. Did your children get into trouble? (answer "no" if participant has no children)	0	1	+1	-1	0
17. Did you have trouble reading or understanding something that was important to you?	0	1	+1	-1	0
18. Did you return to school? (if "no" the answer to question 19 is "no")	0	1	+1	-1	0
19. Did you have trouble with your teacher(s)?	0	1	+1	-1	0
20. Did your regular child care arrangements change in any way? (answer "no" if participant has no children)	0	1	+1	-1	0
21. Did you get married?	0	1	+1	-1	0

22. Did you get a divorce or break up with a partner?	0	1	+1	-1	0
23. Did you get back together with a partner?	0	1	+1	-1	0
24. Did a family member die?	0	1	+1	-1	0
25. Did a friend die?	0	1	+1	-1	0
26. Did anything happen in your neighborhood that made you feel unsafe?	0	1	+1	-1	0
27. Did you feel emotionally or physically abused?	0	1	+1	-1	0
28. Did your child(ren) feel emotionally or physically abused? (answer “no” if participant has no children)	0	1	+1	-1	0
29. Were you a victim of a crime while you were in your own home?	0	1	+1	-1	0
30. Were you a victim of a crime while you were outside or away from your home?	0	1	+1	-1	0
31. Did you hear violence outside your home? (e.g. gunfire)	0	1	+1	-1	0
32. Did you see violence?	0	1	+1	-1	0
33. Did your child(ren) see violence? (answer “no” if participant has no children)	0	1	+1	-1	0
34. Was your child a victim of a crime? (answer “no” if participant has no children)	0	1	+1	-1	0
35. Was anyone else in your household a victim of a crime?	0	1	+1	-1	0
36. Did you see drug dealing in your building or neighborhood?	0	1	+1	-1	0
37. Did you(r partner) get pregnant? (if answer is “no”, answer questions 38, 39, and 40 “no”)	0	1	+1	-1	0
38. Did you(r partner) have a baby?	0	1	+1	-1	0
39. Did you(r partner) have a miscarriage?	0	1	+1	-1	0

40. Did you(r partner) have an abortion?	0	1	+1	-1	0
41. Did you ever use alcohol or drugs to get through a day?	0	1	+1	-1	0
42. Did you become ill or did you have a flare up of a chronic illness?	0	1	+1	-1	0
43. Did your child(ren) become ill or did your child(ren) have a flare up of a chronic illness? (answer “no” if participant has no children)	0	1	+1	-1	0
44. Did you get admitted to the hospital?	0	1	+1	-1	0
45. Did your child(ren) get admitted to the hospital? (answer “no” if participant has no children)	0	1	+1	-1	0
46. Did another family member become ill?	0	1	+1	-1	0
47. Did a friend become ill?	0	1	+1	-1	0
48. Did a relative or friend move into your home?	0	1	+1	-1	0
49. Did a relative or friend move out of your home?	0	1	+1	-1	0
50. Did you move?	0	1	+1	-1	0
51. Did rats, mice or insects bother you in your home?	0	1	+1	-1	0
52. Did you have trouble with your landlord?	0	1	+1	-1	0
53. Did you have trouble with your neighbors?	0	1	+1	-1	0
54. Did you have trouble with social service agencies?	0	1	+1	-1	0
55. Did you have trouble with medical or health professionals?	0	1	+1	-1	0
56. Did someone treat you unfairly because of your age?	0	1	+1	-1	0
57. Did someone treat you unfairly because of your sex?	0	1	+1	-1	0
58. Did someone treat you unfairly because of your race?	0	1	+1	-1	0

59. Did someone treat you unfairly because you didn't have a lot of money?	0	1	+1	-1	0
60. Did you work in the last four months? **(already asked in initial interview, if answer is "no" then answer "no" to 61, 62, and 63)**	0	1			
61. Did you begin a new job or get promoted?	0	1	+1	-1	0
62. Did you get laid off?	0	1	+1	-1	0
63. Did you have trouble with superiors at work?	0	1	+1	-1	0
64. Did you look for a job?	0	1	+1	-1	0

