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Effects of Depression and Health Habits on Diabetes Outcomes

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Walden University
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Abstract

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Abstract

Diabetes mellitus outcomes are intensified by the lack of screening and awareness for depressive symptoms, alcohol consumption, cigarette use, and gender difference. The purpose of this quantitative survey study, grounded in biopsychosocial theory, was to investigate the best predictor (alcohol consumption, cigarette use, and the exploratory variable gender) of diabetes outcome in a Mexican American population. Data were collected using the Patient Health Questionnaire-9 with 120 Mexican American patients from a diabetic clinic in Southern Texas. Results from a multiple regression analysis indicated that gender was the best predictor. A series of Pearson correlations revealed a significant positive relationship between depression severity and diabetes outcome. Cigarette and alcohol use showed a significant medium positive relationship with diabetic outcome. Results may be used to strengthen prevention, treatment, and interventions to improve diabetes outcomes in Mexican American adults.

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Dedication

I lovingly dedicate this work to my parents who taught me to never give up! Dad, although you are not here physically, I promise to keep you close to my heart and inspire others to follow their dreams as you always encouraged me. Mom, you are my inspiration, my rock, and my confidant. It was through your strength, grace, and boldness that I chose to take a leap of faith and dare to be different.

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Chapter 1: Introduction to the Study

Introduction

Researchers have gained significant understanding in recent years about how individual and collective environments and behaviors affect people's mental and physical conditions. Masel, Rudkin, and Peek (2006) and Diaz, Geesey, and Mainous (2008) focused on the influence of acculturation on health behaviors and outcomes in ethnic minority groups in the United States. Based on findings reported by the Texas Department of State Health Services (2013), chronic diseases cause 60-70% percent of the deaths in Texas, nationally, and globally. Modifiable health risk behaviors (e.g., lack of physical activity, poor nutrition, tobacco use, and excessive alcohol consumption) are major reasons for illness and premature death related to chronic diseases; if these risk factors were removed, at least 80% of heart disease, stroke, and type 2 diabetes cases would be prevented, and more than 40% of cancer cases would be prevented. This report suggested that behavioral risk factors play a prominent role in causing chronic disease (Texas Department of State Health Services, 2013); therefore, exploring ways to minimize these factors would be a remedy to this problem.

The Texas Behavioral Risk Factor Surveillance (2015) documented the leading causes of death in the Texas Hispanic population as diseases of the heart (73.0%), malignant neoplasms (69.8%), accidents (24.9%), cerebrovascular diseases (19.5%), and diabetes mellitus (17.1%). Diabetes affects the Hispanic population at a disproportionate rate (The Texas Behavioral Risk Factor Surveillance, 2015). In the state of Texas, mortality rates for diabetes vary between those who identify as White (16.7%), Black

(36.3%), Hispanic (32.3%) and Other (13.8; Texas Department of State Health Services, 2013). There is a need to explore preventable disease in minority groups, especially those that result in elevated mortality rates (Texas Department of State Health Services, 2013).

According to data from the Centers for Disease Control and Prevention (CDC, 2011), Mexican Americans have an increased risk of comorbidity when compared to other ethnicities. Beckles and Chou (2016) reported that 29.1 million Mexican Americans have been diagnosed with diabetes, which is approximately 9.3% of the total population (within all ethnicities). Diabetes mellitus is a chronic condition that affects the amount of glucose in the bloodstream (Beckles & Chou, 2016). *Mellitus* is a Latin word for "sweet like honey", referring to the excess glucose in the blood and urine of an individual with diabetes (Beckles & Chou, 2016). *Diabetes* is a general term used to describe a group of diseases that alter the way the body metabolizes blood glucose (Beckles & Chou, 2016). In this chronic disease, the pancreas does not make enough insulin, or the body is unable to produce insulin properly, which can lead to negative health outcomes and comorbidity (Beckles & Chou, 2016).

According to Enguidanos, Green, & Nguyen (2015), depression may be another factor linked to negative health outcomes and comorbidity in many Mexican Americans. Enguidanos et al. examined the relationships between smoking cigarettes, excessive drinking, and the comorbidity of depression and diabetes. According to Bădescu et al. (2016), depression can disrupt emotions, cognitive function, and behaviors. Bădescu et al. conducted a review regarding the link between depression and diabetes, and concluded that depression indicators could appear 2 to 3 times higher in participants with diabetes

mellitus. Bădescu et al. also reported that diabetes could emerge simultaneously with depressive symptoms, which makes it difficult to determine whether there is comorbidity. Bădescu et al. explained that two pathophysiological mechanisms, stress and inflammation, are related to the origins of diabetes and depression. There remain clear gaps in the literature regarding depression in diabetes patients, common origins of these comorbidities, and outcomes of both diseases.

