EXAMINING PSYCHOLOGICAL AND PHYSICAL HEALTH INDICATORS OF INDIVIDUALS DIAGNOSED WITH DIABETES

A Dissertation

by

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ABSTRACT

The purpose of this study was to describe a sample of rural residing individuals diagnosed with diabetes as well as to examine the psychological and physical health indicators associated with their diabetes diagnosis. In addition, the potential moderating role of social statuses on the relationships between diabetes and mental and physical health indicators was investigated. Health indicators examined were: individuals' self-reported or subjective health, depressive symptoms, anxiety symptoms, and body mass index (BMI). Data were drawn from a larger health assessment project spanning nine counties in rural central Texas. Descriptive statistics of the sample demonstrate that diabetics tended to be older, poorer, more overweight, and experiencing more depression and anxiety symptoms. A logistic regression model was conducted to examine whether depressive symptoms, anxiety symptoms, and BMI predict diabetic status. Results indicate poor predictive power of the logistic regression model tested. However, marital and caregiver statuses appear to be protective factors in the relationships between diabetes and depression, anxiety symptom endorsement. Results also indicate that Black diabetics have higher BMI scores while females have lower BMI scores.

DEDICATION

This is dedicated to my dad for inspiring the topic and leaving behind a legacy; my mother for believing in me, pushing me, and supporting me through this journey; my brother for unconditional acceptance; and my niece and godson for whom I hope to have laid a foundation of inquiry and excellence. Lastly, I dedicate my work to my ancestors who fought and sacrificed that I might have this opportunity, and to all of the Black lives lost in the struggle for freedom.

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CHAPTER I

INTRODUCTION

According to the Centers for Disease Control (CDC), 29.1 million people, or 9.3% of the U.S. population had diabetes mellitus (hereafter referred to as diabetes) in 2012 (NCCDPHP, 2014). Almost 30% of those living with diabetes are undiagnosed (NCCDPHP, 2014). It is one of the top ten causes of death for individuals as young as 15 years, and moved up to the fifth leading cause of death in the U.S. for individuals age 55-64 in 2010 (NCCDPHP, 2014). In the United States, the diabetes “epidemic” accounts for “$174 billion” in treatment costs (Sanders, 2012, p. 12), “over 3 million hospital stays,” (Quiñones, Liang, and Ye, 2013, p. 310) and “more than 300,000 deaths” annually (Brancati, Kao, Folsom, Watson, & Szklo, 2000, p. 2253). Diabetes also ranks in the top ten global causes of death accounting for 1.26 million deaths in the world (Department of Health and Human Services, 2013). By the year 2025, an estimated 300 million individuals worldwide will be diagnosed with diabetes (CDC, 2011; King, Aubert, & Herman, 1998; Ma et al., 2012). If the current pace is maintained, 1 in 3 adults will be diagnosed with type 2 diabetes by the year 2050 (Quiñones, Liang, & Ye, 2013; Sanders, 2012). Diabetes’ impact is clearly widespread making it a timely and relevant issue to explore further, particularly with underrepresented and diverse populations.

Definitions

Health disparities will be defined as “differences in health profiles across major subgroups of the population, including a broad spectrum of physical and mental health indicators, from self-reported health to mortality, from psychological well-being to major mental disorders" (Schnittker & McLeod, 2005, p. 75). Furthermore, these differing health indicators "are closely linked with social, economic, and environmental disadvantage...often driven by the social conditions in which individuals live, learn, work and play" (Department of Health and Human Services, 2011, p.1). Despite medical and technological advances, health disparities continue to exist in the U.S. particularly along racial and ethnic lines. These disparities are well-documented and longstanding (Brondolo, Gallo, & Myers, 2009). They cost the nation not only in mortality or lives, but also literal monetary costs upwards of billions of dollars (DHHS, 2011). Still, it is important to note that any characteristic "historically linked to exclusion or discrimination" can and does affect health status. These social determinants include: geographic location, mental health, and even age. They can contribute to the enhancement of health as well as its detraction. The current study seeks to advance the goal of health equity across populations by providing the basis for the development of evidence-based interventions and increased access, based on data collected with a vulnerable population defined by geography, among other important characteristics.

Diabetes can be referred to as a lifestyle illness, which means it is a disease that develops and progresses as a result of the cumulative effects of multiple risk factors drawn out over time that relate to how an individual lives their life ("lifestyle disease", n.d.). These may include: diet, exercise, weight, and alcohol or substance use for example. These risk factors act upon an individual both independently and synergistically and result in numerous psychological and physical consequences.

The 2014 National Diabetes Statistics Report provides a more technical, biological definition: “Diabetes is a group of diseases marked by high level of blood glucose (hemoglobin A1C) resulting from problems in how insulin is produced, how insulin works, or both. People with diabetes may develop serious complications such as heart disease, stroke, kidney failure, blindness, and premature death” (CDC, 2014a, p.7). There are multiple types of diabetes but the three most common are: type 1, type 2, and gestational. Gestational diabetes develops in women during pregnancy. No data was collected on individuals with this diagnosis and as such, it will not be included in this review.

Type 1 diabetes, which diagnostically peaks during adolescence, may also be referred to as juvenile-onset diabetes or insulin-dependent diabetes (CDC, 2014a). Type 1 diabetes refers to a form of the disease in which an individual’s beta cells (located in the pancreas), responsible for producing the hormone insulin, are destroyed resulting in an inability to produce any or sufficient amounts of insulin needed to lower blood glucose levels (CDC, 2014a). Individuals with type 1 diabetes accommodate their condition through external administration of insulin usually via pump or injection, and this form of diabetes accounts for approximately 5% of all diagnosed cases (CDC, 2014a).

Type 2 diabetes may be referred to as non-insulin-dependent or adult-onset diabetes due to its later peak diagnosis period (CDC, 2014a). Type 2 diabetes typically begins with insulin resistance disorder wherein muscle, liver, and fat tissue cells misuse insulin, which results over time in the inability of the beta cells to produce necessary amounts of insulin; the need for the hormone insulin exceeds the supply (CDC, 2014a). Type 2 diabetes accounts for approximately 90-95% of diagnosed cases and individuals vary in their profiles with regard to the role of insulin resistance and beta cell dysfunction (CDC, 2014a).

The data collected in the current study identified individuals who have received a diagnosis of diabetes that excludes gestational diabetes, but does not distinguish between type 1 and type 2. Therefore, conclusions drawn from the results will extend the body of knowledge concerning patterns and consequences that accompany both. Finally, prediabetes describes a condition in which an individual's blood glucose levels are elevated but do not reach a clinical threshold to warrant a diagnosis of diabetes (CDC, 2014a; NCCDPHP, 2014). Prediabetic persons do have an increased risk for developing diabetes but lifestyle interventions involving diet, exercise, and weight loss have been shown to prevent or delay type 2 diabetes in studies with national and international samples (CDC, 2014a; NCCDPHP, 2014).

The rural context from which the participants in the current study were drawn warrants additional examination here. Approximately 20% of the U.S. population lives in rural areas (Health Resources and Services Administration, 2005 as cited in McCord, Elliott, Brossart & Castillo, 2013). Individuals living in rural areas are more likely to live in an underserved area and to enter healthcare systems later with symptoms of greater severity that require more rigorous treatment (Brossart et al., 2013; Smalley & Warren, 2014). In 2013 the National Center for Health Statistics (NCHS) updated their urban-rural classification scheme, expanding the urbanization scheme to a total of six metropolitan and nonmetropolitan categories (Ingram & Franco, 2013). The biggest change from previous schemes was the subdivision of the largest metropolitan areas into fringe and core counties. In practice, the NCHS found that self-reported health status typically worsened as one radiated out to more rural (nonmetropolitan) areas, and the likelihood of one being under-/uninsured increased (Ingram & Franco, 2013). However, there are numerous definitions of "rural" and no one definition is agreed upon in the literature. Moreover, what characterizes "rural" is further complicated by regional distinctions and whether an area is considered "metro" or "nonmetro" which deals with underlying economic factors. Often population density or geographic isolation are key defining criteria for the designation of "rural" (Brossart et al., 2013; Ingram & Franco, 2014).

This study will use the rural classification used by Brossart and colleagues (2013). This classification uses the Urban Influence Codes (UICs) and the Rural-Urban Continuum Codes (RUCCs) in tandem as developed by the U.S. Department of Agriculture's Economic Research Service (2003). RUCCs take into account the aggregate population at the county level, whereas the UICs concentrate on the population of the largest town/city in a county (Farley et al., 2002 as cited in Brossart et al., 2013). For the present study, as in theirs, "this dichotomous classification was used because it is the only system that assigns codes at the county level." Furthermore, separately, both RUCCs and UICs are calculated at the census level but the sample size for this study was too small for that level of analysis. In an effort to be as accurate as possible, the updated classification derived from the system used by Brossart and colleagues (2013) was utilized for the current study; the methodology for its basis was taken from 2010 Census data and the 2006-2010 American Community Survey (ACS). “To create the 2013 Rural-Urban Continuum Codes, all U.S. counties and county equivalents were first grouped according to their official metro-nonmetro status”, defined by the Office of Management and Budget (OMB) as of February, 2013. The 2013 Rural-Urban Continuum Codes form a classification scheme that distinguishes “metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and adjacency to a metro area,” (U.S. Department of Agriculture’s Economic Research Service, 2013). Based on these definitions, the current study used data collected in one micropolitan, (mini metropolitan), and six rural counties. Four of these rural counties are nonmetro and three are metro. Based on the 2013 NCHS urbanization classification scheme, none of the Brazos Valley counties are considered metropolitan. Within this system, the sole “micropolitan” represents a small, densely populated area that is still isolated and nonmetropolitan (Ingram & Franco, 2014).

Seven counties comprise the Brazos Valley in south central Texas and each of these counties comprises “a health professional shortage area” (Health Resources and Services Administration [HRSA], 2014). The designation of a health professional shortage area indicates that the area being described lacks sufficient healthcare providers to service the population’s mental and physical health needs. In addition to specific provider to population ratios, the U.S. Department of Health and Human Services states, “Mental health professionals [or] primary medical professionals in contiguous areas are overutilized, excessively distant or inaccessible to residents of the area under consideration," (HRSA, 2014). Limited availability of services is just one example of the health disparities faced by individuals living in rural areas. Other examples include: low income, lack of insurance, high unemployment, lack of transportation, and geographic isolation, which affect access and affordability. Bird, Dempsey, and Hartley (2001) reported that more than 85% of mental health professional shortage areas exist in rural areas. Texas has one of the largest rural-residing populations in the U.S. and therefore its population is adversely impacted by the health disparities described.

Differential race/ethnic issues in rural areas

There is significant data to suggest that the health disparities faced by rural-residing residents are compounded for individuals who are members of racial/ethnic minority groups; this is in comparison to their White counterparts as well as their urban counterparts (Probst, Moore, Glover, & Samuels, 2004). Williams et al. (2007) presented data that suggest depression among African Americans in rural, underserved areas may be persistent and virulent. Importantly, additional research indicates a decreased likelihood that African Americans will report their depressive symptoms to a healthcare professional in comparison to their White counterparts (Probst, Laditka, Moore, Harun, and Powell, 2007). Women residing in rural areas have been shown to experience a greater risk for depression and abuse due partially to social isolation and limited employment options which means that racial/ethnic minority women often have the worst outcomes of all (Annan, 2006; Hauenstein & Peddada, 2007; McCord, et al., 2012).

In addition to this, African Americans and those of Hispanic/Latino background face additional barriers related to discrimination (actual or perceived), acculturative stress, and stigma related to cultural beliefs (Brown, Brody, & Stoneman, 2000; Castillo & Caver, 2009; Kogan, Brody, Crawley, Logan, & Murray, 2007; Probst, Moore, Glover, & Samuels, 2004; Torres & Ong, 2010). Some of these contribute to worsening depressive symptoms. The added barriers associated with rural residence exacerbate health disparities that racial/ethnic minorities already face such as overdiagnosis, misdiagnosis, and poorer treatment outcomes overall (Ridley, 2005). Furthermore, racial/ethnic minorities are less likely to obtain needed mental health services and are generally less well understood because they are underrepresented in mental health research (Office of Minority Health and Health Disparities, 2007). Any factor that sets an individual apart (e.g. age, sex) affects availability, access, service delivery, and outcomes; these are more acute in rural areas (McCord, et al. 2012).

Just as mental and physical health disparities in rural communities are exacerbated by the lack of providers and services, so too are the health disparities worsened for those who identify with racial/ethnic minority backgrounds who must overcome barriers associated with discrimination, poverty, and limited occupational options (Warren, 1994). Moreover, although racial/ethnic minorities and new immigrants comprise only 15% of the rural population, they make up 30% of the U.S. rural poor population (Health Resources and Services Administration, 2014). Demographic characteristics such as age or sex further increase the disparities and barriers to access faced by all rural-residing individuals. For example, the older adult population that tends to predominate rural populations struggle with higher rates of depression, less social support, and a tendency toward chronic disease (Brossart et al., 2013; CCHD, 2013). Individuals over the age of 65 represent approximately 25% of total residents in each of the rural counties included in the current study. As it relates to diabetes in particular, despite differences in diabetes incidence related to racial/ethnic differences or age, “greater variability can be attributed to lifestyle factors” (Ma et al., 2012, p. 2226).

Purpose

The purpose of the current research is to explore and better understand the relationships among physical and psychological health indicators in rural-residing individuals diagnosed with diabetes. The selected health indicators include: the presence of depressive symptoms as indicated by endorsement on the Patient Health Questionnaire 2 (PHQ-2); the presence of anxious symptoms as indicated by endorsement on the Generalized Anxiety Disorder 7-item scale (GAD-7); calculated body mass index (BMI) and individuals’ self-reported, subjective health. The potential moderating role of social support in the form of marital and caregiver statuses will be examined. Between-group comparisons by gender and race (African American, Hispanic/Latino, and White) will be explored to further refine results.

Given that African Americans and Hispanics bear a well-documented disproportionate disease burden (impact of a health concern as measured in terms of financial, mortality, and disability costs and often quantified by years of life lost see “Global burden of disease”, n.d.) (Brossart et al., 2013; McCord et al., 2012; Skelly et al., 2006), between-group comparisons will be conducted to display this rural population's congruence with national trends. Although diabetes has been studied and compared along racial/ethnic lines, typically non-dominant cultures have been studied within an urban context, and limited quantitative data exists on individuals of these backgrounds in rural contexts (Pieterse, Todd, Neville, & Carter, 2012). Importantly, the sample used in this study is drawn from an area of the U.S. where there are large numbers of African Americans and Hispanics not found elsewhere.

The current study will highlight an understudied population: rural-residing individuals as a whole, and in particular shed light on additional barriers (or possibly buffers) experienced by racial/ethnic minorities managing diabetes. Given the documented associations between diabetes and obesity, and the link between depression and obesity; this research serves to extend existing literature by illuminating relationships among all three co-morbid conditions. This study explores the interaction of biopsychosocial factors to determine overall health status and diabetes disease course in diagnosed individuals as demonstrated by the selected physical and mental health indicators. The incorporation of the impact of social status variables within the model contributes to the extant research in a new way; by examining social resource effects through quantitative analysis. This study will examine the relationships between depressive and anxiety symptoms, BMI, and subjective health; the potential moderating role of social statuses such as marriage; and broadly highlight connections between diabetes, obesity, and depression. Insights gained from this study can be applied to the development and expansion of culturally sensitive treatment interventions and the creation of policy recommendations that promote positive health behaviors and allocate/target resources to populations in greatest need.

CHAPTER II

LITERATURE REVIEW

> [There are] [g]laring disparities in access and availability of mental health…care in rural areas…Almost 20 percent (fifty-five million people) of the total US population live in rural areas and are faced with the barriers of low accessibility, availability, and perceived acceptability of mental health services, (McCord et al., 2012, p. 323-324).

According to 2014 data, the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA) reports that the Brazos Valley region examined here represents a health professional shortage area (HPSA) that encompasses a deficit in terms of providers of both physical and mental health. According to the HRSA (2014), HPSAs may be "geographic (county or service area), demographic (low income population), or institutional" (para. 1). The agency distinguishes between HPSAs and medically underserved areas (MUAs), which are characterized by: too few primary care providers, high elderly population, and high poverty rates. It is apparent that some overlap exists between the two designations, and much of rural America likely falls into one or both categories. Finally, HRSA defines medically underserved populations (MUPs) as: "groups of persons who face economic, cultural or linguistic barriers to health care," (2014). While one's residence in a rural area does not automatically make them a member of an MUP, it does increase the likelihood that they comprise an MUP, or reside in an HPSA or MUA. Rural communities face documented difficulties in recruiting and retaining health and mental health professionals due to: the increased likelihood of facing ethical problems particularly surrounding confidentiality; lack of mental health funding; and the increased probability that a mental health/health professional will have to work for a lower salary/compensation and higher burnout rates (McCord et al., 2012). In sum these data reinforce Hartley and colleagues' (1999) assertion that rural mental and physical healthcare systems have profound differences from urban ones.

Rural disparities and the majority culture (White) experience

In their article on rural health, Brossart and colleagues (2013) highlighted a number of prominent health concerns and health care issues faced by rural residents. According to the authors, rural residents are considered members of a "vulnerable" population because many live in areas without health professionals and must travel greater distances to receive care, which has been linked to an increased likelihood of hospitalization and decreased frequency of outpatient visits (p. 252). Wagenfeld (2003) echoed these concerns and added that rural residents report poorer health and exhibit greater prevalence of chronic health issues while representing an underinsured (or uninsured) population with higher rates of poverty. For example, women residing in rural areas experience heightened risks for depression and abuse due to: limited employment opportunities, social isolation, poverty, and lack of childcare (p. 253). In fact, female rural residents display rates of depression that exceed those of the general population (McCord et al., 2012). Men evidence high suicide rates in rural areas (Eberhardt & Pamuk, 2004). Both genders are less likely to receive mental health treatment in comparison to their urban counterparts (Brossart et al., 2013) despite higher substance abuse and depression rates in rural areas as compared to urban ones (McCord et al., 2012). Furthermore, McCord and colleagues (2012) stress that there is evidence to suggest that the prevalence of some mental health problems are disproportionately higher in rural areas (p. 333).