Appendix B: Spanish Data Collection Forms
Center for Epidemiologic Studies Depression Scale

Las siguientes frases indican distintas maneras de sentirse. Por favor indique la frecuencia con que usted se ha sentido de estas maneras en la semana pasada. Las respuestas posibles son:

1 = raramente o nunca (menos de un día)
2 = alguna o pocas veces (1-2 días)
3 = ocasionalmente o una cantidad moderada (3-4 días)
4 = la mayor parte o todo el tiempo (5-7 días)

DURANTE LA SEMANA PASADA……	**Raramente o nunca**	**Alguna**	**Ocasionalmente**	**La mayor parte**
1. Me molestaron cosas que usualmente no me molestan	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
2. No me sentía con ganas de comer - tenía mal apetito.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
3. Me sentía que no podia quitarme de encima la tristeza aun con la ayuda de mi familia o amigos.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
4. Sentía que yo era tan buena(o) como cualquier persona.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
5. Tenía dificultad en mantener mi mente en lo que estaba haciendo.	Raramente o nunca	Alguna	Ocasionalmente	La mayor o parte
6. Me sentía deprimida/deprimido	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
7. Sentía que todo lo que hacia era un esfuerzo.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
8. Me sentía optimista sobre el futuro.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
9. Pensé que mi vida había sido un fracaso.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
10. Me sentía con miedo.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte

Appendix B (Continued): Spanish Data Collection Forms
Center for Epidemiologic Studies Depression Scale

Las siguientes frases indican distintas maneras de sentirse. Por favor indique la frecuencia con que usted se ha sentido de estas maneras en la semana pasada. Las respuestas posibles son:

1 = raramente o nunca (menos de un día)
2 = alguna o pocas veces (1-2 días)
3 = ocasionalmente o una cantidad moderada (3-4 días)
4 = la mayor parte o todo el tiempo (5-7 días)

DURANTE LA SEMANA PASADA……	**Raramente o nunca**	**Alguna**	**Ocasionalmente**	**La mayor parte**
11. Mi sueño era inquieto.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
12. Estaba contenta/contento.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
13. Hablé menos de lo usual.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
14. Me sentí sola/solo.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
15. La gente no era amistosa.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
16. Disfruté de la vida.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
17. Pasé ratos llorando.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
18. Me sentí triste.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
19. Sentía que no le caía bien a la gente.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte
20. No tenía ganas de hacer nada.	Raramente o nunca	Alguna	Ocasionalmente	La mayor parte

Appendix B (Continued): Spanish Data Collection Forms
City Stress Inventory

Instrucciones

- La lista siguiente contiene situaciones estresantes que han experimentado otros pacientes en sus barrios o vecindades.
- Queremos saber si usted ha experimentado estrés en su vecindad en los ÚLTIMOS CUATRO MESES.
- El término BARRIO o VECINDAD se refiere a las calles, casas o edificios que quedan cerca de su casa.
- El término CASA se refiere a la casa o apartamento donde usted pasa la noche.
- Por favor indique la frecuencia con que cada acontecimiento ha ocurrido en su barrio. Encierre en un círculo UNA SOLA respuesta.

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	Nunca	**Una vez**	**Algunas veces**	**Varias veces**
EN LOS ÚLTIMOS CUATRO MESES….				
1. Robaron o atracaron a un familiar.	Nunca	Una vez	Algunas veces	Varias veces
2. Escuché a unos vecinos quejarse de la inseguridad en nuestra vecindad.	Nunca	Una vez	Algunas veces	Varias veces
3. Robaron o atracaron a un amigo. veces	Nunca	Una vez	Algunas veces	Varias veces
4. Vi u oí algo sobre un "crack house" (lugar donde venden cocaína "crack") cerca a mi casa.	Nunca	Una vez	Algunas veces	Varias veces
5. Alguien apuñaló o disparó contra algún familiar suyo.	Nunca	Una vez	Algunas veces	Varias veces
6. Ví a desconocidos o borrachos vagando cerca de mi casa.	Nunca	Una vez	Algunas veces	Varias veces
7. Alguien apuñaló o disparó contra un amigo.	Nunca	Una vez	Algunas veces	Varias veces
8. Hubo una pelea entre pandillas cerca a mi casa.	Nunca	Una vez	Algunas veces	Varias veces
9. La gente de la vecindad se quejó del acoso policial.	Nunca	Una vez	Algunas veces	Varias veces
10. En mi calle vi automóviles que se desplazaban a alta velocidad o de manera peligrosa.	Nunca	Una vez	Algunas veces	Varias veces