Depression can cause significant distress or impairment in individuals' social and occupational functioning (American Psychiatric Association, 2013), yet depression is not easily diagnosed or linked to some negative health outcomes. The American Psychiatric Association (2013) stated that a diagnosis of depression includes five (or more) of the following symptoms: depressed mood, diminished interest, significant weight loss or gain, insomnia or hyper-insomnia, psychomotor agitation, fatigue or loss of energy, feelings of worthlessness, diminished ability to think or concentrate, and recurrent thoughts of death. These symptoms must be present during the same 2-week period, and at least one of the symptoms must represents a change in mood or loss of interest from previous daily functioning before a mental health professional can diagnose a major depressive disorder (American Psychiatric Association, 2013). The American Psychiatric Association categorized depression as a first episode, a recurrent episode, or a chronic episode (mild, moderate, or severe) with or without psychotic or physical features. Doherty and Gaughran (2014) observed how networks between psychological processes and physiological functions communicate to monitor, regulate, and guard against internal and external threats. Preliminary findings indicated that both systems (psychological and

physiological) may contribute to disease vulnerability increasing the risk of mortality (Doherty & Gaughran, 2014).

This chapter includes the background of Mexican American health disparities, the problem statement, the purpose of the study, the research questions, the conceptual framework, the nature of the study, and definitions of terms specific to this study. The chapter also includes assumptions, scope and delimitations, limitations, and the significance of the gap in research regarding diabetes outcomes among Mexican Americans as it relates to depression, alcohol use, and cigarette smoking. The chapter concludes with a summary.

Background

Medical practitioners have linked health outcomes to interactions between diseases and risk factors for many generations (Valderas, Starfield, Sibbald, Salisbury, & Roland, 2009). In 1846, a Hungarian doctor named Ignaz Semmelweis championed handwashing as a way of saving lives (Semmelweis Society International [SSI], 2009). Dr. Semmelweis, like other scientists during his time, had started applying scientific training to the practice of medicine (SSI, 2009). According to information from SSI (2009), Dr. Semmelweis collected data regarding the deaths of women in maternity wards from puerperal fever (childbed fever). Dr. Semmelweis performed several different experiments to find a link between the deaths of the women and the fever (SSI, 2009). Dr. Semmelweis eventually found a link between the actions of physicians performing autopsies and delivering babies (SSI, 2009). Dr. Semmelweis hypothesized that cadaverous particles were present on the hands of the physicians when they touched the

women giving birth, which contaminated their bodies and led to the childbed fever (SSI, 2009). Dr. Semmelweis implemented a handwashing regiment for the physicians and quickly noticed a reduction in childbed fevers and women's deaths associated with the fever (SSI, 2009).

The concept of linking one disease to the causes of another disease has been around for many generations. However, it was not until 1970 when Alvan Feinstein coined the term *comorbidity*, which referred to a situation in which an individual has two or more physical or mental medical conditions or illnesses (Jones, 2010). Physicians examine comorbidity from various positions when considering the management of a disease like diabetes and its prevalence and association with other diseases (Texas Behavioral Risk Factor Surveillance System, 2015). Examining how comorbidity impacts disease and prevalence may enable clinical practitioners to understand how to manage diabetes outcomes and comorbidities associated with Mexican Americans

The Texas Behavioral Risk Factor Surveillance System (2015) on diabetes prevalence by public health indicated that 15.1% of the region where I gathered data to conduct my research showed a significantly higher diabetes prevalence rate when compared to Texas prevalence (11.4%). Researchers selected diabetes complications/comorbid conditions and compared the prevalence rates to various other comorbidities (Texas Behavioral Risk Factor Surveillance System, 2015). The results showed that heart disease (10.8%), cardiovascular disease (23.7%), stroke (8.8%), high blood pressure (67.0%), and high cholesterol (63.6%) were all comorbidities associated with diabetes (Texas Behavioral Risk Factor Surveillance System, 2015). The report

indicated how those without diabetes showed significant differences in prevalence rates in heart disease (2.5%), cardiovascular disease (6.1%), stroke (2.2%), high blood pressure (24.5%), and high cholesterol (31.4%) when compared to those with diabetes (Texas Behavioral Risk Factor Surveillance System, 2015). Prevalence rates also differed by race/ethnicity: Black (17.0 %) and Hispanic (12.2%) populations showed higher prevalence rates for comorbidities compared to White (10.2%) and other multiracial groups (7.1%; The Texas Behavioral Risk Factor Surveillance System, 2015).