Built/Physical environment. Barriers such as poverty and lack of transportation increase the likelihood that rural residents will access needed treatment (related to physical and mental health) later, when their conditions are worse and require more intensive treatment. The existence of such barriers emphasizes the need for systemic solutions that consider the unique relationships between people and the environments in which they live (p. 333). Eberhardt and Pamuk (2004) asserted that a rural health disadvantage exists in the areas of chronic health conditions, including a risk factor of obesity, one of the leading comorbidities commonly associated with diabetes. The National Advisory Committee on Rural Health and Human Services (NACRHHS) reported in 2011 that obesity in rural children surpasses that of their urban counterparts and identified obesity as a primary contributor for why their life expectancy may be shorter than their parents. Bhattacharya's (2012) study adds credence to these arguments with data that suggested that physical activities are affected by the built environment (p. 1078). This was echoed in the 2011 NACRHHS report, which emphasized that children feeling unsafe playing outdoors severely limited their activity levels. This report also highlighted insufficient nutrition sources in the surrounding area. These factors are relevant to adults as well. Overall many rural areas are not designed in a manner that promotes physical activity. Lower income neighborhoods may lack public recreation facilities such as parks, and sidewalks or bike trails may also be unavailable.

The disparities that exist between subjective and objective health status of those living in urban vs. rural areas, points toward the significant impact of one's environment on their health. Indeed Lazarus and DeLongis (1983) asserted "environmental conditions of living" shape one's coping patterns (p. 246). This environment includes not only the physical space or built environment (e.g. neighborhood characteristics), but also one's social context (e.g. support network, network density). With this in mind, some researchers and practitioners encourage the use of an ecological model when framing and addressing health care (physical and mental) provision (McLeroy, Bibeau, Steckler, & Glanz, 1988). An ecological approach focuses on utilizing and developing the strengths and existing resources within a given context to enhance the overall health of the populace. This is in line with the NACRHHS's support of community transformation grants (CTGs) that focus on "capacity building and implementation"; understood to mean the development of healthier communities via adaptive interventions and strategies that work with the people and existing infrastructure (NACRHHS, 2011). The current study seeks to provide additional information that could be used toward efforts similar to NACRHHS's CTGs or the development of policy recommendations that are culturally sensitive and empirically based.

Diabetes and the elderly. Another key consideration in any discussion of rural health is the elderly (hereafter understood to mean individuals at least 65 years old). Rural elderly are impacted by unique financial, geographic, and demographic challenges. Elderly comprise a larger proportion of the population in rural as opposed to urban areas (Administration on Community Living (ACL), 2014; Hutchison, Hawes, & Williams, 2005; NACRHHS, 2011). In 2005 approximately 22% of the nation's total elderly population resided in rural areas, and this demographic continues to increase (ACL, 2014; Hutchison, et al., 2005; NACRHHS, 2011). According to the 2010 Census, individuals aged 65 and above accounted for approximately 13% of the total U.S. population and 10.3% of the Texas population (ACL, 2014; NACRHHS, 2011). These figures are expected to rise, and it is projected that the elderly population will reach 16.1% by 2020 and 20.2% by 2050; meaning that approximately one-fifth of the U.S. population will be over age 65 (ACL, 2014). "Approximately 75% of those over 65 suffer from at least one chronic illness," (Calkins, Boult, & Wagner, 1999 as cited in Hutchison, et al., 2005, p. 1) increasing the relevance of research on diabetes because an increasing proportion of those chronically ill will suffer from that disease.

The 2010 Census also revealed that there are more married elderly men 72% vs. women 42% (ACL, 2014). Elderly women then face additional healthcare challenges due to age, rural location/residence, and gender. This most recent Census reported that most individuals aged 65 and older were living in family households, approximately 65.7% (ACL, 2014). This suggests that there are a significant number of family caregivers, which implies that increased integration of community and ecological models could prove more successful in addressing the needs of rural elderly with diabetes (or other chronic illnesses). Further, since elderly populations are less likely than other age groups to change their residence (ACL, 2014) and more likely to live in poverty (ACL, 2014; Hutchison, et al., 2005; NACRHHS, 2011), the importance of improving rural healthcare access and delivery is underscored.

The generally lower educational attainment and income levels of rural elderly negatively affect both treatment utilization and subjective health reports (ACL, 2014; Hutchison, et al., 2005). "Poverty increases with rurality" (NACRHHS, 2011) and associations between these personal background characteristics and diabetes diagnoses have been identified as well (CDC, 2014a). "Rural populations disproportionately suffer from higher rates of chronic disease than the general population, and in many areas experience a poorer quality of life," (NACRHHS, 2011). Although rural elderly have actually been found to have greater *quantity* of life in comparison to their urban peers, they experience greater morbidity, which tends to decrease the *quality* of life, and increase demands for long-term care (Hutchison, et al., 2005). These findings express the high level of need for mental and physical health services in rural areas; and particularly long-term care. In the same way that rural elderly experience added barriers to treatment due to age and age-specific needs, racial/ethnic minorities face additional challenges to getting their health needs met. Despite advances in technology and healthcare overall, disparities still exist for members of non-dominant groups that increase the need for culturally sensitive and adaptive healthcare delivery systems and approaches.

Rural disparities and the racial/ethnic minority experience

The experience of racial and ethnic minorities in the rural context deserves special attention. Braveman et al. (2011) state that one's ecological context has the potential to reproduce and exacerbate race-based health disparities. Racial and ethnic minorities living in rural areas must deal with added risk factors including: "perceived racism, acculturative stress, and stigma" (Brossart et al., 2013; Brown, Brody, & Stoneman, 2000; Probst, Moore, Glover, & Samuels, 2004). It is well-documented that individuals who experience systemic discrimination due to social or economic disadvantage also experience greater challenges to optimal health status (HHS, n.d.).

Two of the most relevant categories associated with such impacts on health status include racial/ethnic background and geographic location. Because the current study focuses on African Americans and those identifying as Latino or Hispanic (hereafter used interchangeably), in comparison to White counterparts, that will be the focus of this review as well. The number of individuals who identify as racial/ethnic minorities in rural settings is increasing (Brossart et al., 2013). Minorities account for 15% of the rural population and 30% of rural poor (HHS, n.d.). The Office of Rural Health Policy (ORHP) acknowledges that rural minorities have unique health needs, and has had a longstanding concern with their health needs (HHS, n.d.).

The already decreased likelihood for individuals in rural areas to receive mental health treatment is "compounded for African Americans and Hispanics" in those same areas (Hauenstein et al., 2006). Brossart and colleagues (2013) found that African Americans and women displayed greater risk for depression regardless of rural status and African American women showed the highest rates of depression when compared to Hispanics, Whites, and males. Extant research suggests that African Americans are less likely to communicate their depressive symptoms or distress to a health professional in comparison to White or Hispanic counterparts (Probst, Laditka, Moore, Harun, 2007, p. 519). Although health disparities also exist for racial/ethnic minorities residing in urban areas, they are less pronounced in comparison to those residing in rural areas (Probst, et al., 2004). A health disparity exists around depression in rural vs. urban racial/ethnic minorities; with the former experiencing greater depression, which is associated with perceived racial discrimination (Brown, Brody, & Stoneman, 2000; Torres & Ong, 2010).

The Institute of Medicine's (IOM) 2002 "landmark" report identified lack of insurance as a primary source of health disparities noting significantly that it, "more than any other demographic or economic barrier, negatively affects the quality of health care received by minority populations. Racial and ethnic minorities are significantly less likely than the rest of the population to have health insurance," (Institute of Medicine, 2002, p. 3). In line with these data, the 2013 Regional Health Partnership (RHP) Brazos Valley Regional Health Assessment Community Snapshot reported that uninsured individuals across the region described poorer health outcomes and severely limited access to healthcare. The annual Agency for Healthcare Research and Quality (AHRQ) National Health Disparities Reports (NHDR) which documents health disparities by socioeconomic status and racial/ethnic background, reported that racial/ethnic minorities frequently receive lower quality care and face more barriers in accessing care in comparison to their non-Hispanic White counterparts (DHHS, 2011; Braveman, Egeter, & Williams, 2010). The documented disparities include chronic disease management and preventative care, both of which are relevant to the severity, prevalence, incidence, and progression of diabetes cases.

The ratio of racial/ethnic minorities who comprise the U.S. population vs. those who make up the physicians in the nation is quite unbalanced. African Americans and Hispanics each account for approximately 16% of the U.S. population but represent only about 6% of its physicians (DHHS, 2011, p. 3). Extant research suggests that a lack of diversity in the healthcare workforce is one contributor to the poorer quality of patient-provider interactions reported by racial/ethnic minorities (DHHS, 2011; Braveman et al., 2011). These challenges are even worse for those with limited English proficiency (DHHS, 2011).

In sum these findings emphasize the perspective advocated by critical race theory; that the embeddedness of racism within cultures via institutions and systems allows for the construct of race to impact every facet of an individual's life including their health (Braveman et al., 2011; Hylton, 2008). Moreover, this remains true even in communities where minorities predominate because of the pervasiveness and systemic nature of racism at work (Walker & Cunningham, 2014). In other words, even in all or mostly African American or Hispanic communities, racism is still at work. Thus access, availability, and acceptability of resources remain inequitable and minority individuals continue to suffer (Edwards & Cunningham, 2013; Gobster, 2002). Racial minorities living in rural areas must overcome racial and contextual (rural-specific) barriers to good health underscoring the importance of the consideration of intersectionality during the development of interventions and other resources (Braveman et al., 2011; Hylton, 2008; McLeroy et al., 1988). "For racial minorities living in rural communities...they face dual barriers to health and well-being: racism and ecological barriers associated with living in rural communities" (Walker & Cunningham, 2014, p. 165).

Diabetes and the majority culture (White) experience

To reiterate, despite large scale improvements and advances in medical knowledge and technology, it is well documented that individuals living in rural areas still experience worse health outcomes in a number of areas when compared to those residing in communities of varied levels of urbanization, and even national averages. Of particular relevance is the rural health disadvantage in the area of chronic health conditions such as diabetes, and elevated rates of associated risk factors such as obesity (Eberhardt & Pamuk, 2004). CCHD's 2013 regional report on the Brazos Valley showed that rural counties reported higher rates of chronic diseases in comparison to non-rural counties such as Brazos. Eberhardt and Pamuk (2004) also identified a rural health disadvantage in the form of individuals being less likely to have insurance. Recall that the Institute of Medicine found this to be the primary driver of health disparities to an extent greater than any other demographic variable including economic status (DHHS, 2011).

Data from the 2014 National Diabetes Statistics Report highlights a number of additional important themes. This report uses the 2010 U.S. Census data, 2009-2012 National Health and Nutrition Examination Surveys (NHANES), 2010-2012 National Health Interview Surveys (NHIS) as well as other published data from the Centers for Disease Control and Prevention (CDC). Both the NHANES and NHIS use nationally representative cross-sectional samples. According to the 2014 National Diabetes

Statistics Report, 29.1 million people (9.3% of the U.S. population) have diabetes and 8.1 million (27.8% of the U.S. population) of those individuals are undiagnosed. Further, although identified as the seventh leading cause of death in the U.S. in 2010, diabetes is likely underreported due in part to the significant number of individuals with the disease who are living undiagnosed (CDC, 2014a). The 2014 National Diabetes Statistics Report states that only 35-40% of individuals diagnosed with diabetes who died had it listed at all on the death certificate, and a mere 10-15% listed diabetes as the cause of death (CDC, 2014a). Despite this, in 2003-2006, death rates were approximately 1.5 times higher among adults (those aged 18 or older) diagnosed with diabetes compared to those without (CDC, 2014a). Increased investigation and data on the disease would allow for its impact to be more accurately identified and addressed.

Although the impact of diabetes within certain populations and data on death rates? has gaps, the financial costs are clear and staggering due in part to the numerous psychological and physical conditions that develop as a result of, or in relation to the disease. In 2012, combined direct and indirect costs associated with diabetes totaled $245 billion with diagnosed individuals spending, on average, 2.3 times more on medical expenditures than those without diabetes (CDC, 2014a). In the same year $176 billion was spent on direct medical costs (CDC, 2014a).

This large-scale report also supports findings that suggest diabetes and dysglycemia increase with age (Marcinkevage, Alverson, Narayan, Kahn, Ruben, & Correa, 2013). The majority of individuals with diabetes are aged 20 or older, 28.9 million (12.3%)(CDC, 2014a). Older adults account for much of the figure: 13.4 million

(13.6%) aged 45-64 and 11.2 million (25.9%) aged 65 or older (CDC, 2014a). Moreover, older age is a risk factor for both prediabetes and type 2 diabetes (CDC, 2014a). From 1997-2011, the median age at diabetes diagnosis fell nationally to 50-55 years, with a tendency to be slightly younger for females vs. males, and slightly older for Whites in comparison to African Americans and Hispanics (CDC, 2013). With such a large proportion of the rural population being elderly, exploration of this topic is extremely timely and relevant. In fact, the 2013 RHP 17 Center for Community Health Development (CCHD) Brazos Valley regional report stated that the Brazos Valley has a rapidly increasing older adult population created by the entry of retirees and aging of the existing adult population.

Nonetheless, the increasing rates of diabetes in children and the close link between obesity and diabetes has been acknowledged at national levels through policies and initiatives such as *Let's Move* campaign and *Healthy People 2020.* From 2008-2009, an estimated 23,525 individuals under age 20 were newly diagnosed with type 1 or type 2 diabetes annually (CDC, 2014a). The most recent CDC data demonstrates 208,000 individuals under age 20 have been diagnosed with type 1 or type 2 diabetes, which represents 0.25% of all individuals in the older adult age group (CDC, 2014a). Ahn et al.'s (2012) research found that approximately 8% of baby boomers (individuals born between 1946-1964) and 10% of older adults (individuals born before 1946), had diagnoses of diabetes and obesity (p. 123-124). (The authors analyzed 2007-2008 National Health and Nutrition Examination Survey, NHANES, cross-sectional data.) The increased likelihood that older adults diagnosed with diabetes will be simultaneously managing additional chronic conditions underscores the importance of regular physician contact and monitoring, as well as good communication and coordinated care.

Sex/Gender and diabetes. Surprisingly, at the national level there is a fairly even split between men and women with diabetes, 15.5 million and 13.4 million respectively (CDC, 2014a; Schneider et al., 2013). Still, a study conducted by Ahn et al. (2012) reported that having diabetes and obesity was more common in female baby boomers highlighting the health impact of a sex-age interaction. The trend of an even split in diabetes diagnoses does not persist when racial/ethnic minorities are examined separately; those statistics will be explored in the section that follows. In addition, Costacou and Orchard (2013) observed a stronger effect of hyperglycemia as a risk factor for hypertension in men vs. women, with type 1 diabetes.

A barrier to healthcare access that all of these groups share is transportation. The 2013 RHP 17 CCHD Brazos Valley regional report found that 43% of rural residents travel more than 20 minutes and an average of 13.7 miles in order to gain access to medical care (CCHD, 2013). In conjunction with public transportation that was described as "unreliable, unaffordable, and inadequate"; there is agreement amongst residents and service providers that older adults have numerous unmet needs and "inadequate financial resources forcing choice among basic needs". There are multiple barriers that undoubtedly impact peoples' decisions with regard to routine, preventative, and urgent care (CCHD, 2013, p. 2). This again highlights the interrelation between access, affordability, and acceptability that underscore the health barriers that rural-residing individuals face.

The diabetes belt. The health disparities experienced by individuals diagnosed with diabetes in rural communities extends beyond the county-level to a national scale concern. CDC scientists have identified what is known as the diabetes belt. The diabetes belt is comprised of 644 counties in 15 states, primarily in the Southeast. (Barker, Kirtland, Gregg, Geiss, & Thompson, 2011). The premise behind identifying the diabetes belt at the county vs. state level, was to encourage community-based intervention. The criteria for inclusion in the diabetes belt are as follows: counties with at least 11% of residents diagnosed with diabetes, and proximity to adjoining areas with high rates of diabetes (Barker et al., 2011). The authors excluded areas meeting the diagnosis criteria that were isolated from neighboring counties that also met those thresholds. The authors drew their data from the Behavioral Risk Factor Surveillance data.

The diabetes belt includes parts of: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, and all of Mississippi (Barker et al., 2011). Although none of the Texas counties within the diabetes belt include counties within the Brazos Valley, the region is borderline with rates ranging from approximately 8.1-11.1% for adults diagnosed with diabetes (Barker et al., 2011). Communities within the diabetes belt have higher rates of obesity and predominantly sedentary lifestyle. Researchers found that this sedentary lifestyle accounted for approximately one third of the increased risk of type 2 diabetes for individuals who reside there. These individuals are more likely to be African American and not posess a college degree. Both of the latter factors increase one's risk of type 2 diabetes on their own, so their presence in an individual residing in the diabetes belt further heightens risk (Barker et al., 2011).

Diabetes and the racial/ethnic minority experience

"For most chronic diseases, minorities tend to have earlier onset and higher severity" and diabetes is no exception (Insaf, Strogatz, Yucel, Chasan-Taber, Shaw, 2014, p. 318). Racial/ethnic minorities bear a well-documented disproportionate illness burden with regard to diabetes (Bhattacharya, 2012; Garcia et al., 2012; Getaneh et al., 2012; Insaf et al., 2014; Jones-Smith et al., 2013; Laiteerapong et al., 2013; Ma et al., 2012; Marcinkevage, Alverson, Narayan, Kahn, Ruben, Correa, 2013; Quiñones, Liang, & Ye, 2013; Wong, Chou, Sinha, Kamal, & Ahmed, 2014;). "African Americans suffer disproportionately from the complications of T2D [type 2 diabetes]" (Bhattacharya, 2012, p. 1072). For instance, they suffer two to four times the rates of type 2 diabetes as well as its accompanying consequences such as: renal failure, glaucoma, and amputations; in comparison to non-Hispanic White counterparts nationwide (Bhattacharya, 2012). To elaborate, the CDC states that racial/ethnic background is a risk factor for diabetes in and of itself with Hispanic/Latino, African American, Asian American, Pacific Islander, American Indian, and Native Hawaiian backgrounds increasing one's chances of developing diabetes (CDC, 2014a; NCCDPHP, 2014; Schneider et al., 2013). Approximately 20% of African Americans vs. only 10% of

Whites have diabetes, and Mexican Americans' diabetes prevalence is two times that of Whites' (Laiteerapong et al., 2013).