Appendix B (Continued): Spanish Data Collection Forms
City Stress Inventory

Instrucciones

- La lista siguiente contiene situaciones estresantes que han experimentado otros pacientes en sus barrios o vecindades.
- Queremos saber si usted ha experimentado estrés en su vecindad en los ÚLTIMOS CUATRO MESES.
- El término BARRIO o VECINDAD se refiere a las calles, casas o edificios que quedan cerca de su casa.
- El término CASA se refiere a la casa o apartamento donde usted pasa la noche.
- Por favor indique la frecuencia con que cada acontecimiento ha ocurrido en su barrio. Encierre en un círculo UNA SOLA respuesta.

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	Nunca	**Una vez**	**Algunas veces**	**Varias veces**
EN LOS ÚLTIMOS CUATRO MESES….				
11. Vi a gente traficar drogas cerca de mi casa.	Nunca	Una vez	Algunas veces	Varias veces
12. Alguien asaltó o golpeó a un familiar suyo.	Nunca	Una vez	Algunas veces	Varias veces
13. Un familiar fue detenido e interrogado por la policía.	Nunca	Una vez	Algunas veces	Varias veces
14. Escuché a personas adultas discutir en voz alta en mi calle.	Nunca	Una vez	Algunas veces	Varias veces
15. Alguien amenazó a un familiar.	Nunca	Una vez	Algunas veces	Varias veces
16. Un conocido mío fue arrestado o encarcelado.	Nunca	Una vez	Algunas veces	Varias veces
17. De todos los vecinos que usted conoce, ¿cuántos han recibidos estampillas de comida durante los últimos cuatro meses?	Ningunos	Algunos	Cerca de la mitad	La mayoría
18. ¿Cuántas CASAS o EDIFICIOS de su vecindad han estado VACÍOS o DESOCUPADOS durante los últimos cuatro meses.	Ningunos	Algunos	Cerca de la mitad	La mayoría

Appendix B: Spanish Data Collection Forms
Mastery Scale

Instrucciones
Por favor haga un circulo alrededor la respuesta que describa lo que piensa (esta muy de acuerdo o no estas muy de acuerdo) sobre usted mismo/a.

	(1) Estoy totalmente de acuerdo	**(2) Estoy de acuerdo**	**(3) Estoy neutral**	**(4) Estoy desacuerdo**	**(5) Estoy totalemente en desacuerdo**
1. En realidad no hay ninguna manera en que yo pueda solucionar algunos de los problemas que tengo.	1	2	3	4	5
2. Algunas veces me siento que estoy siendo empujado(a) por la vida.	1	2	3	4	5
3. Yo tengo muy poco control sobre las cosas que me pasan.	1	2	3	4	5
4. Yo puedo hacer cualquier cosa si en verdad me lo propongo.	1	2	3	4	5
5. Con frecuencia me siento inútil para confronter los problemas de la vida.	1	2	3	4	5
6. Lo que me pase en el futuro depende en su mayor parte de mí.	1	2	3	4	5
7. Hay muy poco que yo pueda hacer para cambiar muchas de las cosas importantes de mi vida.	1	2	3	4	5

Appendix B (Continued): Spanish Data Collection Forms
CRISIS - Crisis en el Sistema Familiar©

Ahora quisiera preguntarle sobre algunas situaciónes que habría encontrado a usted o sus amigos or su familia durante losúltimos cuatro meses. Piense atrás a (fecha hace cuatro meses). Quisiera saber si encontró usted algunas de las situaciónes siguientes. Por favor, responde sí o no a cada situación.