The first epidemic of diabetes was in 1921 and was reported by Dr. Joslin (Tattersall, 2009). Tattersall (2009) noted that type 1 diabetes occurs in approximately 10 to 20 per 100,000 people per year in the United States. By age 18, about 1 in 300 people in the United States develop type 1 diabetes. For unknown reasons, the worldwide incidence of type 1 diabetes has been increasing by 3% percent each year, whereas type 2 diabetes accounts for 90-95% of all cases in the United States (Cefalu, 2004; Tattersall, 2009). Cefalu (2004) indicated that individuals with diabetes mellitus have elevated rates of morbidity because they are at higher risk for cardiovascular disease, eye complications leading to blindness, kidney failure, extremity amputations, and other diabetes-related complications.

Researchers and medical practitioners have examined comorbidities between diabetes and mental illnesses such as depression and negative health practices such as consuming alcohol or smoking cigarettes (Valderas et al., 2009). Alcohol has been described as being responsible for “illnesses, insanity, accidents, immorality, impiety, social disorder, catastrophes, crime, and death” (Phillips, 2014, p. 2). From the middle

ages to modern times, it has been conventional to view alcohol as the central problem from which all other issues originate (Phillips, 2014). Furthermore, alcohol abuse may have higher prevalence in populations like Latinos and their subgroups. Acculturation plays a role in unhealthy behaviors such as alcohol abuse and smoking. According to a Surgeon General's report (as cited in Masel et al., 2006), smoking rates increase as ethnic minority groups adopt values, beliefs, and norms different from their own traditions. Several studies on comorbidity (Acee, 2010; Fernander, Shavers, & Hammons, 2007; Masel et al., 2006; Matto, 2005; Texas Behavioral Risk Factor Surveillance System, 2015) indicated further investigation is needed to address diabetes outcomes among minority groups like Mexican Americans as it relates to depression, alcohol use, and cigarette smoking.

Vaeth, Caetano, and Durazo (2014) reported that diabetes has adversely affected many minority groups. In subsequent studies, researchers using the Hispanic Health and Nutrition Examination survey found that diabetes was more prevalent in Mexican Americans (23.9%) and Puerto Ricans (26.1%) compared to Cuban (15.8%) respondents (Baquero, Borrell, Crawford, & Dallo, 2009; Caetano et., 2014). Baquero et al. (2009) noted that the prevalence of diabetes in the following states were as follows: California (10.9%), Texas, (10.5%), Puerto Rico (10.0%), New York (8.0%), and Florida (7.2%). Baquero et al. also discovered that most Mexican Americans reside in California and Texas. Baquero et al. suggested that researchers should continue to gather data on Hispanic subgroups (Mexican Americans, Puerto Rican, and Cubans) to improve

understanding of variables that can impact Hispanic health (specifically diabetes outcomes), given the continuous growth and diversity in this population.

Problem Statement

The problem addressed in this study was the need to evaluate the association between depressive symptoms and diabetes in Mexican American adults, and to understand how alcohol and cigarette smoking are linked to diabetic outcomes in this population. Castellanos et al. (2015) noted that Hispanics who did not have a diagnosis of diabetes "showed a 24% lower all-cause death rate" (p. 469) whereas the death rates (51%) in individuals with diabetes were significantly higher for Hispanics (including its subgroups) than those of other ethnic background in the United States. Castellanos et al. emphasized that comorbidity rates of diabetes and depression impact approximately 13.9% Mexican Americans. Despite an increased interest in diabetes in Mexican Americans (Dominquez et al., 2015; Caetano et., 2014), little empirical research has been conducted on this population regarding health habits related to diabetes control (e.g., alcohol use and cigarette smoking) and the influence depression may have on diabetes outcomes.