Race, age, and diabetes diagnosis. Ahn, et al.'s (2012) research with NHANES data demonstrated that having "twin diagnoses" of diabetes and obesity was more common among older adults and baby boomers who were African American (OR = 1.79, p =.029), while having one condition or the other was more common in Hispanic baby boomers (obesity only: OR = .47, p = .022; diabetes only: OR = 3.65, p = .001, p. 123). In general older adults with diabetes have a drastically lower health-related quality of life (HRQL) in comparison to their peers without the disease. Research has shown that racial/ethnic minorities such as Hispanics and African Americans report lower HRQL than Whites in the general population, so it follows that older members of these groups with diabetes will have an even lower HRQL than their White counterparts (Laiteerapong et al., 2013). Even without consideration of the age element, this highlights another example of race/ethnicity exacerbating one's health status for the worse. By contrast however, Laiteerapong and colleagues (2013) produced results that showed just the opposite. In the authors' study, which used a multiethnic sample of insured older adults diagnosed with diabetes, Whites reported a lower HRQL than racial/ethnic minorities. The authors concluded that this was attributable to the unique context in which participants were observed: they had "uniform access to care" within an established "integrated healthcare delivery system" (Laiteerapong et al., 2013, p. 1108). Although these results are surprising and encouraging in terms of clinical utility and future research directions, other unique aspects of the population: drawn from Northern

California, insured, and of higher income and education; limit the external validity of this study (Laiteerapong et al., 2013).

African Americans and Hispanics are showing increasing rates of diagnosis of type 2 diabetes in children and adolescents (CDC, 2014a). In contrast, non-Hispanic white children and adolescents had the highest rate of new cases of type 1 diabetes (CDC, 2014a). Recall that type 1 diabetes is not preventable and refers to the form of the disease in which insulin is not produced whereas type 2 describes the form of the disease wherein insulin is misused or its production is insufficient. Type 2 diabetes is preventable in some cases through maintenance of a healthy lifestyle, underscoring the environmental and social factors that can vastly impact its development. Therefore it follows that members of groups that are socially marginalized and denied access to various resources would be more susceptible to this form of the disease. Just as racial/ethnic minorities bear a disproportionate illness burden of diabetes, so too do older adults (Laiteerapong et al., 2013). Therefore, aging members of racial/ethnic minority populations are at the greatest risk of developing diabetes even before additional risk factors or demographic variables are considered.

Extant literature demonstrates a number of shared patterns among Hispanic/Latinos and African Americans diagnosed with diabetes, their risk factors, and how they compare to non-Hispanic White counterparts. Ma and colleagues (2012) found that the two groups shared a lower dietary quality than Whites, but when these were matched their diabetes risk decreased by approximately 7% (p. 2230). Similarly, when education levels were adjusted to equal those of White control/comparison group(s), Hispanic incidence rates fell by about 14% (p. 2230). The authors assert that this data suggests that African Americans and Hispanics are more sensitive to lifestyle modifications and weight loss than their White counterparts (p. 2230). Importantly, they concluded that despite documented disparities between racial/ethnic groups, the greatest variability in incidence is accounted for by "lifestyle factors" (Ma et al., 2012, p. 2226). Therefore new cases are indeed preventable and since racial/ethnic minorities are more susceptible to lifestyle modifications, current trends could certainly be reversed with the appropriate, tailored interventions.

Race and sex/gender. As with any condition, intersectionality or how an individual is uniquely situated at the meeting point of all of their group memberships or identities is of critical importance in determining the full extent of their risk factors as well as their resilience factors. In examining diabetes, sex interacts with race/ethnicity in noteworthy ways. For example, in Ma and colleagues' 2012 study, African Americans as a whole, and Hispanic women in particular, were at the greatest risk for developing diabetes in comparison to non-Hispanic Whites. In every racial/ethnic group examined incidence was highest among women with high body mass index (BMI) and low physical activity. Socioeconomic status (SES) also interacted with race/ethnicity in significant ways. Ahn et al. (2012) noted "double jeopardy effects" with regard to the greater proportion of obese African Americans vs. non-Hispanic Whites living in near-poverty conditions (p. 129). Data drawn from the 2013 Brazos Valley Regional Health survey reflect that 17.9% of respondents fall into the low-income category: 101-200% of the federal poverty level. Often persons at this income level make too much to qualify for federal assistance programs, but too little to afford many out of pocket services or unexpected expenses (p. 12).

Race and treatment adherence. Hunt and colleagues' (2013) work with diabetic veterans extends previous research that suggests that African Americans display lower adherence to insulin and oral hypoglycemic agents than do Whites. This lower treatment adherence is associated with poorer glycemic control, greater hospitalization, greater overall (not limited to diabetes as the cause of death) mortality, increased healthcare costs, and greater rates of hyperglycemia, all of which are linked to greater risk of cardiovascular disease mortality (Hunt et al., 2013, p. 78). Hunt and colleagues (2013) contend that "poorly controlled diabetes" is not the best predictor of mortality for any racial/ethnic group, but instead "medication nonadherence, noninitiation of antidiabetic medications, and comorbidity" are stronger indicators (p. 78). Additionally, advanced age and increased number of comorbidities, elevated the mortality risk for all racial/ethnic groups (p. 77). These findings underscore the importance of effective management of comorbid conditions, preventive screening, and medication adherence for successful treatment of diabetes. Although Hunt et al. (2013) study looked specifically at veterans, its sample was national, based on the current body of literature, and its conclusions are relevant to non-veterans as well.

Disparities related to acculturation. Getaneh and colleagues (2012) point out the importance of going beyond racial and ethnic background when exploring differences in prevalence, incidence, and outcomes; to examine acculturation level including potential language barriers and intra-group (or within group) diversity. For example, in their research, which sampled Mexicans, Puerto Ricans, and Dominicans they found differences in glucose control despite uniform access to care which suggests cultural, environmental, and health literacy differences that supersede shared monolithic ethnic labels such as Hispanic or Latino. National CDC data supports their recommendations with research demonstrating the following: Puerto Ricans with the highest percentage of adults (age 20 and over) diagnosed with diabetes (14.8%)--a rate almost double that of Central and South Americans (8.5%), and Mexican Americans with the second highest rate (13.9%) from 2010-2012 (CDC, 2014a).

Physical complications and comorbidities of diabetes

Regardless of one's racial/ethnic makeup there are physical complications of diabetes that every diagnosed individual is susceptible to and must manage. In the state of Texas alone, 56.9% of adults (age 18 and over) reported having experienced at least one day of poor health in the past 30 days and 33.2% reported being unable to do their usual activities (according to the most recent Behavioral Risk Factor Surveillance data from 2010, CDC, 2014b). While state-wide incidence showed slight decreases from 2008-2010, the percentage of adults (age 18 and over) reporting prediabetes has continued to rise (CDC, 2014b). These data align with national trends (CDC, 2014b).

There are a number of physical conditions that are both frequently co-occurring and also risk factors for diabetes. Two major conditions are obesity and hypertension (in addition to smoking and high cholesterol). In 2009, the CDC reported that Texas exceeded the national rates for the three comorbidities: hypertension, high cholesterol, and obesity in adults with diabetes (CDC, 2014b). Ahn et al. (2012) found evidence of the presence of what is sometimes referred to as the deadly triad: diabetes, obesity, and hypertension. Having diabetes and obesity was common in those with hypertension ($p < .001$) as well as those with high cholesterol ($p < .001$) (p. 126). The authors analyzed NHANES data; a national cross-sectional population (Ahn et al., 2012). Costacou and Orchard (2013) echo the pervasiveness and danger of this health profile:

> Hypertension is the number one attributable risk factor for death within the general population worldwide and remains particularly prevalent among individuals with diabetes...Among individuals with type 1 diabetes, the presence of hypertension has been associated with…increased…complications, and it also raises overall mortality risk (p. 77).

The co-occurrence of any of the aforementioned conditions exacerbates the negative health consequences associated with any one of the conditions and also makes effective management more difficult. Although those without a chronic health condition have a longer life expectancy and typically, a better quality of life, the impact(s) of managing multiple chronic illnesses may take more of a toll on certain members of society.

Diabetes and obesity. In the instance of the "twin" obesity epidemic, one underlying cause for disparities along racial/ethnic lines relates to culture and particularly attitudes concerning body image and weight. There is a good amount of evidence to suggest that cultural norms concerning normal body weight and shape not only differ among Whites, African Americans, and Hispanics; but also that the latter two are more likely to positively endorse a larger body size. It follows that individuals of larger sizes identifying with these groups, may be more satisfied and less motivated to change their body weight. Because of the close relationship and growing co-occurrence of obesity and diabetes, cultural factors pertain to the increase in individuals diagnosed with diabetes too, particularly in people of color. Ma and colleagues (2012) reported, “BMI was the most important determinant of diabetes incidence” (p. 2229). This is consistent with other recent research in the area such as that by Wong, Chou, Sinha, Kamal, & Ahmed (2014) as well as Jones-Smith and colleagues (2013).

Medical conditions associated with diabetes. Much of what has been detailed thus far deals with co-occurring conditions that represent simultaneous challenges for patient and provider when it comes to individuals diagnosed with diabetes. However, diabetes on its own has a number of accompanying complications that are common and costly:

> Chronic pain (41%) and peripheral neuropathy (25%) were the most frequent diabetes mellitus–related conditions. There were significant ethnic differences in rates of heart failure, foot ulcer, peripheral neuropathy, chronic pain, depression, and being underweight. Blacks had the highest rate of heart failure (5%), foot ulcer (6%), and peripheral neuropathy (31%). Blacks and Hispanics had the highest rates of chronic pain (both 45%), whereas whites had the highest rate of depression (10%), (Laiteerapong et al., 2013, p. 1106).

From a more richly biological standpoint, Schenider et al. (2013) conducted research investigating liver enzymes, their association with diabetes risk, and race comparisons. Their results suggested that abnormalities, and particularly elevations, in certain liver enzymes may be a better indicator of individuals at high risk of diabetes (p. 932). They found that the appearance of these elevated liver enzymes often preceded the diagnosis of diabetes by several years (p. 932). Schneider and colleagues (2013) reported that although differences in prevalence were identified for elevated liver enzymes by race, ultimately the manner in which these contributed to insulin resistance, was similar across races (pp. 929 - 930). Yet they still reported a higher absolute risk for diabetes in

African Americans when compared to Whites, even when controlling for other risk factors (p. 929). These findings underscore the importance of examining data carefully to fully understand that differences do not always indicate better or worse outcomes in and of themselves. Their research also suggests a new area of inquiry that could provide knowledge on methods of earlier detection and prevention of diabetes.

Health-related quality of life. Laiteerapong and colleagues (2013) examined health-related quality of life (HRQL) in insured older adults with diabetes, within an established integrated healthcare delivery system which produced divergent outcomes by race. The authors identified differences in physical and mental HRQL by race/ethnicity that favored people of color. Specifically, physical HRQL was better in African Americans, Hispanics, Asians, and Filipinos when compared to Whites (p. 1106). The authors noted that the differences in HRQL were relatively large and clinically relevant since the differences were derived from subjective health reports which have been shown to relate to various mortality levels (p. 1106). Notably, after controlling for potential mediators, the differences in HRQL decreased appreciably and the authors concluded that the sum of health behaviors, SES, acculturation levels, and related conditions better accounted for the differences observed (p. 1106).

Diabetes and erectile dysfunction. Erectile dysfunction is a condition associated with diabetes that is less well researched and less frequently discussed. It has been shown to impact quality of life and health-related quality of life in both clinically and statistically significant ways that go beyond quality of sexual life into other domains of healthy functioning (Chitaley, Kupelian, Subak, & Wessells, 2009; De Berardis et al., 2005; Ladds, 2006; Thorve et al., 2011). Thorve et al. (2011) define erectile dysfunction or impotency, “as the inability to achieve and/or maintain an erection sufficient to permit satisfactory sexual intercourse” (p. 129). Erectile dysfunction (ED) is a condition that affects more than 40% of men over the age of 40 years old (Hotaling et al., 2012, p. 515). Importantly, this age group overlaps with individuals at a high risk of developing diabetes and currently being diagnosed. The prevalence of impotence in diabetic men is even higher, affecting 50% or more of that population (Thorve et al., 2011; Wessells, 2013). This comorbidity presents a serious and costly public health concern. In fact, if all of the men with ED alone were to receive treatment, it would cost upward of $10 billion (p. 515). Despite these staggering statistics, it is likely that ED is underestimated due to the lack of validated quantitative instruments to identify the condition. Reliance on self-report may be inaccurate due to shame or embarrassment of the individual in question (Hotaling et al., 2012; Ladds, 2006). Additional research is needed to close this knowledge gap because the prognosis for individuals struggling with this comorbidity is poor.

Diabetes is one of the greatest risk factors for ED (Chitaley, Kupelian, Subak, & Wessells, 2009; Ladds, 2006; Thorve et al., 2011; Wessells, 2013). Researchers have found evidence that diabetic men have a 1.3-4 times greater likelihood of developing ED in comparison to men without diabetes (Chitaley, Kupelian, Subak, & Wessells, 2009, p. S46; Thorve et al., 2011, p. 130). Relatedly, there is a greater incidence of ED in diabetic men compared to men without diabetes, and a noteworthy percentage of these new cases were also found to suffer from previously undiagnosed diabetes (Johannes et al., 2000;

Thorve et al., 2011). Diabetic men also develop ED at an earlier age as compared to the general population and typically experience less success with existing treatments (Chitaley, Kupelian, Subak, & Wessells, 2009; Thorve et al., 2011). Thorve and colleagues' (2011) identified a direct relationship between the duration of diabetes diagnosis and the risk of developing ED; risk of ED increases the longer a man has diabetes (p. 130). This risk is exponentially increased when a man suffers from cardiovascular disease, poor glycemic control, elevated BMI, or obesity particularly in men with type 2 diabetes (Chitaley, Kupelian, Subak, & Wessells, 2009; Thorve et al., 2011; Wessells, 2013). The interactive effects of the sum of these co-occurring conditions can lead to grave physical consequences such as: limb loss, blindness, nerve damage, hypogonadism (malfunction in the gonads or testes in men), and cardiovascular problems (Chitaley, Kupelian, Subak, & Wessells, 2009; Ladds, 2006; Thorve et al., 2011).

Managing these comorbidities, but particularly ED, can lead to a host of psychological issues as well. A longitudinal study conducted by De Berardis and colleagues (2005) produced results demonstrating the deterioration of quality of sexual life, physical functioning, social functioning, overall health perception, and quality of life; and an increase in depressive symptomology among diabetic patients with ED (p. 2637, 2639, 2641). Likewise, Malavige and colleagues' (2007) research linked ED to diminished HRQL, as well as poorer emotional life and sexual experiences to a statistically significant extent when compared to individuals with normal sexual function (p. A500-A501). It is evident that comorbid ED, diabetes, and even obesity have long-term and far-reaching consequences for numerous domains of an individual’s functioning and well-being. With all of these conditions increasing in incidence and prevalence, particularly among the growing elderly population, this is an area for further inquiry that adds to the importance and timeliness of exploring diabetes and its relationship to these other health concerns.

Physical environment. The physical environment itself is another key factor related to obesity and diabetes rates. The built environment refers to the design, layout, and amenities of a given neighborhood or community that either promote or discourage physical activity. For example, the availability of walking/biking trails, sidewalks, playgrounds, or parks support physical activity by all income levels because free forms of exercise can take place in these settings. However, actual or perceived neighborhood safety also impact the use of such amenities when they are present, and if people do not feel safe or are aware of significant crime activity in these areas, their presence is unlikely to have a positive impact on one’s health. Again, discrimination may have an insidious and subtle influence wherein persons of color face unique challenges to being active, such as the perception that they are not welcome in certain recreational or leisure spaces/activities, as well as financial limitations (Edwards & Cunningham, 2013; Gobster, 2002). Still, Ma and colleagues (2012) study included members of various racial/ethnic backgrounds and found that “[p]hysical inactivity was associated with the greatest risk for all groups” (p. 2229). However, their study investigated diabetes using an all-female sample. The current study will be able to compare physical health indicators such as those examined by Ma and colleagues (2012), by sex, due to its inclusion of both men and women in the sample.

Despite barriers that individuals face to being active, it is well known that regular, moderate physical activity promotes greater physical and mental health. It has been linked to decreases in mortality and morbidity in a number of conditions including type 2 diabetes for individuals of all racial/ethnic backgrounds (Blair & Brodney, 1999; Edwards & Cunningham, 2013; Lees, Taylor, Hepworth, Feliz, Cassells, & Tobin, 2007; Powell, Paluch, & Blair, 2011).

Food environment. The food environment impacts both diabetes and obesity rates. Both diseases require maintenance of a balanced diet including regular consumption of fruit and vegetables in order to best manage or delay progression of ill effects. A lack of access to healthy food contributes to health disparities by affecting one's ability to consume the recommended amounts of healthy foods regularly, (Dean & Sharkey, 2011a,b; Walker & Cunningham, 2014; Walker, Keane, & Burke, 2010). Two terms used in the literature to describe this lack of access are food desert and food (in)security. A food desert is an area where there is a marked absence of stores from which to purchase healthy, affordable food (Cummins & Macintyre, 2002; Liese, Weis, Pluto, Smith, & Lawson, 2007; Walker et al., 2010). Food (in)security is a broader term that includes not only the retail food environment within which an individual resides but also household factors such as income which (dis)allows one to purchase healthy, balanced food items at an affordable price, and the presence or absence of the need to skip meals by household members (Dean & Sharkey, 2011 a,b).

The consequences of food insecurity and food deserts might be more prominent in rural settings where additional barriers such as employment status (e.g. higher unemployment or greater reliance on fixed incomes), and transportation variables (e.g. access to vehicle, availability of public transportation, distance/travel time to retail outlets) create added barriers to healthiness (Dean & Sharkey, 2011 a,b; McLeroy, Bibeau, Steckler, & Glanz, 1988; Smith et al., 2010). As stated elsewhere, the effects of location, income, availability, and racism may be more detrimental for persons of color (McLeroy et al., 1988, Walker & Cunningham, 2014). Although the survey for which this study relies upon for data did not collect detailed enough information for respondent diet to be analyzed, it deserves attention in this review because diet is a significant factor in diabetes and a driver of positive or negative disease outcomes.