Durante los últimos cuatro meses (piense atrás a *esa fecha*):

(1) **¿Se ha encontrado en alguna de estas situaciones?**
(ENTREVISTADOR: Encierre en un círculo las respuestas adecuadas)
(2) **En general, ¿fue eso positivo, negativo o indiferente para usted?**
(ENTREVISTADOR: Encierre en un círculo la respuesta adecuada)

	¿Se ha encontrado en esta situación?		**En general, ¿fue eso positivo, negativo o indiferente para usted?**		
	No	**Sí**	**Pos**	**Neg**	Indiferente
1. ¿Aumentaron considerablemente sus ingresos?	0	1	+1	-1	0
2. ¿Se endeudó mucho?	0	1	+1	-1	0
3. ¿Disminuyeron considerablemente sus ingresos?	0	1	+1	-1	0
4. ¿Tuvo que pasar sin comer porque no tenía dinero para comprar alimentos?	0	1	+1	-1	0
5. ¿Tuvo que privarse o pasar sin comprar ropa porque no tenía dinero para pagarla?	0	1	+1	-1	0
6. ¿No hizo un pago de alquiler o de hipoteca por falta de dinero?	0	1	+1	-1	0

7. ¿Lo amenazó la compañía de servicios públicos o de teléfonos con suspenderle el servicio porque usted no podía pagar las cuentas?	0	1	+1	-1	0
8. ¿Le cortaron su servicio de teléfono, electricidad o gas?	0	1	+1	-1	0
9. ¿No pudo comprar muebles porque no le alcanzaba el dinero?	0	1	+1	-1	0
10. ¿No pudo comprar electrodomésticos porque no le alcanzaba el dinero?	0	1	+1	-1	0
11. ¿Perdió su vivienda?	0	1	+1	-1	0
12. ¿Faltó a una cita o tuvo que cambiar de planes porque no tenía medios de transporte?	0	1	+1	-1	0
13. ¿Tuvo problemas legales?	0	1	+1	-1	0
14. ¿Arrestaron a alguna persona de su familia?	0	1	+1	-1	0
15. **¿** Estuvo en la cárcel alguna persona de su familia?	0	1	+1	-1	0
16. ¿Se metieron sus hijos en problemas? (answer “no” if participant has no children)	0	1	+1	-1	0
17. ¿Tuvo problemas para leer o comprender algo que era importante para usted?	0	1	+1	-1	0
18. **¿**Volvió a estudiar? (if “no” the answer to question 19 is “no”)	0	1	+1	-1	0
19. ¿Tuvo problemas con su(s) maestro(s) o profesor(es)?	0	1	+1	-1	0
20. ¿Cambiaron de alguna manera los arreglos que había hecho para el cuidado de sus hijos? (answer “no” if participant has no children)	0	1	+1	-1	0
21. ¿Se casó?	0	1	+1	-1	0
22. ¿Se divorció o rompió con su pareja?	0	1	+1	-1	0
23. ¿Se reconcilió con su pareja?	0	1	+1	-1	0
24. ¿Falleció algún miembro de la familia?	0	1	+1	-1	0

25. ¿Falleció alguno de sus amigos?	0	1	+1	-1	0
26. ¿Sucedió algo en su vecindario que le dio inseguridad o sentido de riesgo o peligro?	0	1	+1	-1	0
27. ¿Se sintió maltratado/a en forma emocional o física?	0	1	+1	-1	0
28. ¿Se sintieron sus hijos maltratados en forma emocional o física? ? (answer “no” if participant has no children)	0	1	+1	-1	0
29. ¿Fue usted víctima de algún delito o acto de violencia dentro de su hogar?	0	1	+1	-1	0
30. ¿Fue usted víctima de algún delito o acto de violencia afuera o lejos de su casa?	0	1	+1	-1	0
31. ¿Escuchó actos de violencia afuera de su hogar? (por ejemplo, disparos)	0	1	+1	-1	0
32. ¿Vio algún acto de violencia?	0	1	+1	-1	0
33. ¿Vieron sus hijos algún acto de violencia? ? (answer “no” if participant has no children)	0	1	+1	-1	0
34. ¿Fue alguno de sus hijos víctima de un delito o acto de violencia? (answer “no” if participant has no children)	0	1	+1	-1	0
35. ¿Fue alguna otra persona en su hogar víctima de un delito o acto de violencia?	0	1	+1	-1	0
36. ¿Vio tráfico de drogas en su edificio o vecindario?	0	1	+1	-1	0
37. ¿Quedó embarazada usted o su pareja? (if answer is “no”, answer questions 38, 39, and 40 “no”)	0	1	+1	-1	0
38. ¿Tuvo usted o su pareja un bebé?	0	1	+1	-1	0
39. ¿Tuvo usted un aborto **no provocado** (su pareja)?	0	1	+1	-1	0
40. ¿Tuvo usted un aborto **provocado** (su pareja)?	0	1	+1	-1	0
41. ¿Alguna vez usó drogas o bebidas alcohólicas para poder pasar un día?	0	1	+1	-1	0