Purpose Statement

The purpose of this quantitative study was to use de-identified archived data collected in a diabetes clinic in Southern Texas to examine whether alcohol use, cigarette smoking, and/or depression predict diabetes outcome measures in Mexican American adult patients. The study was important because results may indicate factors related to adverse diabetic outcomes in Mexican Americans, and results may be used to design

diabetes and mental health (depression) management and treatment using the biopsychosocial model as a framework. I used de-identified archived data from the diabetic clinic in Southern Texas, including Patient Depression Questionnaire (PHQ-9) scores to measure depression severity. A demographic survey that addressed alcohol and cigarette use was also used. I also used smoking status and the glycated hemoglobin HbA1c test to assess diabetes outcomes for the 3-month test period.

Research Questions

The present study addressed the following research questions:

RQ1: Does depression severity predict diabetes outcome in Mexican American adults with diabetes?

$H_0$1: Depression, as assessed by the Patient Health Questionnaire-9, does not predict diabetes outcomes as measured by the HbA1c test in Mexican American adults with diabetes.

H_a1: There is a significant association between diabetes outcomes and depression severity in Mexican American adults with diabetes as assessed by the Patient Health Questionnaire-9 score and diabetes outcome as measured by the HbA1c score.

RQ2: Does frequency and quantity of cigarette smoking predict diabetes outcome in Mexican American adults with diabetes?

$H_0$2: Frequency and quantity of cigarette smoking, as assessed by the demographic questions, does not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a2: There is a statistically significant association between frequency and quantity of cigarette smoking and diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

RQ3: Does frequency and quantity of alcohol consumption predict diabetes outcome in Mexican American adults with diabetes?

H_03: Frequency and quantity of alcohol consumption, as assessed by the demographic questions, does not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a3: There is a statistically significant association between frequency and quantity of alcohol consumption and diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

Theoretical Framework

The theoretical framework used for this study was Engel's biopsychosocial model (Frazier, 2020; Malhi et al., 2013). This model advocates for an intricate view of health that acknowledges the influence of physical, psychological, and social-cultural factors (Malhi et al., 2013; Krantz, Suls, & Williams, 2013). This framework allows practitioners to comprehend the complex and comorbid patient (Malhi et al., 2013; Krantz et al., 2013). A complex and comorbid patient can be an individual who has more than one disease that may influence health outcome (Malhi et al., 2013; Krantz et al., 2013). This framework is a comprehensive and integrative perspective for conceptualizing an individual and can provide an in-depth understanding of internal and external factors that influence health (Frazier, 2020; Malhi et al., 2013; Krantz et al., 2013). Additionally,

implementing treatment strategies can improve social functionality by addressing how health habits can be of value in reducing the burden of depression, which can be linked with diabetic outcomes (Fox, Gavin, & Grandy, 2011; Krantz et al., 2013). Malhi et al. (2013) indicated that this multifactorial, complex issue requires a theoretical and clinical model (biopsychosocial) for intervention that accommodates interdisciplinary collaboration (physical, mental, and social components of an individual). Looking at health habits like cigarette smoking and consumption of alcohol can better inform a clinician regarding early recognition techniques, treatment of depressive symptoms, management of diabetes, and prediction of outcome (Fox et al., 2011; Krantz et al., 2013). The biopsychosocial model is a framework that addresses the complexity of medical issues and how multiple factors internal and external to an individual impact health outcome; the biopsychosocial model also addresses the challenges for health care professionals, patients, and their families (Fox et al., 2011; Krantz et al., 2013). Researchers have used the biopsychosocial model to study patients with diabetes and depression (Byrn & Penckofer, 2015; Covinsky & Landefeld, 1996; Kruger, McMurry, & , 1999; Krantz et al., 2013). The purpose of these studies was to understand which of the three dimensions (biological, psychological, and social) directly or indirectly link to the health outcomes (Byrn & Penckofer, 2015; Covinsky & Landefeld, 1996; Kruger et al., 1999; Krantz et al., 2013). Engel's model was relevant to the current study because it revealed to what extent the biopsychosocial model contributes to a better understanding of diabetes outcomes and indicated where improvements were necessary.