Psychological complications and comorbidities of diabetes

As extensive as the physical complications of diabetes are, individuals diagnosed with the illness may also encounter a number of mental, emotional, and psychological challenges especially if they feel alone or that they must keep their diagnosis a secret. There is a well-established association between diabetes and depression in the extant literature. Quiñones, Liang, and Ye (2013) reported that diabetics are in fact at an increased risk for depression. Ahn et al. (2012) found supporting evidence and reported that individuals with mild or greater depression (p = .009) commonly held dual diagnoses of diabetes and obesity (p. 126).

In a highly relevant study, Bell and colleagues (2005) analyzed data from the Evaluating Long-term Diabetes Self-Management Among Elder Rural Adults (ELDER) study that sampled men and women of multiple racial/ethnic backgrounds ages 65 and older, residing in rural North Carolina. The authors assessed depression using the Center for Epidemiologic Study of Depression (CES-D) scale with a cutoff score of ≥ 9 to signify depression. They reported 15.8% (n = 696) of the sample had depressive symptoms (p. 823). Their results demonstrate a high risk for depressive symptoms in older rural adult diabetics regardless of their racial/ethnic background (p. 823). They did find that sex, education level, number of chronic conditions, BMI, and marital status were key personal characteristics that factored into this association such that being female, having less than a high school education, multiple chronic conditions, elevated BMI, and being unmarried led to an increased likelihood of experiencing depressive symptomology. In most cases multivariate analyses showed these characteristics to be statistically significant (p. 823). Bell and colleagues' (2005) study is especially pertinent for review as it dealt with a rural, elderly population and identified links between diabetes and depression via traits common to the sample used in the current study.

Diabetes and depression. Although diabetes and depression have an established connection in the existing literature, results are mixed and somewhat contradictory concerning the nature and significance of the relationship. One contributor to the lack of consensus is the use of a wide range of instruments used to assess depression, as well as the semantic or actual differences in diagnosed individuals' experience(s) of clinical depression, depressive symptomology, or distress over their illness. Conclusions drawn from Mezuk and colleagues' (2013) study offer one example of different results being obtained as a result of the use of different measures. Their study investigated the relationships among type 2 diabetes, generalized anxiety disorder (GAD), and major depression. Results demonstrated associations between “clinically-identified but not screen-detected” type 2 diabetes and major depression, an association between GAD and both (p. 511). In other words, the relationship between diabetes and mood symptoms (e.g. depression or anxiety) varied depending on how diabetes had been diagnosed. In addition, their finding that the link between major depression and type 2 diabetes is strongest when the diagnosed individual is not obese, stands in contrast to other extant research (Mezuk et al., 2013).

Fisher and colleagues (2007) conducted research to further investigate the difference in depression diagnoses based on the instrument selected. The authors examined diagnostic outcomes for major depressive disorder (MDD) using: a structured interview-Composite International Diagnostic Interview (CIDI), symptom questionnaire-Center for Epidemiological Studies Depression Scale (CESD), and a distress measure-Diabetes Distress Scale, with diabetic patients. Their results produced very different and inconsistent results especially when comparing the CIDI and CESD. Some patients reached cut points who were not clinically depressed, while others who were clinically depressed did not reach cut points. The authors concluded, “Diabetes distress was minimally related to MDD but substantively linked to CESD scores and to outcomes. Most patient with diabetes and high levels of depressive symptoms are not clinically depressed” (p. 542). In other words, it appears from the results that CESD scores better indicate general emotional and diabetes-related distress vs. clinical depression (p. 542). Franks, Lucas, Stephens, Rook, and Gonzalez (2010) extend these results with their conclusion that “diabetes distress was associated with depressive symptoms more strongly for male than for female patients” (p. 599).

Chiu, Wray, Beverly, and Dominic’s (2010) study utilized structural equation models (SEM) and demonstrated that health behaviors accounted for 13% of the link between depressive symptoms and glycemic control in adults with type 2 diabetes, a statistically significant association (p. 67, 73). These authors, whose study was longitudinal in design, also concluded that continuous or consistent depressive symptoms were more indicative of general and diabetes-specific distress rather than clinical depression (Chiu, Wray, Beverly, & Dominic, 2010; Fisher et al., 2008; Fisher et al., 2007; Gonzalez et al., 2007). In sum, these studies demonstrate the impact of instrument selection on results obtained. Varying results or conclusions may be drawn depending on how key constructs are measured. Furthermore, these studies highlight the conflation of diabetes distress with clinical depression or anxiety within extant research. The current body of literature does not provide strong evidence of discrete diagnoses between diabetes-related distress and depression or anxiety.

A common research concern regarding the association between diabetes and depression is the difficulty in distinguishing between distress over diabetes, and clinical depression or depressive symptoms. Any chronic illness requires a number of life-altering changes in order to successfully manage the condition, which is a challenging process for anyone and often impacts many areas of their lives. That being said, some level of distress often accompanies this adjustment process to a new way of living and sometimes a new way of viewing oneself (e.g. integrating one’s illness into their identity). The question then becomes how is this distress different from depression or depressive symptoms, or are they the same? Additionally, it can be difficult to determine directional influences of either condition; is the depression/depressive symptomology worsening diabetes complications, or are diabetes complications leading to depressive symptoms? To reiterate there is currently a lack of consensus in existing literature. Additional research is needed to address these questions. The current study aims to address some of these gaps by providing additional information on the relationship between diabetes and depression in a rural-residing population using a different instrument.

Diabetes and anxiety. An additional understudied area that the current study aims to contribute to is the potential link between diabetes and anxiety. Although much research has been conducted that details the connection between diabetes and depression, there is still a dearth of literature concerning the role of anxiety and its impact, likely bidirectional, on the disease. It would seem as though this would be a logical area of inquiry to pursue given both the well-established frequent co-occurrence of anxiety and depression in individuals, as well as the reasonable conclusion that the numerous and stringent lifestyle modifications required for successful diabetes management could result in the appearance or increase of anxiety symptoms. In fact, Smith and colleagues (2013) conducted a meta-analysis to investigate the understudied area of comorbidity between anxiety and diabetes, given that anxiety has already been linked to poor outcomes in diabetics. The authors found evidence of significant associations between diabetes and anxiety symptoms and disorders such that a diabetes diagnosis increased the likelihood of the presence of an anxiety disorder, and the elevation of anxiety symptoms. A recent study conducted by McDade-Montez and Watson (2011) used a multiple sample confirmatory factor analysis to explore whether diabetes is correlated with an increased probability of co-morbid anxiety. Results suggested that symptoms of the two conditions often overlapped and related to mood disturbance in persons with and without diabetes. The McDade-Montez and Watson (2011) study failed to identify a substantial unique contribution by diabetes. It is apparent that further research is needed to more clearly describe the co-occurrence of mood disturbances such as depression and anxiety, with diabetes. The current study seeks to add information that will aid in clarifying these relationships.

Impact of culture. Another often-overlooked but important consideration in understanding the effects of diabetes diagnosis on one's health is the impact of culture. In certain cultures mental illness itself is shunned let alone disclosing symptoms, feelings, or experiences of mental distress to authority figures such as healthcare providers (Bhattacharya, 2012). Some cultures would view such disclosure as shameful, and in certain instances that shame would extend beyond the individual to their family as well. In particular, Latino and African American communities may exert intragroup conformity pressure against "airing dirty laundry", and instead encourage alternatives such as prayer, counsel with religious/spiritual leaders, or just carrying on (e.g. ignoring or working through it). If one experiences this type of pressure or response, this could result in underreporting. Moreover, rural African Americans in Arkansas reported "doubts about their ability to make the lifestyle changes" necessary to successfully manage their diabetes (Bhattacharya, 2012, p. 1074). Specifically, they expressed themes of “distress, concern, helplessness, challenge, fatalism, and hopelessness” upon receiving a type 2 diabetes diagnosis. The author points out that “a sense of hopelessness may hinder treatment seeking” (pp. 1073-1074) in a population that already underuses health services overall.

Furthermore, different cultures have different sets of knowledge and beliefs about diabetes that guide their behavior (Skelly et al., 2006). For example, some people who begin to feel down or depressed may interpret discussing that with a healthcare professional, or even acknowledging those feelings to be giving in, giving up, or letting the disease take over. In their mind it may be better to dismiss those feelings and carry on as a way of fighting back and assuring themselves of their ability to continue to take care of themselves (Bhattacharya, 2012; Carter-Edwards, Skelly, Cagle, & Appel, 2003; Hammond, 2010). For individuals who do seek assistance with disease management, there may still be limited options based on their perception(s) of acceptability, above and beyond accessibility.

In Cooper and colleagues’ (2003) study on depression, they found racial/ethnic differences in the acceptability of different treatment modalities: both Hispanics and African Americans were less likely than Whites to find antidepressant medication acceptable; but Hispanics were more likely to find counseling acceptable than Whites. Alternatively, racism or discrimination embedded into the healthcare system could result in misdiagnosis, delayed diagnosis, or no diagnosis at all for those who do seek treatment (Braveman et al., 2011; Feagin, 2006; Hammond, 2010; Hylton, 2008; Peek, Tang, Cargill, & Chin, 2011; Ridley, 2005). Relatedly, Ell and colleagues (2010) observed improvement in depression and functional outcomes when a culturally adaptive, collaborative care model was used with Hispanics diagnosed with diabetes. Based on this data and Cooper and colleagues' (2003) study, it seems apparent that cultural beliefs, particularly concerning mental health, need to be integrated into the development of treatment plans when working with individuals with diabetes.

Social support and diabetes

When considering the role of culture and its influence on diabetics' mental health, the role of social support and social environment come into view as important considerations as well. Cultural congruence; defined as fit among the diagnosed individual's worldview, understanding of the disease, support system, and the chosen treatment plan, is critical for treatment adherence. An understanding and incorporation of those elements by healthcare providers is essential for effective treatment planning. When treatment goals, plans, and interventions are aligned with an individual's beliefs and values, it increases the likelihood that their culture and social system (e.g. friends, family) can, and will support healthful behaviors and assist them in successful management of their disease (Skelly et al., 2006).

A discussion of the social context within which an individual diagnosed with diabetes exists is highly important. For the present study in particular, the social landscape represents a critical personal variable that can positively or negatively influence disease outcomes in light of its impact for the vulnerable populations being examined: rural residents, racial/ethnic minorities, and elderly. The U.S. Department of

Health and Human services notes that health disparities in the form of health outcomes are closely tied to socioeconomic and environmental disadvantage, which is driven by the social conditions in which one experiences life over the course of their lifetime (DHHS, 2011).

Ahn, et al. (2012) endorsed a similar life course perspective in reporting on racial/ethnic health disparities, "The deterioration of health among aging African-Americans can also be understood as a byproduct of biological and physiological burdens" (p. 129). They highlighted the greater susceptibility to liver damage, the multisystem response to stressors that creates heightened physiological burdens, and decreased exposure to environments supporting healthy living in comparison to White counterparts. In addition, the authors referenced prior research that "found that African-Americans who were socially disadvantaged ate less fruits and vegetables and performed less physical activity…than their white peers" (Ahn, et al., 2012, p. 129). As previously mentioned maintenance of a healthy balanced diet and regular physical activity are central to any diabetes treatment plan, and this data presents information on a social climate that does not support these necessary habits. Finally, the authors commented on the enduring systemic inequities remarking on the health impacts of lower educational attainment, greater exposure to occupational hazards, and disproportionate unemployment experienced by African Americans. Latinos, as a group, face a number of these same challenges.

For persons of color in particular, coping and disease management models that emphasize individualism may prove ineffective and incongruent with how their lives otherwise operate. Nevertheless some individuals may feel uncomfortable or unaware of an effective way to communicate this lack of fit with healthcare providers. Bhattacharya (2012) elaborated on these points, noting that one's struggles or inability to adhere to recommended guidelines for disease management is often framed as a "personal failure" (p. 1080). Latino, African American, and other racial/ethnic minorities cultures tend to emphasize collective decision-making more than Whites; yet literature on coping has tended to emphasize individualistic approaches (e.g. personal agency and action) (Folkman & Moskowitz, 2004). The current study will specifically examine the influence of marital and caregiver social statuses so that will be the primary focus of this review. However, it is necessary to comment briefly on the role of social support more broadly as well.

Older adults comprise a large portion of rural populations and also account for the majority of diabetes incidence. "Social networks are essential to successful aging because they provide embeddedness in systems of norms, control, and trust" (Coleman, 1988 as cited in Cornwell, Laumann, & Schumm, 2008, p. 186). Likewise Cornwell, Laumann, and Schumm (2008) found support for community involvement for successful aging. In addition, gender differences with regard to what characterizes successful aging, particularly as it pertains to social needs have been well established in the literature (Barnes, Mendes de Leon, Bienias, & Evans, 2004; Carter-Edwards, Skelly, Cagle, & Appel, 2003; Cornwell, Laumann, & Schumm, 2008; Skelly et al., 2006). Nonetheless decreased contact with social networks has been linked to poor health particularly in males as opposed to females (Cornwell, Laumann, & Schumm, 2008; van Tilburg & van

Groenou, 2002). Social isolation inhibited individuals' ability to make the necessary lifestyle modifications to properly manage their diabetes (Bhattacharya, 2012). In terms of the family system there are multiple layers and members involved. Adult or older children may begin to take on a caregiver role for their parents or other aging relatives, and if spouses have to take on a caregiver role that can shift expectations, communication, and other aspects that previously characterized the relationship(s). Declines or changes in an individual's health status can increase or decrease the strength of familial relationships. Often this interacts sharply with culture with regard to expectations and problem-solving about continuous care needs or living accommodations.

Diabetes and marriage. Because diabetes is a lifestyle illness that affects many aspects of a diagnosed individual's life, including their relationships, exploration of marital status seemed like a reasonable area of inquiry to include in the present study and this review. The CDC reports that social support may be a factor in decreasing lifestyle risk factors associated with a diabetes diagnosis; and data from the 2012 National Health Interview Survey revealed the lowest percentage of diabetes diagnoses by marital status, in married individuals (CDC/NCHS, 2012). However, poor marital quality has been correlated with responses from the immune and metabolic systems that could create proximal and distal diabetes-related complications (Whisman, Li, Sbarra, & Raison, 2014). Whisman and colleagues (2014) operationalized poor marital quality as rates of positive and negative partner exchanges. Poor marital quality was associated with increased prevalence of diabetes in men, suggesting that it may be a unique risk factor for diabetes. Again, it is important to note that the relationship between marital status and health has been shown to vary by gender. Schwandt, Coresh, and Hindin (2010) found that being unmarried was linked to an increased probability of developing diabetes for women and an increased likelihood of death for men.

One study detailed by Roberts (2002) found evidence that people married longer who perceived experiencing a high quality marriage, felt that diabetes disrupted their lives less, expressed less distress, and better controlled their blood sugar levels. Yet, Trief, Wade, Britton, and Weinstock's study that same year found no predictive ability of marital status to either health-related quality of life (HRQL) or glycemic control. A fair amount of current research suggests that marital satisfaction, quality, and adjustment is correlated with diabetes-related quality of life and adjustment (e.g. intensity and type of complications, experience of distress for diagnosed individual) (Beverly, Penrod, & Wray, 2007; Beverly, Wray, & Miller, 2008; Trief, Himes, Orendorff, & Weinstock, 2001; Trief, Sandberg, Dimmock, Forken, & Weinstock, 2013; Whisman, Li, Sbarra, & Raison, 2014; Yorgason, Roper, Sandberg, & Berg, 2012).

Additional research investigating diabetes and marital status has centered on such topics as: communication within a marriage wherein one or both partners are managing a chronic illness; tools for spouses to manage expectations about assisting/being assisted; exploration of the impact of the illness for younger adults/couples particularly concerning decisions to have children or marry; sexual dysfunction and health related to diabetes; and other relational topics which are important but beyond the scope of this review. Overall, the extant literature has produced mixed results and does not allow clear conclusions to be drawn. Nonetheless, there seems to be agreement that having a supportive system of individuals, particularly one's spouse with whom a diagnosed individual can honestly, openly communicate about their needs for help, feelings (including fear or distress), and develop (and carry out) lifestyle changes, improves diabetes-related outcomes and maintains a high level of quality of life for a person with diabetes. Still, despite the range of topics being explored there is still a dearth of quantitative data concerning the role of social support in general, and marriage in particular as it relates to diabetes course. Much of the data that currently exists on marriage and family within the diabetes literature is derived from qualitative studies, but quantitative data would be an excellent supplement and manner in which to refine and confirm conclusions drawn; this is a gap the current study aims to contribute to.

Diabetes and caregiving. Another unique social support role that has been mentioned but deserves focused attention is that of the caregiver. The caregiver in this study refers to the diabetic individual caring for someone else. There are well established links in the literature between caregiver roles and the physical, emotional toll that it can have on someone including: experience of depressive or anxious symptoms, weight fluctuations, changes in sleep or diet, and potentially elevated risk for the very condition(s) they are assisting others to manage. A thorough exploration of caregiver literature is beyond the scope of this review but it is important to highlight key facts and findings that incorporate the intersectionality mentioned earlier and underscore the need for a holistic health approach to the treatment of diabetes.

Culture will influence one’s stress appraisal, coping style, availability of supports, and use of supports (Aranda & Knight, 1997). The Cultural Justifications for Caregiving Scale (CJCS) has been found reliable for use with White and African American caregivers, and could be a useful tool for healthcare providers to utilize with families for treatment planning (Powers & Whitlatch, 2014). An exploratory factor analysis of the CJCS revealed Duty and Reciprocity as the two most important themes related to caregiving although the authors acknowledged the impact of family expectations and religious beliefs on decision-making (Powers & Whitlatch, 2014). Persons of color caring for older persons of color with chronic illnesses such as diabetes face additional challenges because: populations of color are at greater risk of developing chronic diseases, onset often occurs at earlier ages, and severity is often worse.