42. ¿Se enfermó o volvió a tener síntomas de una enfermedad crónica?	0	1	+1	-1	0
43. ¿Se enfermaron sus hijos o volvieron a tener síntomas de una enfermedad crónica? (answer "no" if participant has no children)	0	1	+1	-1	0
44. ¿Estuvo hospitalizado?	0	1	+1	-1	0
45. ¿Estuvo hospitalizado alguno de sus hijos? (answer "no" if participant has no children)	0	1	+1	-1	0
46. ¿Se enfermó algún otro miembro de la familia?	0	1	+1	-1	0
47. ¿Se enfermó alguno de sus amigos?	0	1	+1	-1	0
48. ¿Se mudó con usted alguno de sus familiares o amigos?	0	1	+1	-1	0
49. ¿Se mudó de su casa algún familiar o amigo que vivía con usted?	0	1	+1	-1	0
50. ¿Se mudó usted?	0	1	+1	-1	0
51. ¿Tuvo problemas con ratas, ratones o insectos en su casa?	0	1	+1	-1	0
52. ¿Tuvo algún problema con el dueño de su casa?	0	1	+1	-1	0
53. ¿Tuvo problemas con sus vecinos?	0	1	+1	-1	0
54. ¿Tuvo problemas con agencias de servicio social?	0	1	+1	-1	0
55. ¿Tuvo problemas con médicos u otros profesionales de la salud?	0	1	+1	-1	0
56. ¿Lo trató alguien injustamente alguna vez debido a su edad?	0	1	+1	-1	0
57. ¿Lo trató alguien injustamente alguna vez debido a su sexo?	0	1	+1	-1	0
58. ¿Lo trató alguien injustamente alguna vez debido a su raza?	0	1	+1	-1	0
59. ¿Lo trató alguien injustamente alguna vez porque no tenía mucho dinero?	0	1	+1	-1	0

60. ¿Trabajó usted en los últimos seis meses? **(already asked in initial interview, if answer is "no" then answer "no" to 61, 62, and 63)**	0	1			
61. ¿Comenzó a trabajar en un nuevo empleo o lo ascendieron?	0	1	+1	-1	0
62. ¿Lo despidieron por falta de trabajo?	0	1	+1	-1	0
63. ¿Tuvo problemas con sus superiores en el trabajo?	0	1	+1	-1	0
64. ¿Estuvo buscando trabajo?	0	1	+1	-1	0

About the Author

Kristen Wells received a Bachelor's Degree in Psychology from Appalachian State University in 1995 and a Master's Degree in Public Health from Emory University in 2000. Ms. Wells conducted health services and health policy research at Emory University while pursuing her master's degree. She continued conducting health behavior research while pursuing the doctoral degree at the University of South Florida with a focus on psychosocial factors affecting chronic diseases.

While completing the Ph.D. program at the University of South Florida, Ms. Wells served as a graduate student teaching assistant for Research Methods and Psychological Sciences I. Ms. Wells was also employed at Moffitt Cancer Center and completed a clinical internship at the University of Florida.

Ms. Wells has authored nine publications and has made eight presentations at national conferences. She has served as a reviewer for *Health Education Research* and *Social Science & Medicine.*