Nature of the Study

I used a quantitative archival survey design. Quantitative methodology was appropriate in developing an understanding of whether and how symptoms of depression, as well as alcohol and cigarette use, are related to diabetic outcomes in Mexican Americans. I used de-identified archived data from a diabetic clinic in Southern Texas. The independent variables in this study were depression severity, alcohol use, and cigarette smoking. The dependent variable was diabetes outcomes for the 3-month study period. The dependent variable was a continuous numerical variable. The independent variable depression severity was a continuous numerical variable. The independent variables alcohol use and cigarette smoking were binominal variables that had two categories (yes and no) with no intrinsic order. The archived data provided continuous numerical values for frequency and quantity of alcohol and cigarette use. I used the de-identified archived data from the diabetic clinic in Southern Texas to assess the PHQ-9scores to measure depression severity, alcohol use, and smoking status. I used the glycated hemoglobin HbA1c test to assess diabetes outcomes for the 3-month study period.

Definitions of Terms

I used the following operational terms and phrases throughout the study:

Adverse health habits: Special individualities of participants' experiences that include cigarette smoking and alcohol consumption, which are important in understanding individual responses to disease, treatment, and health outcomes (Fleary, Freund, & Nigg, 2018).

Alcohol consumption: Drinking patterns of alcohol use from populations with varying traditions, histories, and cultures (Phillips, 2014).

Biopsychosocial model: A multifactorial model that encompasses biological, psychological, and social factors that influence health outcomes in various diseases; a continuum of factors that impact all systems associated with the human body (Purdy, 2013).

Cigarette use: A substance that is inhaled and is considered the most commonly used tobacco product in U.S. adults (Jamal et al., 2018; Ferguson, Scharf, Shiffman, & Tindle, 2016).

Comorbid disease: A disease that has the presence of one or more additional diseases; diseases linked to diabetic outcome in Mexican Americans. (Mendenhall, 2012; Ma et al., 2012; Petrak et al., 2013).

Correlational research: The type of investigation in which variables are measured, not manipulated, to determine the relationships between variables (e.g., predictor and criterion). The researcher does not have control over subject assignment or the conditions of the study (Dziak, 2016).

Depression symptoms: Symptoms include depressed mood or the loss of interest in nearly all activities (Dobmeyer, 2018). Symptoms may include changes in appetite, sleep, psychomotor activity, decreased energy, feelings of worthlessness, difficulty making decisions, and concentrating (Dobmeyer, 2018).

Diabetes mellitus: A chronic metabolic disease defined by significantly high levels of glycemia (Forrest, 2013; Joslin & Kahn, 2005).

Disparity: The conditions of being unequal, or a noticeable difference in ethnic groups like Mexican Americans (Hansen & Cabassa, 2012).

Hb1AC number: This number represents hemoglobin, which is a biomarker in diabetic diagnosis and management. This measure indicates recent blood glucose concentrations in the blood (Donaldson, 1996).

PHQ-9: A cross-cultural, psychometric tool used to measure the construct of depression severity in various languages (including Spanish). This 9-item self-report questionnaire is used to assess depression on a 4-point scale (Chung et al., 2006; Kroenke et al., 2013).

Assumptions

There were multiple assumptions associated with this quantitative study. The first assumption was that the de-identified archived data from the diabetic clinic in Southern Texas were reliable and that the PHQ-9 and the HbA1c instruments had enough reliability and validity to accurately assess depression severity and diabetic outcomes. Another assumption was that the participants and health care providers honestly completed the patients' information and their responses were accurate, which is part of the validity and reliability questions associated with any measurement tools.

Scope and Delimitations

The scope of the study included de-identified archived data from the diabetic clinic in Southern Texas about adult Mexican Americans with diabetes mellitus and how depression severity and adverse health habits may or may not have been associated with their diabetic outcomes. The scope was limited to a convenience sample of Mexican

Americans from Southern Texas. I assessed the relationship between diabetes outcome, depression, and adverse health habits by analyzing data with IBM SPSS Statistics 25 software.

I limited the archival data to Mexican Americans, a specific geographic region, and participants diagnosed with diabetes. I did not include other ethnic groups. Additionally, Latinos outside the United States were not included. Lastly, archival data related to gestational and borderline diabetic patients and other diseases affecting Mexican Americans in Southern Texas were not included in the study.