In a unique extension of cultural considerations related to caregiving, Lahaie, Earle, and Heymann (2013) conducted a study to examine the experiences of working adult caregivers in the U.S., specifically those caring for an older adult. Their foci were whether employed caregiving (e.g. caregivers who also work) varied by demographic background and whether working environment/conditions and quality of life varied by specified personal variables. They identified no difference by sex of being an employed caregiver, but did find that women averaged more time spent caregiving vs. men (Lahaie, Earle, & Heymann, 2013). The same study found no differences by race/ethnicity of being an employed caregiver; but did find that the employed caregivers group was comprised primarily of individuals with only a high school diploma (in comparison to employed non-caregiver peers) (Lahaie, Earle, & Heymann, 2013).

Female caregivers and those with lower educational attainment were more likely to report worse job outcomes (e.g. wages lost, need to quit), and lower quality of life due to interference because of caregiving responsibilities (Lahaie, Earle, & Heymann, 2013). These data relate significantly to the population being explored in the current study as many individuals in the sample have high school education or less, and women in particular are affected by higher unemployment in the rural context. Decisions concerning caregiving may be impacted by these factors and healthcare providers need to consider them when treatment-planning.

Rationale for the present study

Although numerous studies document the mental and physical health complications that accompany diabetes, a number of gaps remain. There is a lack of research exploring the potential connection between diabetes and anxiety, a lack of clear understanding about the nature of the relationship between diabetes and depression, a lack of research that focuses on the comorbidity of diabetes, obesity, and depression; and a lack of quantitative data concerning the role of social status in diabetes. Broadly, there is a dearth of literature that captures and communicates the experiences of rural-residing individuals diagnosed with diabetes, particularly elder and racial/ethnic minority subgroups of this population. The literature that does exist about these populations tends to be qualitative, or focused solely on physical health. The determinants of documented disparities among elderly diabetics and diagnosed persons of color, are understudied and not well understood. This has resulted in a lack of agreement about how to approach treatment or explain the disease’s progression (Ma et al., 2012). Existing research on diabetes in these populations is elementary and further work is needed in order to reach firmer and better-substantiated conclusions.

If the current pace persists, by 2050 1 in 3 adults will be diagnosed with type 2 diabetes (Quiñones, Liang, & Ye, 2013). “A person with diabetes has a shorter life expectancy and about twice the risk of dying on any given day as a person of similar age without diabetes” (NCCDPHP, 2014). However, there is hope; “findings show that the majority of diabetes cases are preventable” (Ma et al., 2012, p. 2226). The CDC lists as one of its stated goals in line with reducing disparities, is to prevent diabetes in members of the highest risk populations (NCCDPHP, 2014). In order to carry out this goal it is necessary to identify these populations, which the current study helps to do. In addition, results of the current study will help educate both healthcare providers and the general public about the best self-management practices for diabetes through deeper examination of the role of social support/status, and its interaction(s) with the physical and psychological complications of the disease. This is in line with additional goals set by the CDC in terms of diabetes prevention and control.

Greater depth and breadth of knowledge concerning the indicators and progression of diabetes within various demographic groups can help healthcare providers target preventive services and develop tailored interventions that have a greater likelihood of success. Although other studies have explored the relationships between diabetes and race/ethnicity, sex, and even social status, few have examined these demographic variables in tandem, or from a quantitative framework. We could not identify any studies that investigated the health of individuals diagnosed with diabetes within the rural context, in the manner that this study will. The current study will highlight the understudied population of rural-residing individuals, and in particular shed light on additional considerations relevant for the treatment of rural racial/ethnic minorities managing diabetes. This study will examine the relationships between depressive symptoms, anxiety symptoms, BMI, subjective health, and diabetes. This research will extend existing literature by illuminating relationships among diabetes, obesity, and depression. The potential moderating role of marital and caregiver statuses will also be explored.

Research questions

This research will attempt to address the following questions:

1. What characteristics (age, sex, race/ethnicity, educational attainment, marital status, caregiver status, household income) comprise a sample of diabetics in rural Central Texas?
2. Do depression symptoms, anxiety symptoms, and body mass index (BMI) predict diabetes in a sample of individuals living in rural Central Texas?
3. What is the role (moderator) of the following social statuses: marital status, caregiver status in the relationship between diabetes and mental health indicators (subjective health, depression symptoms, anxiety symptoms); and diabetes and the physical health indicator, body mass index (BMI)?
4. What is the role (moderator) of the following demographic characteristics: race, ethnicity, gender in the relationship between

diabetes and mental health indicators (subjective health, depression symptoms, anxiety symptoms); and diabetes and the physical health indicator, body mass index (BMI)?

CHAPTER III

METHOD

Participants

The current study is derived from a secondary dataset from a regional triennial health survey of the Brazos Valley conducted by the Center for Community Health Development (CCHD), the Brazos Valley Health Partnership (BVHP), and its community outreach program. The CCHD is a collaborative effort established in 2004 between the Texas A&M Health Science Center and the Centers for Disease Control and Prevention (CDC), that aims to use research, education, and experience to improve population-level health status through community development approaches. There is an emphasis on low-income and disadvantaged segments of the rural population. The BVHP is a non-profit incorporated in 2009 whose mission is to collectively develop, and locally implement strategies to address health disparities across the rural Brazos Valley; with an emphasis on resource development and access improvement for residents (BVHP, n.d., CCHD, 2013). The data analyzed in the present study was drawn from the fourth comprehensive regional health assessment conducted by these organizations during the past eleven years (CCHD, 2013). The three prior assessments identified: factors affecting health status, community-level needs (both met and unmet), current local resources, local health priorities, and finally tracked/compared health status indicators over time.

Participants for the current study were individuals residing in the seven counties that comprise the Brazos Valley. A total of 5,230 individuals agreed to participate and returned the survey packet, of which 3,200 came from the Brazos Valley. Overall a response rate greater than 50% was achieved. Participants identified with various racial/ethnic backgrounds including: White, African American, Hispanic, Asian/Pacific Islander/Hawaiian Native, Native American/Alaskan Native, and multiracial. Given the purposes of the present study, analyses were restricted to responses from participants who self-identified as: Black (hereafter referred to as African American), White, or Hispanic/Latino/Spanish origin (hereafter referred to as Hispanic or Latino). Participants were a minimum age of 18 years, with some over the age of 65. Respondents included males and females as well as varied educational, occupational, and income levels.

The current study focuses on individuals diagnosed with diabetes residing in the Brazos Valley, as such the sample analyzed was further limited to those who selected *Diabetes (high blood sugar)* as their response to the following question: *Has a medical care provider (physician, nurse practitioner or physician assistant)* ***EVER*** *told you that you had any of the following health problems?* Directions explicitly stated that woman should answer no if they were told they had diabetes only during pregnancy. The final sample resulted in *n* = 489 individuals (15.3%) who self-reported a diagnosis of diabetes; 20.7% of whom identified as non-White racial/ethnic minorities (*n* = 101). The sample was fairly balanced in terms of gender with females accounting for 59.1% (*n* = 289). The majority of individuals with diabetes reported being over the age of 65 (*n* = 245, 50.1%) with an average age of 60.7. Most were married (*n*=317, 64.8%), educated beyond high school (*n*=284, 58.1%), and did not endorse caregiver (*n* = 405, 82.8%) status. Of those diagnosed, the average calculated BMI, (*M* =33.02, *n* = 477) falls into the obese category as defined by the CDC (NCCDPHP, 2014). In addition, the diabetic sample reported experiencing depressive or anxious symptoms more frequently than did those participants without diabetes

Health survey

Preparation and planning for the survey began in November 2012 and data collection and analysis for the regional survey was completed in August 2013 (CCHD, 2013). The final 24-page document resulted in a self-reported health status assessment comprised of 71 questions. Participants provided demographic information, medical history, and responded to items related to: engagement in physical activity, transportation, diet, mental health status, insurance, and social networks or status (e.g. civil status, caregiver status). Participants were also asked to comment on community demographics and local healthcare services. The health survey was distributed across nine south-central Texas counties: Brazos, Burleson, Grimes, Leon, Madison, Montgomery, Robertson, Walker, and Washington. For the purposes of this study, only data obtained from the seven counties that comprise the Brazos Valley will be used. This includes six rural and one micropolitan county, Brazos, as defined by the U.S. Office of Management and Budget and U.S. Census Bureau (Brossart et al., 2013) and excludes Montgomery and Walker county data from analysis.

Procedure

A regional health survey as aforementioned was distributed to households across nine primarily rural counties (results included here refer only to data obtained from the Brazos Valley participants). Based on population estimates, a target number of completed surveys was determined for each county. 15,000 households were randomly selected from a comprehensive list and mailed letters to inform them of their selection followed by telephone recruitment one week later. During that phone call, the adult member of the household with the next birthday was invited to participate to further increase randomization (CCHD, 2013). Participants were provided the option to complete the survey as written in English or Spanish. Data from the survey was entered into SPSS and Microsoft Excel.

Measures

Demographics. Demographic information was collected from participants for descriptive purposes. Information obtained included: race/ethnicity, sex, age, level of educational attainment, annual income, marital status, and employment status, among other items.

Physical health indicators. Physical health was assessed using each individual's calculated body mass index (BMI). BMI is a ratio of height to weight expressed a kg/m^2. BMI is a frequently used weight status indicator. However, this measure does not account for individual variations in bone or muscle mass. These variations have been shown in some studies to differ based partly on one's racial/ethnic background so the use of this measure has been criticized (CCHD, 2013; Wong et al., 2014). The National Institute of Health guidelines for the five weight categories ranging from Underweight to Morbidly Obese, were used to characterize individual responses.

Psychological health indicators. Psychological health was assessed using responses to: Patient Health Questionnaire-2 (PHQ-2) and Generalized Anxiety Disorder-7 (GAD-7).

Depression. The PHQ-2 (Kroenke, Spitzer, & Williams, 2003) is a clinical tool used to screen for depression by inquiring about the frequency of anhedonia: disinterest and lack of pleasure in formerly enjoyable activities, and depressed mood during the past two weeks. It is derived from the Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2003; Kroenke, Spitzer, & Williams, 2001), a more thorough diagnostic tool. The 2-item scale asks: *Over the past 2 weeks, how often have you been bothered by any of the following problems? Little interest or pleasure in doing things; Feeling down, depressed, or hopeless.* A 4-point scale ranging from 0 (*Not At All)* to 3 (*Nearly Every Day)* anchored each item. PHQ-2 scores range from 0-6, with a cutoff score of 3 meaning that a score ≥ 3 indicates the possibility of depression that should be further investigated. Kroenke, Spitzer, & Williams' (2003) statistical analyses demonstrated strong psychometric properties of the PHQ-2 which displayed true positive and true negative rates (correctly identifying those with depression and correctly identifying healthy individuals or those without depression), both greater than 80%.

Anxiety. The GAD-7 is a clinical tool used as a screening and severity measure for Generalized Anxiety Disorder (GAD) (Spitzer, Kroenke, Williams, & Lowe, 2006). It has also been demonstrated to have fairly good utility in screening for certain specific anxiety disorders such as panic disorder or social anxiety disorder, (Spitzer, Kroenke, Williams, & Lowe, 2006). GAD-7 scores range from 0-21, with a cutoff score of 10 to identify cases of GAD. “At a cut point of 10 or greater, sensitivity and specificity exceed 0.80, and sensitivity is nearly maximized” (Spitzer, et al., 2006, p.1094). Both internal consistency and test-retest reliability of the GAD-7 were very good, coefficient alpha for internal consistency was α = .92 and the intraclass correlation (ICC) = 0.83 (Spitzer, et al., 2006). The 7-item scale asks: *Over the past 2 weeks, how often have you been bothered by any of the following problems? Feeling nervous, anxious, or on edge; Not being able to control or stop worrying* and features five additional items. “Cut points of 5, 10, and 15 might be interpreted as representing mild, moderate, and severe levels of anxiety” (Spitzer, et al., 2006, p. 1095).

Social status. Social status was evaluated by observing an individual’s response to two single-items on the questionnaire. The first examined the respondent’s civil status: *Which of the following best describes your marital status?* Respondents were asked to select from the following options: *Married (1), Widowed (2), Divorced/Separated (3), Single never married (4), Living with partner not married (5).* Secondly, participants’ caregiver status was assessed using a single-item preceded by the following directions: *People may provide regular care or assistance to a friend or family member at home who has a long-term health problem or disability (for example, not including temporary conditions). During the past month, did you provide such care or assistance to a family member or friend?*

Subjective health. Participants’ subjective health status was assessed using a single-item indicator: *In general, would you say your health is: Excellent (1), Very good (2), Good (3), Fair (4), Poor (5).* Idler and Benyamini (1997) reviewed twenty seven community studies in the U.S. and abroad which consistently produced results demonstrating that self- evaluations of health status are good predictors of mortality, in some cases better than the presence of health problems or lifestyle factors. Additionally, such self-perceptions shed light on the psychosocial factors affecting one's health. The studies examined in Idler and Beyamini's (1997) review bear similarity to the current study in important other ways beyond the inclusion of a self-rated health item; they all used community vs. patient samples, and most examined chronic diseases and collected additional health indicator information. DeSalvo, Fan, McDonnell, and Fihn (2005) offered additional support for the use of a single-item subjective health indicator in the current study. Notably, their self-rated health item contains identical wording and scale to that used in the Brazos Valley health survey. Collectively DeSalvo, et al. (2005) concluded participants' responses to a single-item self-evaluation of health status was strongly linked to mortality even when controlling for other key factors such as ability status or comorbidities.

CHAPTER IV

RESULTS

The purpose of this study was to examine the relationships between psychological and physical health indicators and diabetic status, for rural-residing individuals diagnosed with diabetes. The potential moderating role of social status on these relationships was also examined. In addition, this study aimed to explore the relationships among depression, diabetes, and obesity. The variables of interest were selected, and research questions developed, to add to the current canon of research on diabetes and mental and physical health. (See Rationale section for additional details regarding timeliness and relevance.) The following research questions provided a framework for inquiry:

1. What characteristics (age, sex, race/ethnicity, educational attainment, marital status, caregiver status, household income) comprise a sample of diabetics in rural Central Texas?
2. Do depression symptoms, anxiety symptoms, & body mass index (BMI) predict diabetes in a sample of individuals living in rural Central Texas?
3. What is the role (moderator) of the following social statuses: marital status, caregiver status in the relationship between diabetes and mental health indicators (subjective health, depression symptoms, anxiety symptoms); and diabetes and the physical health indicator, body mass index (BMI)?
4. What is the role (moderator) of the following demographic characteristics: race, ethnicity, gender in the relationship between diabetes and mental health

indicators (subjective health, depression symptoms, anxiety symptoms); and diabetes and the physical health indicator, body mass index (BMI)?

Question one was addressed by conducting descriptive analyses, frequencies, and using analysis of variance (ANOVA) tests to compare group means (i.e. diabetic and non-diabetic). Question two was examined using logistic regression analysis due to the dichotomous nature of the outcome variable, diabetic status, and the goal to determine whether the other variables (i.e. depression and anxiety symptoms, BMI) predicted diabetic status. This analysis fit with the scale of data and also is a commonly used method for studies including physical health outcomes. The third and fourth research questions were explored using path analysis, which allows one to test a theoretical model and determine its fit with actual data, particularly when only observed variables (vs. latent variables) are being investigated. Moderators were examined using interaction terms. The path coefficients allow one to determine which relationships are best supported by extant research.

The current study is derived from a secondary dataset from a health assessment of the geographical area designated as Regional Healthcare Partnership 17 (RHP 17) conducted by the Center for Community Health Development (CCHD), the Brazos Valley Health Partnership (BVHP), and its community outreach program. The RHP 17 spans the following nine counties in South Central Texas: Brazos, Burleson, Grimes, Leon, Madison, Montgomery, Robertson, Walker, and Washington. The sample for this study was comprised only of those individuals residing in the seven-county region known as the Brazos Valley who voluntarily participated in a regional household health survey. Participants represented a diverse range of demographic background characteristics. Still, the final sample over represents White, female, higher socioeconomic class, and individuals with more years of education. Likewise, the sample underrepresents lower income and racial/ethnic minority individuals. This is typical of survey research and will be discussed further in the section detailing limitations of the current study.

Descriptive statistics

General (non-diabetic) population. One of the primary aims of this study was to identify and describe key characteristics of the rural residing diabetic population in the Brazos Valley. The data that follows represents a summary of such defining characteristics of this population. Approximately 5,230 people completed the regional health assessment (CCHD, 2013, p. 4-5), which produced usable data representing 5,065 individuals. 3,200 (63.2%) were Brazos Valley residents with representation from each of its seven counties (see Table 1). The amount of missing data across all of the variables examined was less than 10%. Missing data were noted across multiple variables and deleted listwise such that each case had the same data. The remaining data was sufficient for strong statistical analyses.

Table 1

Survey response by county.

County	Total Surveys Completed[a]	% of Brazos Valley Sample
Brazos	1,560	48.8%
Burleson	233	7.3%
Grimes	242	7.6%
Leon	231	7.2%
Madison	158	4.9%
Robertson	226	7.1%
Washington	550	17.2%

[a] Residence was not indicated on all surveys

The assessment included participants representing multiple racial and ethnic backgrounds. See Table 2 for demographic breakdown. There was unequal gender representation such that female participation was greater; 66% (n = 2,112). The majority of respondents were age 45-64 (48.8%, n = 1,560) and the average age overall was 58.75. However, the median age was 61 and the most commonly reported age was 66. The majority of individuals were married (73.2%, n = 2,343), had attained education beyond high school (68.3%, n = 2,187), and were currently unemployed (52%, n =

1,664). The median annual household income was $45,000 and the average was $61,160.83. A fair amount endorsed caregiver (*n* = 485, 17.9%) status.

Table 2

Survey response by race and ethnicity

Race/Ethnicity[a,b]	Total Surveys Completed[c]	% of Brazos Valley Sample
Asian/Pacific Islander	26	.8%
Black/African American	215	7%
Native American/Alaskan Native	17	.6%
White	2,739	88.9%
Multiracial	83	2.6%
Hispanic/Latino	203	6.7%

a. Race/ethnicity was not indicated on all surveys
b. Race and ethnicity tabulated separately for each participant (e.g. Black/Hispanic or Black/Nonhispanic)
c. Sample size for the first five categories was *n* = 3,080 and sample size for Hispanic/Latino was *n* = 3,047

Diabetic population. Participants were asked to self-report their diabetic status using a single-item indicator. Specifically, participants were prompted to indicate whether a medical provider has ever told them that they have diabetes; to which the majority said no (84.7%, *n* = 2,711). Still, the 15.3% (*n* = 489) who reported a diabetes diagnosis is a growing portion of the population both in the Brazos Valley and beyond.