Limitations

This study was limited by its correlational design. The variables were not manipulated; therefore, no causal relationship between variables was inferred. The de-identified archived data from the diabetic clinic in Southern Texas had some limitations that needed to be considered: biases due to selective deposit (biases that influence what information is recorded or deposited in the archival record), selective survival (when archival records are missing or incomplete), and archived data that do not contain detailed information about specific amounts of alcohol and cigarette consumption (see Creswell, 2003). The use of quantitative methodology prevented participants from being able to report their personal stories, which eliminated the possibility of obtaining subjective information on motivations, feelings, and personal insights (see Boyd, 2016; Brown, 2014; Creswell, 2003). In addition, this study did not include data that displayed a prevalence of diabetes (diagnosed plus undiagnosed). According to Beckles and Chou (2016), approximately 28% of the U.S. population goes undiagnosed for diabetes, and

this population can vary by race, ethnicity, and scoioeconmic status. Additionally, due to the selected population sample and the single institution (a diabetic clinic in Southern Texas), the generalizability of findings was limited (see Green & Salkind, 2008). Lastly, the PHQ-9 neglected to screen for other potential correlates to other mental health disorders and diabetes mellitus, which was a limitation.

Significance of the Study

This research filled a gap in understanding the relationship between depressive symptoms, alcohol use, cigarette smoking, and diabetes outcome by focusing on the extent to which alcohol and cigarette consumption and depressive symptoms link to diabetic outcome in Mexican American adults with diagnoses of diabetes. This study was unique because it addressed an under researched population of Mexican Americans, which has experienced a significant increase in diabetes over the past decade (Center disease control, 2014). A study focused on how alcohol, cigarettes, and depressive symptoms link to diabetic outcome was important for several reasons. First, understanding the relationship between adverse health habits (alcohol consumption and cigarette usage), depression severity, and diabetic outcomes may indicate factors related to adverse diabetic outcomes in Mexican Americans. Second, the results of this study may provide insight for individuals (e.g., diabetic patients, ethnic groups who have higher prevalence of mortality, health care providers, and mental health professionals) regarding how to manage disease, health outcomes, and comorbid health disparities in Mexican Americans. Third, this study may provide insight into quality care in the Mexican American community that includes better practices in clinical recognition for depression,

increased understanding of the management of diabetes in Mexican Americans, tailored treatment using the biopsychosocial model as a framework, proper recognition of patterns of adverse health habits (alcohol consumption and cigarette usage), and adequate referrals to mental health providers.

Summary

This chapter included an introduction about diabetic outcomes (as measure by the HbA1c test) potentially linked to depression (as measured by the PHQ-9 score), alcohol consumption, and cigarette use. Additionally, the chapter addressed how the biopsychosocial model may play a role in linking diabetes and depression to adverse health habits including alcohol consumption and cigarette use. Chapter 2 includes a review of relevant literature related to diabetes and the other variables that support the theoretical framework, the gap in research, and the need for the study.

Chapter 2: Literature Review

Introduction

Researchers have predicted that "approximately half of the U.S. population will suffer from diabetes or prediabetes in 2020" (Munukutla et al., 2016, p. 686). The Texas Behavioral Risk Factor Surveillance System (2015) indicated an increased prevalence of health disparities when diabetes mellitus, depression, the consumption of alcohol, and cigarette use are comorbid. The negative health habits of many Mexican Americans impact their health outcomes when they experience comorbidity like depression and diabetes (Ciechanowski, Katon, Russo, & Hirsch, 2003; Hudson et al., 2013; Scobie, 2014). The problem this study addressed was the gap in the literature concerning an association between depressive symptoms and diabetes in Mexican American adults, and the need to understand whether alcohol and cigarette smoking predict diabetic outcome in this population (see Bandiera, Vaeth, Caetano, & Pérez-Stable, 2018). I used the biopsychosocial model to examine potential associations between alcohol consumption, cigarette smoking, and diabetic outcome. De-identified archived data were collected from a diabetic clinic in Southern Texas to determine whether alcohol use, cigarette smoking, and depression symptoms were associated with diabetes outcome in Mexican American adults treated for diabetes between 2017 and 2019.

This chapter includes the literature search strategies and a review of studies about comorbidity, depression symptoms, consumption of alcohol, cigarette smoking, and diabetes mellitus. The review also addresses literature relating to the biopsychosocial

model and health outcomes related to diabetes mellitus. The chapter concludes with a summary.

Literature Search Strategy

I used several search strategies to complete the literature search. I located peer-reviewed articles by using databases that allowed me to search for only peer-reviewed articles. I typed keywords into Google, Google Scholar, PsycArticles, PsycInfo, PsycExtra, PsycTests, MEDLINE, Academic Review, Science Direct and ERIC search engines. Some of the key words included in the searches were *biopsychosocial theory*, *depression, diabetes, ethnic disparities, alcohol consumption, cigarette smoking, comorbid disease, correlational research, health habits related to diabetes, etiology, testing measurements*, *PHQ-9*, *Latino populations*, and more specifically subgroups like *Mexican Americans*. The sources obtained, identified, analyzed, and reviewed for this study included primary state sources, professional journals (peer reviewed), books, tests and measurements, and theory and theorists.