When the diabetic subset (*n* = 489) is more closely examined, many characteristics of the larger sample are replicated as well as some data that reflects poorer health outcomes.

Individuals who identified as diabetic were found in all of the counties that comprise the Brazos Valley. The largest portion of individuals with diabetes came from Brazos county (*n*=203, 41.5%), followed by Washington (*n*=85, 17.4%), and Grimes (*n*=51) counties. Gender distribution was fairly balanced in the diabetic subset; females accounted for 59.2% (*n* = 289) of participants. Although the majority of diabetic individuals identified as White (*n* = 388, 83.6%), Black/African American (*n* = 57, 12.3%) and Hispanic/Latino individuals (*n* = 39, 8.6 %) were over represented in comparison to their representation in the greater population. Black/African Americans account for 7% of the Brazos Valley respondents and Hispanic/Latinos account for 6.7%.

The majority of individuals with diabetes reported being over the age of 65 (*n* = 245, 51%) with an average age of 60.7 and a median age of 65. No diabetic participants reported being age 18-24. Similar to the general population, individuals who indicated a diabetes diagnosis tended to be female (*n*=289, 59.2%), married (*n*=317, 64.8%), and educated beyond high school (*n*=284, 59.5%). A larger proportion of diabetics were caregivers (*n* = 76, 15.5%) in comparison to non-diabetics. Although the majority of individuals with diabetes reported being unemployed (*n* = 329, 67.3%), unlike the general population, their mean and median annual household incomes (mean= $43,616.28, median= $25,000) were notably lower in comparison to non-diabetic counterparts residing in the Brazos Valley.

Comparative health outcomes. Table 3 below summarizes the dispersion of the mental and physical health indicators investigated in the current study, and provides a side by side comparison of diabetic and non-diabetic groups.

Table 3

Means and standard deviations of study variables by diabetic status

	Diabetic			Non-diabetic		
	n	*Mean*	*SD*	*n*	*Mean*	*SD*
Subjective health	472	3.28	.94	2637	2.40	.95
BMI/obesity status	477	33.02	7.97	2636	28.06	6.29
Depressive symptoms (PHQ-2 score)	481	1.07	1.62	2680	.70	1.30
Anxious symptoms (GAD-7 score)	484	3.71	5.02	2689	2.93	4.07

Subjective health. Participants were asked to self-report their overall health status using a single-item indicator; *In general would you say your health is: Excellent (1), Very good (2), Good (3), Fair (4), Poor (5).* Most non-diabetic individuals reported that they were in Very Good (42.9%, n = 1,132) or Good (29%, n = 765) health, whereas diabetic persons reported that they were in Good (n = 194, 41.1%) or Fair (n = 140, 29.7%) health. These data suggest that by comparison, diabetic individuals are experiencing a slightly lower level of overall health. A statistically significant association of medium strength was observed between diabetic status and subjective health report, $\chi^2(4, N = 3109) = 325.2, p < .001$; ($\phi = .323$).

Table 4

Subjective health report of survey respondents with percentages[a]

		Non-diabetic	Diabetic
Overall health status response			
	Excellent	15.7%	2.3%
	Very Good	42.9%	16.9%
	Good	29%	41.1%
	Fair	9.9%	29.7%
	Poor	2.5%	10%

[a] Percentages reflect proportion of either diabetic or non-diabetic subset

Physical health. The primary measure of physical health investigated in this study was body mass index (BMI). BMI was used as a proxy for obesity in order to further explore the relationship between diabetes and obesity due to the high co-occurrence of the diseases. BMI is a frequently used weight status indicator. BMI was calculated using participants' self-reported height and weight, converted to the standard unit of kg/m^2. National Institute of Health (NIH) guidelines were used to place participants in one of five weight categories: Underweight (0-18.4), Normal weight (18.5-24.9), Overweight (25-29.9), Obese (30-34.9), or Morbidly Obese (35+).

An analysis of variance showed differences in BMI between diabetic participants (n= 477, M= 33, 95% CI [32.3, 33.7]), and non-diabetic participants (n=2636, M=28.1, 95% CI [27.8, 28.3], were statistically significant, $F(1, 3111) = 229.32$, $p < .001$.

However, the homogeneity of variance assumption was not met for these data as indicated by the Levene's Test, *F*(1, 3111) = 31.71,*p* < .001. As before, a Welch robust test of equality of means was conducted, *Welch's F*(1, 588.18) = 165.81, *p* < .001. *Welch's F* confirms the results initially obtained; diabetics (33.02±7.97) and non-diabetics (28.06±6.29) differ significantly on BMI. These results allow initial conclusions to be trusted. When these results are interpreted with regard to BMI categories it means that the average BMI for a diabetic individual falls into the Obese range in comparison to an Overweight BMI on average for those not diagnosed with diabetes.

Psychological health. In addition to subjective health reports, psychological health was evaluated using individuals' endorsement of depression and/or anxiety symptoms. Depression symptoms were measured using the Patient Health Questionnaire-2 (PHQ-2); a two-item depression screener with total score ranging 0-6. Anxiety levels were measured using the Generalized Anxiety Disorder-7 (GAD-7) scale; seven items sum 0-21.

An analysis of variance showed differences in depression symptoms between diabetic participants (*n*= 481, *M*= 1.07, 95% CI [0.92, 1.21]), and participants without diabetes (*n*= 2680, *M*= .70, 95% CI [0.65, 0.75]), were statistically significant, *F*(1, 3159) = 31.20, *p* < .001. However, the homogeneity of variance assumption was not met for these data as indicated by the Levene's Test, *F*(1, 3159) = 45.23, *p* < .001. Alpha level was set at *p* = .05 to indicate statistical significance therefore these results demonstrate that the null hypothesis of no variance difference is rejected. As such, a

Welch robust test of equality of means was conducted, *Welch's F*(1, 595.75) = 23, *p* < .001. *Welch's F* confirms the results initially obtained; diabetics (1.07±1.62) and non-diabetics (.70±1.30) differ significantly on endorsement of depressive symptoms. These results allow initial conclusions to be trusted. Still, neither group appears to have experienced depressed mood to a large degree.

An analysis of variance showed differences in anxiety symptoms between diabetic participants (*n*= 484, *M*= 3.71, 95% CI [3.26, 4.16]), and participants without diabetes (*n*= 2689, *M*= 2.93, 95% CI [2.78, 3.09]), were statistically significant, *F*(1, 3171) = 13.81, *p* < .001. However, the homogeneity of variance assumption was not met for these data as indicated by the Levene's Test, *F*(1, 3171) = 31.68, *p* < .001. Therefore a Welch robust test of equality of means was conducted, *Welch's F*(1, 602.44) = 10.33, *p* = .001. *Welch's F* confirms the results initially obtained; diabetics (3.71±5.02) and non-diabetics (2.93±4.07) differ significantly on endorsement of anxiety symptoms. These results allow initial conclusions to be trusted. As a whole these results suggest that participants are experiencing no more than mild anxiety, if any at all. Taken together data from the PHQ-2 and GAD-7 suggest that Brazos Valley residents are either not experiencing or not reporting depression or anxiety. However, those with a diabetes diagnosis more often report disrupted mood.

Predicting diabetes

To answer the second research question, a logistic regression was performed to predict diabetes using BMI, anxiety symptoms (as indicated by GAD-7 scores), and depression symptoms (as indicated by PHQ-2 scores) as explanatory variables. All variables were entered as a block. Nagelkerke's R^2 value of .108 was obtained indicating a very weak relationship between predictor and explanatory variables. The other pseudo R^2 value obtained, Cox and Snell R square = .062 confirming the lack of predictive power of the independent variables tested. Taken together they suggest that 6.2% of the variation in diabetes diagnosis is explained by the model, or a 10.8% relationship between the predictors (e.g. BMI, PHQ-2 and GAD-7 composite scores) and the prediction (e.g. diabetic status). Furthermore, the null model (no predictors) returned an 84.7% prediction success rate vs. the theoretical (tested) model, which returned an 84.6% prediction success rate. This means that the theoretical (tested) model performed worse than chance (the null model) and suggests that the proposed explanatory variables did not improve the model. The Hosmer-Lemeshow goodness of fit statistic = 26.25 (8), $p = .001$. When this statistic is statistically significant it suggests poor model fit. The tables that follow detail results of the null (Block 0) and theoretical (Block 1) models. Tables 5 and 7 present observed and predicted classifications of cases. Tables 6 and 8 display variable coefficient estimations and significance.

Table 5

Classification table for diabetes prediction[a,b] *for Block 0*

Observed			Predicted		
			Diabetic		Percentage Correct
			Non-Diabetic	Diabetic	
Step 0	Diabetic	Non-Diabetic	2608	0	100
		Diabetic	471	0	0
Overall Percentage					84.7

a. The cut value is .500
b. Constant is included in the model

Table 6

Variables in the equation for diabetes prediction (Block 0)

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 Constant	-1.711	.050	1168.59	1	.000	.181

Table 7

Classification table for diabetes prediction[a] for Block 1

Observed		Predicted		
		Diabetic		Percentage Correct
		Non-Diabetic	Diabetic	
Step 1 Diabetic	Non-Diabetic	2578	30	98.8
	Diabetic	445	26	5.5
Overall Percentage				84.6

a. The cut value is .500

Table 8

Variables in the equation for diabetes prediction[a] (Block 1)

Step 1[a]	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Upper
PHQ-2 Sum	.19	.06	10.92	1	.001	1.20	1.08	1.34
GAD-7 Sum	-.02	.02	1.390	1	.238	.98	.94	1.01
BMI	.09	.01	157.65	1	.000	1.09	1.08	1.11
Constant	-4.47	.23	392.15	1	.000	.01		

a. Variable(s) entered on step 1: PHQ-2 Sum, GAD-7 Sum, BMI.

It is noteworthy that of the variables tested, only depressive symptoms and BMI contributed significantly to predict diabetic status. Perhaps as extant literature suggests, it was difficult to distinguish between diabetes-distress vs. more general/clinical anxiety particularly through the use of screening instruments (brief measures). The remaining research questions sought to examine the potential moderating roles of: caregiver status, marital status, race, ethnicity, and gender; on the relationships between diabetes and specified mental and physical health outcomes (variables). Findings are discussed in the sections that follow.

Comparing means among categorical variables

Chi square tests of independence were conducted to examine the relationships between diabetic status and other demographic traits. The pairings of categorical, nominal variables were tested to determine whether statistically significant associations exist. If identified, these significant relationships mean that the null hypothesis is rejected and therefore the variables are not independent. An alpha level of .05 was used as the significance criterion. Chi square tests revealed that within this sample there were statistically significant associations between: diabetic status and marital status, $\chi^2(1, N = 3200) = 20.73, p < .001$; diabetic status and race (White or non-White), $\chi^2(1, N = 3200) = 18.27, p < .001$; and diabetic status and gender (male or female), $\chi^2(1, N = 3200) = 11.99, p = .001$; In addition, diabetic status and employment status were significantly associated $\chi^2(1, N = 3200) = 56.7, p < .001$. Non- significant associations were identified between diabetic status and caregiver status, $\chi^2(1, N = 3200) = 1.58, p = .209$ and diabetic status and ethnicity (Latino or non-Latino), $\chi^2(1, N = 3200) = 2.59, p = .108$. These findings indicate that diabetic status, ethnicity, and caregiver status are independent. Effect sizes, or the magnitude for all relationships were small, $\phi < 0.1$. Therefore, in all relationships, whether identified as statistically significant or not, the differences between variables or lack thereof were minor.

Path analysis

Path analysis was used to examine whether caregiver and/or marital statuses moderate the relationships between diabetes diagnosis and mental health indicators (e.g. subjective health, depressive symptoms, anxiety symptoms); and diabetes diagnosis and BMI. In addition, this model sought to deepen the understanding of the influence of race, gender, and ethnicity (Latino/Hispanic origin) on those relationships. Mplus version 7.4 Mac software (Muthen & Muthen) was used to conduct path model analysis. Missing data were noted across multiple variables and Mplus software was instructed to utilize full maximum likelihood estimation such that missing data is not estimated but instead, observed data is used to compute parameter values. This is an accepted method of handling missing data. The resulting sample size was n = 2,908 for subsequent analysis. Missing data analysis revealed a total of 292 cases with missing data or 9.1% overall. The independent variable, race, and its corresponding interaction variables accounted for the missing data.

The following variables were dummy coded prior to conducting path analysis: diabetic status, race, ethnicity, marital status, and caregiver status. These variables were coded such that 1 indicated membership in the group (e.g. diabetic, married, etc.) whereas 0 indicated that the participant was not a member of the variable being examined. The remaining variables: subjective health, anxiety and depression symptoms, and BMI scores were coded as indicated in the Methods section. For each of these variables, higher numbers indicate worse health.

The initial model was saturated: χ^2 (0, N = 2,908) = 0, p < .001. With zero degrees of freedom, model fit cannot be tested and because the current analysis was conducted on a large sample (Kline, 2004), small deviations between the hypothesized model and one's data may result in a significant chi-square so other indicators of fit need to be examined. Although model saturation means that fit cannot be assessed due to inherent perfect fit, the research questions regarding moderation in the relationships between diabetes and mental and physical health indicators, can still be discussed based on the results. R-square was calculated to determine how much of the model each variable accounted for. Subjective health report explained the largest proportion of the model, 14.8%; followed by BMI, 8.5%. Lastly, depression and anxiety symptoms both explained 4.7% of variance. Overall these figures describe low predictive power. The remaining variance is called residual variance and cannot be linked to specific causes (within the specified model). It is preferred that these figures be low. BMI had the largest residual variance (γ= 41.751, SE = 1.095), followed by anxiety symptoms (γ=16.678, SE = .437), and lastly, subjective health (γ= 0.841, SE = .022), p <.001.

The third research question guiding the current study investigated potential moderation effects produced by select social statuses. Social status variables were coded such that 1 indicated married or caregiver, respectively, and 0 indicated that the participant did not identify with that social role. Marital status was examined as a moderator of the relationship between diabetes and the following mental health indicators: subjective health, depression symptoms, and anxiety symptoms; as well as the physical health indicator BMI. Marital status was a significant moderator of the relationship between diabetes and anxiety symptoms such that married diabetics experienced less anxiety symptoms than those who were unmarried ($b=-.957$, $SE_b = .470$, $p < .05$). Marital status was not a significant moderator of any of the other relationships examined. Caregiver status was also examined as a moderator of the relationship between diabetes and the following mental health indicators: subjective health, depression symptoms, and anxiety symptoms; as well as the physical health indicator BMI. Caregiver status was not found to be a significant moderator of any of the aforementioned relationships. See Figure 1 below for diagram of path model. Note that correlations among outcome variables are not displayed for readability. Refer to Appendix C for correlations identified in the final reduced model.

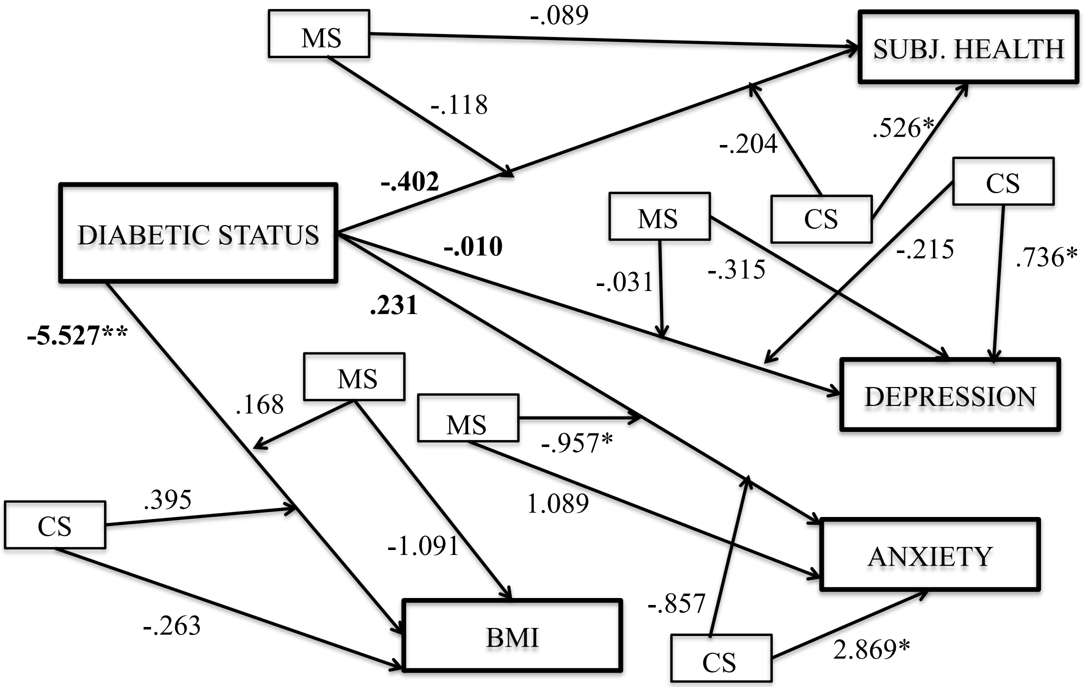

Figure 1. Full (original) path model with social status moderators
**p < 0.05, **p ≤ 0.001*
MS = Marital Status, CS = Caregiver Status

The fourth and final guiding research question investigated potential moderation effects of race, ethnicity, and gender on the named mental and physical health indicators. For these analyses ethnicity was coded using the categorical variable pertaining to whether an individual indicated they were of Latino, Hispanic, or Spanish descent; 1 indicated Latino and 0 indicated not Latino. The race variable examined only Black and White racial categories, and was coded separately in the same manner as ethnicity. Lastly, gender options were categorical: male or female. Female was coded as 1, and male coded as 0. Results demonstrate that the effect of diabetes on BMI differed between Blacks and non-Blacks such that Black people with diabetes had a higher BMI (b=5.601, SE_b = 1.724, p < .005). There were no other significant findings where race was the moderator. Finally, gender was only found to be a significant moderator in the relationship between diabetes and BMI such that female diabetics had lower BMI scores, (b=-1.945, $SE_b = .696$, $p < .05$). See Figure 2 below for diagram of path model.

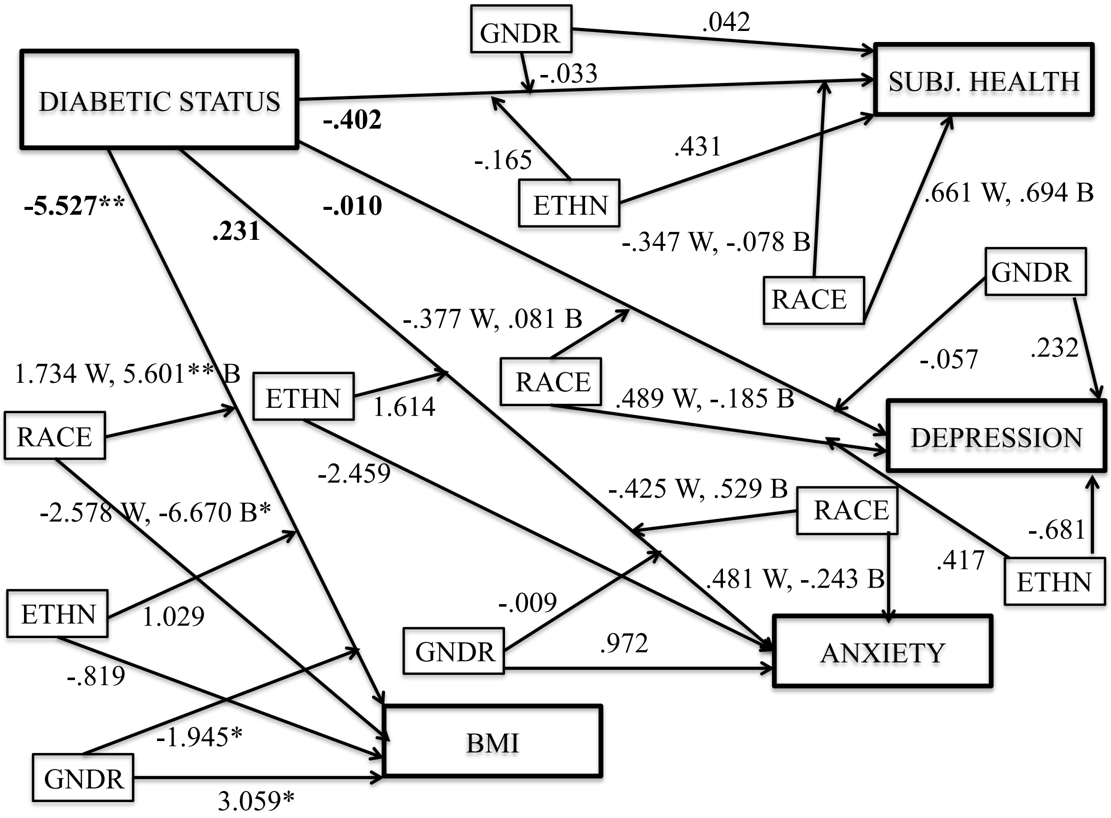

Figure 2. Full (original) path model with demographic moderators
$*p < 0.05$, $**p \leq 0.001$
Within RACE: B = Black & W = White

In sum, no significant moderators were identified for the relationships between diabetes and depressive symptoms, or diabetes and subjective health. It is possible that there is still much stigma attached to endorsing depression or depressive symptoms, and people are reticent to self-identify with the label/illness. In addition, the population examined in the current study overwhelmingly reported fairly good subjective health such that particularly with unevenly matched sample sizes it would have been even more difficult to describe marginal differences between groups.

In an effort to better understand how the variables examined in the current study fit together, a reduced model was created and analyzed. The reduced model resulted from removing non-significant paths one by one from the original path model, up to the point where the model could still be identified. Non-significant paths were removed beginning with the smallest value (or largest p-value) and continuing on, stopping before the model was no longer identifiable (due to insufficient data).

The final reduced model had 30 degrees of freedom in contrast to the original saturated model, which had zero degrees of freedom. (Refer to Appendices for syntax for original and reduced models.) An examination of global fit through observation of the Chi-square test of model fit resulted in a $\chi2 = 76.4$, $df = 30$, $p < .001$. This indicates that the model failed the test of exact fit. The Standardized Root Mean Square Residual (SRMR) = 0.015 indicating good fit (values < 0.05). This value represents the average standardized residual covariance. The Root Mean Square Error of Approximation (RMSEA) = 0.023 [90% CI = .017, .030] which indicated good fit because the estimation value is less than 0.05. Another important index to consider is the Comparative Fit Index (CFI), which ranges from 0 to 1. Values closer to 1 indicate a better fit. Results produced a CFI = 0.988, indicating a good fit based on the current standard of CFI ≥ 0.95. Finally, the Tucker Lewis Index (TLI) echoes the evidence of good model fit put forth by the aforementioned indices; TLI = 0.977 where TLI > 0.95 is the current benchmark.

Although the test of exact fit indicated that the model did not fit these data, when considering the large sample size and the fit indices that indicate good fit, one can tentatively accept the model as fitting these data reasonably well. To evaluate the performance of each variable in the reduced model, R^2 values were examined. Results were similar to the original model in terms of ranked contribution: subjective health report explained the largest proportion of the model, 13.3%; followed by BMI, 7.7%. Lastly, depression and anxiety symptoms explained 3.2%, and 3.1% of variance respectively. Overall these figures describe low predictive power.

The parsimonious revised model returned results that were largely congruent with the full model. All of the paths that were statistically significant in the original path model, were also statistically significant in the final path model: Black diabetics had higher BMI's, female diabetics had lower BMI's, and gender and BMI had a direct relationship in general. Surprisingly, BMI and diabetic status produced an inverse relationship. Also, caregivers reported lower subjective health. For the results that were consistent across the models, coefficient estimates were all in the same direction as indicated by sign, but of smaller magnitude in the parsimonious model. In a few instances, the paths had a higher level of statistical significance, $p \leq .001$; direct effects of caregiver status on depression (b = 1.161, SE_b =.324) and anxiety symptoms (b = 3.477, SE_b = 1.022), and effects of diabetes on anxiety among married and unmarried individuals (b = -.397, SE_b = .084). Caregivers endorsed more depressive and anxious symptoms, and married diabetics reported less anxiety. The correlations tested returned identical results in both models and indicate a large degree of association among the independent variables.

Further, there were additional statistically significant paths identified in the reduced model. The statistically significant relationships identified by the parsimonious model included: diabetic caregivers endorsed lower depressive symptoms ($b = -.446$, $SE_b = .170$, $p < .05$) as did White diabetics ($b=-.078$, $SE_b =.024$, $p \leq .001$) and married persons ($b = -.377$, $SE_b =.052$, $p \leq .001$). With regard to anxiety, females were more anxious ($b=.684$, $SE_b =.105$, $p \leq .001$), and diabetic caregivers endorsed lower anxiety ($b = -1.188$, $SE_b =.537$, $p < .05$). Lastly, the parsimonious model provided new insights about subjective health. Overall, diabetes and subjective health had an inverse relationship suggesting that diabetics are reporting generally good health ($b = -.495$, $SE_b = .108$, $p \leq .001$). Married ($b = -.152$, $SE_b =.021$, $p \leq .001$), and caregiving diabetics ($b=-.270$, $SE_b =.126$, $p < .05$) reported good health as well. Black participants reported poor health ($b = .510$, $SE_b =.089$, $p \leq .001$). In the revised model only five paths were not found to be statistically significant. See Appendix C for correlations table and Figure 3 below for a diagram of the reduced (final) path model.

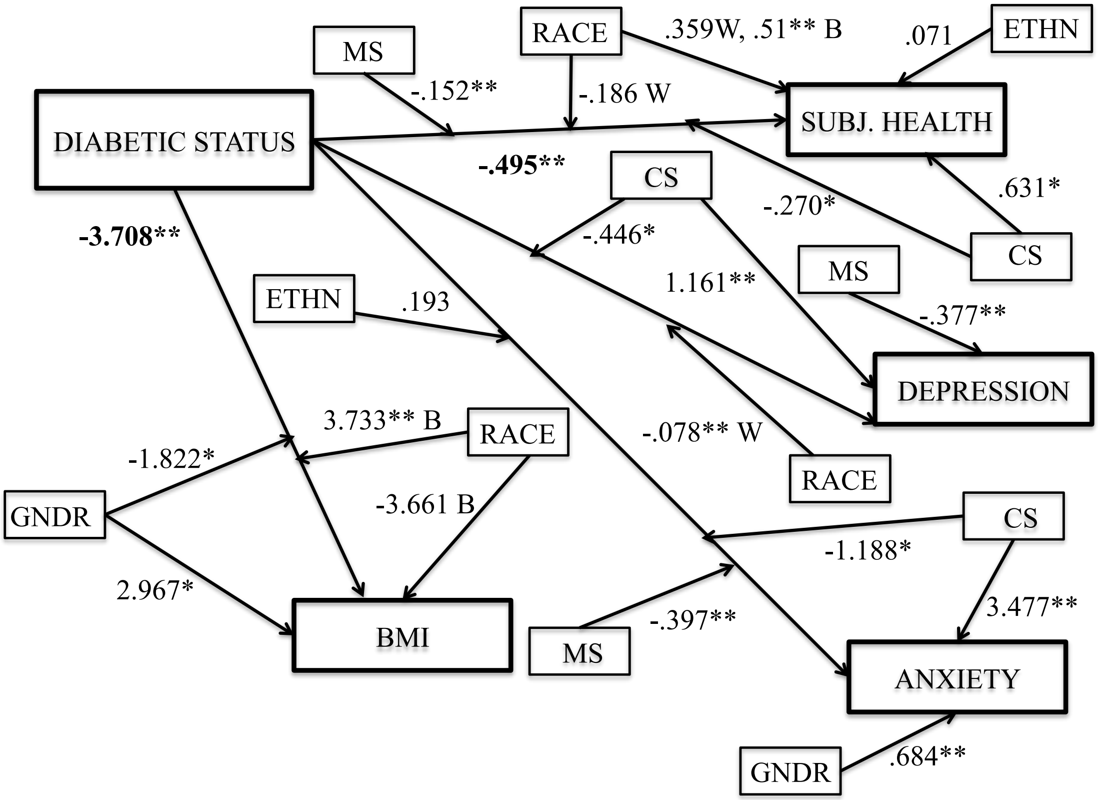

Figure 3. Reduced (final) path model
**p < 0.05, **p ≤ 0.001*
Within RACE: B = Black & W = White

CHAPTER V

DISCUSSION AND CONCLUSIONS

The purpose of the current study was to describe the rural Central Texas diabetic population and distinguish it from those living without diabetes. It sought to examine: the relationships between psychological and physical health indicators (e.g. subjective health, depression, anxiety, BMI) and diabetic status in rural-residing individuals diagnosed with diabetes. The potential moderating role of caregiver and marital statuses, as well as race, ethnicity, and gender on those relationships, was also explored. Specifically, the study examined whether depression, anxiety, and BMI contributed significantly to the prediction of diabetes.

A central purpose of the current study was to describe the sample of rural-residing persons situated in central Texas. This area, known as the Brazos Valley, is unique in a number of ways. It comprises more underrepresented and understudied individuals as identified by race, ethnicity, gender, and age when compared to other areas included in extant literature examining diabetes and its accompanying health issues. These individuals hold multiple-minority statuses/identities and are disproportionately diagnosed with diabetes. The Brazos Valley is also uniquely situated geographically. It is adjacent to the diabetes belt: 644 counties in 15 states where at least 11% of residents have been diagnosed with diabetes, and proximity to adjoining areas with high rates of diabetes. (Barker, Kirtland, Gregg, Geiss, & Thompson, 2011).

Results of the current study were consistent with global and national trends. African American and Latino/Hispanic were over-represented in terms of their proportion of diabetics in comparison to their White counterparts. Small but statistically significant relationships were identified between diabetic status and the aforementioned demographic variables: race and gender, but not ethnicity (Latino/Hispanic). It is surprising that ethnicity did not produce a statistically significant result, however, it is likely due in part to the low number of Latino/Hispanic participants overall. Blackness (e.g. Black or non-Black) moderated the relationship between diabetes and BMI, increasing diabetes' direct effect on BMI. Black diabetics had higher BMI scores. Gender moderated the relationship between diabetes and BMI, such that males were observed to have higher BMI scores. This is unusual since elder women like those who largely comprise the diabetic sample typically reach the threshold for obesity. It is unclear why this did not hold true in these analyses.

Diabetic individuals in the sample also tended to be older, poorer, and unemployed despite having comparable educational levels to persons without diabetes. The elderly and unemployed often must sustain themselves financially based on fixed incomes. For individuals without a local support system there is no one to share costs of living, to aid with transportation considerations, or even serve as emotional support when making lifestyle adjustments required for successful diabetes management (Cornwell Carter-Edwards, Skelly, Cagle, & Appel, 2003; Laumann, & Schumm, 2008). These characteristics highlight the need for consideration of affordability, availability, and accessibility during treatment planning and are consistent with a number of previous studies (Brossart et al., 2013; CDC, 2014a; CCHD, 2013; Marcinkevage et al., 2013; McCord et al., 2012; NACRHHS, 2011; Wagenfeld, 2003). Although there were more diabetic individuals residing in Brazos county, a micropolitan, more broadly the area would still be considered rural by many, and represents a health professional shortage area (with regard to physical and mental health providers; HRSA, 2014). Moreover, rural culture influences what people consider affordable, acceptable, and literally, what is accessible. This certainly has connections to the higher acuity of rural-residing individuals who enter mental, and medical healthcare facilities as compared to urban counterparts (Brossart et al., 2013; Smalley & Warren, 2014).

To reiterate, racial/ethnic minorities' health burden is compounded as their financial standing, educational attainment, and employment statuses are added to complete the picture of their identity. With each added factor, diabetics' health outcomes worsen as seen in the current study and earlier research (see Bell et al., 2005; Bhattacharya, 2012; Brancati, Kao, Folsom, Watson, & Szklo, 2000; Brossart et al., 2013; Insaf et al., 2014; Laiteerapong et al., 2013; Ma et al., 2012; Marcinkevage et al., 2013; Quinones, Liang, & Ye, 2013; Skelly et al., 2006; Wong, Chou, Sinha, Kamal, & Ahmed, 2014; Cooper et al., 2003). Each additional marginalized identity reflects barriers to accessing adequate healthcare and the need for greater resiliency than the population-at-large as one deals with prejudice and discrimination in multiple forms that are pervasive, systemic, and institutionalized. For instance as Wagenfeld (2003) notes, racial/ethnic minorities are more isolated in the rural context where trends include: high unemployment, low income, greater numbers of uninsured persons, and fewer trained providers. The Health Resources and Services Administration (2005) report found that acceptability of accessing mental health services was a greater issue (barrier) in rural settings due to decreased anonymity in help-seeking. This would be magnified for racial/ethnic minorities, whose population is even smaller in number and possibly visibly different from others. Furthermore, the Institute of Medicine (IOM) comprehensive 2002 report identified lack of insurance as a primary driver of health disparities. Lastly, descriptively the diabetic sample was similar to non-diabetics tending to be married, and not endorse caregiver status.

The current study also investigated whether depression symptoms, anxiety symptoms, and BMI predict diabetic status. This question was investigated using a logistic regression model, which did not produce statistically significant results. The proposed model accounted for only 6.2% of variation in diabetic status, whereas the null model successfully predicted diabetic status 84.7% of the time. The tested model did not produce improvement in prediction success in comparison to the null model, and actually performed slightly worse (84.6% success) indicating that the results returned were no more probable than those occurring due to chance. One of the most relevant potential contributors to the model's poor prediction rate, is the lack of variability in both depression (PHQ-2) and anxiety (GAD-7) scores. Most participants only scored low on depression as well as anxiety, therefore a broad range of scores could not be measured. In fact, for diabetics as well non-diabetics, the distribution of PHQ-2 and GAD-7 scores were skewed such that the standard deviations were greater than the means. This is problematic because it is possible that neither depression nor anxiety was measured well to begin with, therefore any subsequent statistical analysis using depression or anxiety would be impacted by that. Moreover, given the uneven sample sizes (diabetic and non-diabetic), it is likely that the null model predicted so well, in part, because the overwhelming majority of participants were not diabetic.

The relationships between diabetic status and depression symptoms, anxiety symptoms, subjective health, and BMI were investigated using path model analysis. The potential moderating role of caregiver and marital statuses in those relationships was also explored. Marital status reduced anxiety experienced by diabetics, as indicated by the final model. This appears to be in line with social support research in the current body of knowledge concerning diabetes; wherein strong social networks serve as a buffer to negative prognosis in diabetes. Perhaps the presence, assistance, and companionship of a partner relieve not only diabetes-related stress, but worries related to daily life too. Married persons without diabetes also reported lower levels of depression.

Relatedly, providing care to others had differential impact on diabetics and non-diabetics. Diabetic caregivers endorsed fewer anxiety and depression symptoms in contrast to their non-diabetic counterparts who reported more symptoms of both. Perhaps for diabetics taking responsibility for someone else increased their self-efficacy with regard to their own health, or simply improved their mental state by shifting their focus from themselves, their disease, and placed emphasis instead on their abilities. It is unclear why non-diabetic caregivers do not appear to enjoy the same benefits. Perhaps their caregiving abilities are greater on average as people may not be as thoughtful about their self-care needs whereas a diabetes diagnosis may command maintenance of a certain degree of personal time.

Diabetes did not produce a statistically significant direct effect on depression. This may be due in part to the fact that depressive symptoms was measured using such a brief screener (2 items). It is also possible that there is lower perceived stigma around anxiety vs. depression such that participants were more willing to disclose experiences of the former. However, White diabetics did report fewer depressive symptoms in comparison to other races. Broadly, this is consistent with other studies that have found worse depression among people of color in comparison to White counterparts.

Overall, the sample reported generally good health and this held true for diabetics, including those married and providing care to others. Notably, Black participants overall reported poor health and results demonstrated that the predictive strength of the relationship between Black diabetics and BMI was stronger than that of their counterparts. In addition, Black diabetics had higher BMI scores. It seems important to highlight the contrast between White diabetics being less depressed and Black diabetics being more overweight; both of which may relate to physical activity level, diet, and stress coping. Brancati, Kao, Folsom, Watson, and Szklo (2000) asserted that such lifestyle factors are most responsible for the significant differences in variance of incidence (new cases) of diabetes between Blacks and Whites.

Broadly the results from the path analysis results underscore the importance of social connection and relationships toward health. Although subtle differences existed among diabetics and others, generally social ties served as protective factors particularly as pertains to mental health indicators. Calkins and colleagues (1999) identify links between depression and dysfunction such that its management is critical toward chronic disease management. Depression can lead to social isolation and decreased physical activity, both of which result in poor prognosis for diabetes.

Limitations

The present study has several important limitations. First, the current study's results are based on secondary data analysis from a dataset that was not collected to address the researcher's specific questions. Procedures for data collection, the methods, and the measures used to obtain these data were dictated by the aims of the original study and this researcher could not control which constructs and variables were included or excluded. Relevant factors such as diet, medication adherence, and duration of diagnosis were unable to be included because they were not a part of the original health assessment. Examining additional physical health variables such as these would enhance future studies.

Another matter related to study design and measures is that the item determining diabetic status did not distinguish between type 1 and type 2 diabetes. The diabetes types have different progressions, treatments, and prognoses that the current study was unable to explore. Because diabetics were grouped into one monolithic category subtle differences in treatment that may have great clinical significance were not observed, and there may be greater resistance or dismissal of this study's conclusions by providers identifying with traditional medical models, due in part to this. Lastly, although this survey was available in Spanish and English (the predominant languages spoken in the geographic region), there is no measure of acculturation or validity check to determine whether the participants understood the survey itself. There also are a fair number of other ethnic enclaves in this geographic region and the survey was not offered in additional languages.

Another drawback of the current secondary data analysis is that it draws from a health assessment conducted as a community survey. Historically racial/ethnic minorities tend to be underrepresented, while older, wealthier, and more highly educated persons are overrepresented in studies of this nature (CCHD, 2013). Description of the rural diabetic population was a primary aim of the current study and the resulting picture may have been altered based on who agreed to participate in the study and completed the health survey. Certain types of people are more likely to participate in research of this nature and those who declined also represent important parts of the rural diabetic population that are not captured in this study. Therefore, despite the relatively large overall sample size (3,200 participants), the sample may not be representative.

Relatedly, although this researcher considers it a strength that this study focused on geographically underserved populations, particularly racial/ethnic minorities, this limits generalizability or external validity to other groups and other locations. As well, the use of the health survey's convenient, cross-sectional data prevents determination of causality, and the higher mean age limits applicability to younger persons with diabetes.

Another limitation of the current study was sample size. Although the Brazos Valley participants comprised a solid 3,200 persons; the researcher's primary interest was in attending to the diabetic subset which comprised only 489 individuals total. Due to the interest in exploring and comparing groups, that sample size continued to shrink during analyses based on participants' group membership. Analysis with samples that are too small or too large can obscure or distort the actual story of the data such that inaccurate conclusions are drawn, or important information is missed given that analyses may be impacted by sample composition and size. Fortunately, there was only a small amount of missing data, however, the small sample was split many ways in order to address the questions of the researcher. Future studies would benefit from having more comparable numbers in diabetic and non-diabetic subgroups, as well as examining larger numbers of diverse diabetics overall.

Finally, this study relied solely on self-report data that is subject to social desirability effects and memory degradation. For example, BMI was calculated from self-reported height and weight, which people often over report and underreport respectively. Further, as noted earlier, BMI has been shown to have differential accuracy depending on demographics. In particular, it may not be the best measure for body weight with racial/ethnic minorities. Similarly, participants did not report experiencing much, if any, depression or anxiety. This response pattern resulted in skewed distributions for the PHQ-2 and GAD-7 scores. Future research may be enhanced by using established cutoff points for the scales to create more descriptive sub-groups of the participants based on their responses (e.g. mild anxiety, moderate anxiety, severe anxiety possible depression diagnosis).

Determination of diabetes diagnosis within the current study also raises some concerns. “It has also been shown in the ARIC cohort that associations of traditional risk factors with diabetes tend to be underestimated when diabetes is self-reported compared with diabetes definitions that use glucose criteria,” (Schneider et al., 2013, p. 931; see also Bielinski et al., 2012). Relatedly, there were some measurement issues. While the anxiety measure was brief, the depression measure was even briefer as a 2-item screener. Although there is evidence to support the use of single-item measures for subjective health, a screening measure such as the PHQ-2 used here, has most utility in a clinical vs. empirical context. It is possible due to word choice and brevity that the PHQ-2 failed to capture an accurate extent of the sample who were experiencing depressive symptoms. For instance, when measuring depression, the wording of self-report items is important because items that “lack specificity and are inflated by general distress” (Brossart et al., 2013, p. 253) tend to produce high rates of depression. In future research use of the PHQ-9 for example, would be recommended for more robust results.

Despite its limitations, this study has several strengths. This study’s use of participants from the community increased the number of racial/ethnic minorities included. This adds to the existing literature because historically racial/ethnic minorities have not been represented at all or underrepresented in research. It is critical that members of marginalized groups continue to be included in greater numbers in empirical studies which professionals (e.g. mental and physical healthcare providers) base treatment and interventions on, because the cultural differences impact efficacy and illness presentation as well as prognosis. If intervention decisions continue to be made based on findings from studies that did not include members representative of the individuals seeking treatment, it is apparent that incongruence and poor outcomes are more probable. The community-based sample also allows for direct application of these findings to community-based intervention efforts.

The current study can be directly applied to comparable or similar rural settings (to the Brazos Valley region). Broadly, rural areas comprise people who are suffering more acutely with greater frequency, appearing later (in worse condition), and addressing those persons' needs with insufficient resources in terms of person-power or money. One way these results could be translated into practical use is to develop a diabetes treatment model that includes not only interprofessional members (e.g. mental and medical healthcare professionals) working collaboratively with individuals to address the apparent psychological and physiological effects of diabetes; but also actively engage the social support networks of individuals with diabetes.

In the cases of those without loved ones who are willing or able to assist with care, partnering with volunteer/philanthropic organizations would be a great way for people to serve, who could be trained on how best to assist. This would allow all individuals with diabetes regardless of family/friend network to gain the benefits that social support offers with regard to slowing disease progression. By consistently including the caregivers and loved ones of the individuals with diabetes, treatment adherence and prognosis would improve. Interventions could include regular, ongoing family/support meetings that facilitate understanding not only for the identified patient(s) but also those who will be assisting them in carrying out their treatment plans. Moreover, with results suggesting that caregivers' mental health is impacted by their role (providing care to others), caregiver support groups could be established and the necessity for relief/release time could be discussed during family/support meetings so that both identified patient and caregivers can be educated and ask questions.

There is a wealth of research that details the pros and cons of interdisciplinary/interprofessional health teams but the most obvious reason that this would be beneficial for diabetics is due to the numerous documented impacts that the disease course has on both brain and body, simultaneously. Treating one area without knowledge about what is going on with the other would be ill-advised and likely harmful. For example, with the knowledge that depression ultimately influences treatment adherence, ongoing communication between physicians and mental healthcare providers would ensure timeliness and coordinated efforts to observe potential warning signs, as well as monitor progress or improvement in mood.

Additionally, since the results indicated that women and Blacks have higher BMI scores, interventions centered on managing weight should be prioritized in treatment plans and discussed often. Free or low-cost methods of increasing physical activity, that can also be social would be beneficial, and could also become community-oriented programs. One example would be a walking club. This study extended research that demonstrates that social support greatly influences diabetes progression and prognosis and there are numerous ways in which the information can be put to good use.

Future research directions

With its balance of limitations and strengths, there is still much room for additional research in this area beyond the scope of the current study. Additional research is still needed to explore the relationships between diabetes and physical and mental health status; as well as factors that potentially buffer or bolster the likelihood of negative outcomes. The current study did not produce statistically significant results in predicting diabetic status through the proposed logistic regression model, and the path model demonstrated reasonable, but not excellent fit. Nonetheless, these findings provide additional support for key themes within existing literature (e.g. rural health disparities, racial health disparities, social support and aging, social support and diabetes), provide directions for future research (e.g. closer examination of the impact of diabetes on subjective health and depression, intra-racial diabetes progression), and highlight many areas of clinical significance (e.g. role of culture in healthcare communication, interactional effects of mental and physical health). Social support variables examined here produced statistically significant effects and underscore the influence of one’s ecological context, including social support network members, on one’s health and well-being both physical and mental.

Insights gained from this study can be applied to the development and expansion of culturally sensitive treatment interventions and the creation of policy recommendations that promote positive health behaviors and allocate/target resources to populations in greatest need. Based on the extant literature and the present study these populations include rural residents as whole, but particularly, racial/ethnic minorities, females, and the elderly.

Overall, the study reinforces the need for holistic, interdisciplinary healthcare systems and treatment approaches. Results of the current study emphasize that mental and physical health are mutually influential, therefore treatment plans that address them separately are suboptimal. Instead, approaches that are person-centered and contextually grounded (e.g. considerate of culture) are needed. Specifically, future research directions include: exploration of pre-diabetic individuals particularly examining children and their parents in regard to disease progression (or not); replication of the current study in other geographic locales; extension of the current study through inclusion of obesity as a primary dependent variable due to its link to cardiovascular disease (increasingly a top cause of death in the U.S.); and finally, extending the current study by collecting data longitudinally to identify the long-term impact of lifestyle factors on mental and physical health. Diabetes has become an epidemic and it will not soon lessen its cost in terms of money or mortality. If we work together as professionals and communities to better understand it, only then can we begin to change current trends. The time to act is now.

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APPENDIX A

Syntax for Full (original) Path Model

```
TITLE:          PATH ANALYSIS OF FULL DISS MODEL V3 3/21/2016;

DATA:           FILE IS "BVCty_Only_NO.NAMES.csv";
LISTWISE IS ON;
VARIABLE: NAMES ARE ID Q1 Diabetic Q32a Q32b Q32c Q32d Q32e Q32f Q32g
        Q32h Q32i Q38 Q58 Q59 Q61 Q62 BMI PHQ2_SUM GAD7_SUM DIab_DI
        ZQ1 ZPHQ2S ZBMI ZGAD7S ZDiab ZDIabdi Q23a Q23b Q23c Q23d
        Q23l Q56 AgeCat EduCat Q63 Q65b IncomeCats Q66 Q69
        BMI_5cat BzVly White Black Multi Asian Native Female
        Male Latino NotLatin Married NotMarr Care NotCare Diab
        NotDiab Underwt NormWt Overwt Obese MorbOb BVCty BrzCty
        BurCty GriCty LeoCty MadCty MonCty RobCty WalCty WasCty filter;

       MISSING ARE ALL (-99);
       USEV ARE Diabetic Married Care White Black Latino Female Q1 BMI Depress
Anxious
       I1 I2 I3 I4 I5 I6;
       !CATEGORICAL ARE bfeed ;


DEFINE:  I1=Diabetic*Married;
      I2=Diabetic*Care;
      I3=Diabetic*White;
      I4=Diabetic*Black;
      I5=Diabetic*Latino;
      I6=Diabetic*Female;
      Depress=Q32c+Q32d;
      Anxious=Q32a+Q32b+Q32e+Q32f+Q32g+Q32h+Q32i;


!ANALYSIS:  ESTIMATOR = ML; LINK = LOGIT; INTEGRATION =
MONTECARLO;

MODEL: Depress on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5
I6;
     Anxious on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6;
     Q1 on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6;
     BMI on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6;
```

```
     Depress with Anxious;
     Depress with Q1;
     Q1 with Anxious;
     Depress with BMI;
     Q1 with BMI;
     BMI WITH ANXIOUS;

OUTPUT: SAMPSTAT STANDARDIZED TECH4;
```

APPENDIX B

Syntax for Reduced (final) Path Model

```
TITLE:          PATH ANALYSIS OF FULL DISS MODEL V3 3/21/2016;

DATA:           FILE IS "BVCty_Only_NO.NAMES.csv";
LISTWISE IS ON;
VARIABLE: NAMES ARE ID Q1 Diabetic Q32a Q32b Q32c Q32d Q32e Q32f Q32g
          Q32h Q32i Q38 Q58 Q59 Q61 Q62 BMI PHQ2_SUM GAD7_SUM DIab_DI
          ZQ1 ZPHQ2S ZBMI ZGAD7S ZDiab ZDIabdi Q23a Q23b Q23c Q23d
          Q23l Q56 AgeCat EduCat Q63 Q65b IncomeCats Q66 Q69
          BMI_5cat BzVly White Black Multi Asian Native Female
          Male Latino NotLatin Married NotMarr Care NotCare Diab
          NotDiab Underwt NormWt Overwt Obese MorbOb BVCty BrzCty
          BurCty GriCty LeoCty MadCty MonCty RobCty WalCty WasCty filter;

        MISSING ARE ALL (-99);
        USEV ARE Diabetic Married Care White Black Latino Female Q1 BMI Depress
Anxious
        I1 I2 I3 I4 I5 I6;
        !CATEGORICAL ARE bfeed ;


DEFINE:  I1=Diabetic*Married;
       I2=Diabetic*Care;
       I3=Diabetic*White;
       I4=Diabetic*Black;
       I5=Diabetic*Latino;
       I6=Diabetic*Female;
       Depress=Q32c+Q32d;
       Anxious=Q32a+Q32b+Q32e+Q32f+Q32g+Q32h+Q32i;


!ANALYSIS:  ESTIMATOR = ML; LINK = LOGIT; INTEGRATION =
MONTECARLO;

MODEL:        !Depress on Diabetic Married Care White Black Latino Female I1 I2 I3
I4 I5 I6 (step 2 taking out diabetic);

       !Depress on Married Care White Black Latino Female I1 I2 I3 I4 I5 I6 (step 5
taking out I1);
```

!Depress on Married Care White Black Latino Female I2 I3 I4 I5 I6 (step 8 taking out I4);

!Depress on Married Care White Black Latino Female I2 I3 I5 I6 (step 10 taking out black);

!Depress on Married Care White Latino Female I2 I3 I5 I6 (step 15 taking out I6);

!Depress on Married Care White Latino Female I2 I3 I5 (step 22 taking out female);

!Depress on Married Care White Latino I2 I3 I5 (step 23 taking out white);

!Depress on Married Care Latino I2 I3 I5 (step 27 taking out Latino);

!Depress on Married Care I2 I3 I5 (step 29 taking out I5);

Depress on Married Care I2 I3;

!Anxious on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6 (step 1 taking out I6);
!Anxious on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 (step 3 taking out black);

!Anxious on Diabetic Married Care White Latino Female I1 I2 I3 I4 I5 (step 9 taking out diabetic);

!Anxious on Married Care White Latino Female I1 I2 I3 I4 I5 (step 11 taking out white);

!Anxious on Married Care Latino Female I1 I2 I3 I4 I5 (step 17 taking out I4);

!Anxious on Married Care Latino Female I1 I2 I3 I5 (step 18 taking out I3);

!Anxious on Married Care Latino Female I1 I2 I5 (step 24 taking out married);

!Anxious on Care Latino Female I1 I2 I5 (step 28 taking out Latino);

Anxious on Care Female I1 I2 I5;
!Q1 on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6 (step 7 taking out female);

!Q1 on Diabetic Married Care White Black Latino I1 I2 I3 I4 I5 I6 (step 13 taking out I4);

```
    !Q1 on Diabetic Married Care White Black Latino I1 I2 I3 I5 I6 (step 14 taking out
I6);

    !Q1 on Diabetic Married Care White Black Latino I1 I2 I3 I5 (step 17 taking out
married);

    !Q1 on Diabetic Care White Black Latino I1 I2 I3 I5 (step 21 taking out I5);

    Q1 on Diabetic Care White Black Latino I1 I2 I3;
    !BMI on Diabetic Married Care White Black Latino Female I1 I2 I3 I4 I5 I6 (step 4
taking out care);

    !BMI on Diabetic Married White Black Latino Female I1 I2 I3 I4 I5 I6 (step 6
taking out I1);

    !BMI on Diabetic Married White Black Latino Female I2 I3 I4 I5 I6 (step 12 taking
out Latino);

    !BMI on Diabetic Married White Black Female I2 I3 I4 I5 I6 (step 16 taking out
I2);

    !BMI on Diabetic Married White Black Female  I3 I4 I5 I6 (step 19 taking out I5);

    !BMI on Diabetic Married White Black Female  I3 I4 I6 (step 20 taking out
married);

    !BMI on Diabetic White Black Female  I3 I4 I6 (step 23 taking out white);

    !BMI on Diabetic Black Female I3 I4 I6 (step 25 taking out I3);

    BMI on Diabetic Black Female I4 I6;
    Depress with Anxious;
    Depress with Q1;
    Q1 with Anxious;
    Depress with BMI;
    Q1 with BMI;
    BMI WITH ANXIOUS;


OUTPUT: SAMPSTAT STANDARDIZED TECH4;
```

APPENDIX C

CORRELATION TABLE FOR FINAL MODEL

Correlations among study variables (reduced/final model), n = 2,908

		1	2	3	4	5	6	7	8	9	10	11
1	Subjective health	1.00										
2	BMI/obesity status	.31**	1.00									
3	Depressive symptoms (PHQ-2 score)	.39**	.13**	1.00								
4	Anxious symptoms (GAD-7 score)	.35**	.10**	.76**	1.00							
5	Diabetic	-.32**	-.25**	-.11**	-.07**	1.00						
6	Marital Status	-.18**	-.08**	-.14**	-.08**	.08**	1.00					
7	Caregiver Status	.05*	.02	.09**	.11**	.02	.01	1.00				
8	Race- White	-.13**	-.08**	-.08	-.07**	.08**	.20**	-.02	1.00			
9	Race-Black	.17**	.12**	.05*	.07**	-.09**	-.16**	0	-.65**	1.00		
10	Ethnicity	.03	.03	.03	.04	-.02	-.01	.01	.20**	-.05*	1.00	
11	Gender	-.04*	-.05*	.06	.12	.05*	-.08**	.07**	0	.04	.06**	1.00

* $p < .05$, ** $p \leq .001$