Theoretical Framework

Engel (as cited in Habtewold, Islam, Radie, & Tegegne, 2016; Purdy, 2013; Smith & Uchino, 2008) developed the biopsychosocial theory by revising the oversimplified biomedical paradigm that associated the extent of physiological damage to the severity of illness and replaced it with an alternative framework that encompasses multiple influences. This model has been used to identify appropriate interventions to treat complex health issues and represents the notion that health reflects a paradigm that includes complex confounders of physiological, psychological, and social factors

(Cooper, 2005; Habtewold et al., 2016). The biopsychosocial model has been adopted as a model in the areas of medical practice, research, and training (Purdy, 2013; Smith & Uchino, 2008). The biopsychosocial model allows practitioners to comprehend cases with multiple comorbidities, such as diagnoses of diabetes coupled with depression, by understanding the impact of internal and external factors on health outcomes. Practitioners can use Engel's (as cited in Gavin et al., 2011; Krantz et al., 2013) biopsychosocial model to comprehend the comorbid relationship between diabetes and depression while providing a comprehensive and integrative perspective for conceptualizing patients' minds and bodies.

Treatment strategies can then be implemented that may improve function by addressing health habits that might be of value in improving diabetic outcomes (Gavin et al., 2011;Krantz et al., 2013). Malhi et al. (2013) stated that the biopsychosocial model integrates a systematic conceptual framework that takes advantage of diverse systems independent of their biological, psychological, and sociological nature. According to Purdy (2013), researchers have used this model to encourage clinicians to examine biological, psychological, and social influences when assessing a wide range of health conditions including depression, cancer, diabetes, HIV-AIDS, personality disorders, and chronic pain. This model has helped researchers achieve significant goals in understanding how physiological, psychological, and social influences interact in the field of medicine, involving a wide range of comorbid health issues and diseases (Habtewold et al., 2016; Smith & Uchino, 2008).

Literature on health and disease indicated a multifaceted approach to exploring possible factors that can influence health outcomes through the biopsychosocial model (Smith & Uchino, 2008; Halligan & Wade, 2017). Wade and Halligan (2017) observed that chronic disease appears to account for the most morbidity and death in Western culture. Wade and Halligan suggested the use of the biopsychosocial model to explore chronic disorders, improve patient outcomes, and control health care cost. In addition, approximately 25% of hospital outpatients have issues that are not accounted for by any specific disease (Halligan & Wade, 2017). Researchers have shown that illness and disease emerge and advance from intertwined biological predispositions, psychological states, and health habits like smoking and alcohol consumption (Cooper, 2005; Habtewold et al., 2016; Lewis, Myers, & Parker-Dominguez, 2003; Purdy, 2013). Researchers have recommended the use of this framework when trying to understand a complex disease, which is commonly present in Mexican Americans (Baquero et al., 2009; Halligan & Wade, 2017). Baquero et al. (2009) suggested that given the continuous growth and diversity of the Hispanic population and their subgroups (Mexican Americans, Puerto Ricans, and Cubans), further investigation is needed to expand the knowledge and understanding of health outcomes within this population. Baqueroet al. (2009) reported that non-Hispanic Black (14.5%) and Mexican American (15.0%) adults had a higher age-adjusted prevalence of diabetes than non-Hispanic White adults (8.8%).

Recently, researchers have embraced the inclusion of indicators (biological, psychological, and social) that guide research toward a holistic assessment of health

(Gallo & Luecken, 2007; Lewis et al., 2003; Halligan & Wade, 2017). Advances in research have scientists exploring neural pathways that involve both mind and body connections (Cooper, 2005; Lewis et al., 2003; Smith & Uchino, 2008). The purpose of this consideration and analysis is to motivate researchers to move toward multiple levels of analysis that include the biopsychosocial perspective (Cooper, 2005; Lewis et al., 2003; Smith & Uchino, 2008; Halligan & Wade, 2017). In addition, looking at how social health habits like cigarette smoking and the consumption of alcohol can better inform a clinician regarding what factors to evaluate in the treatment of depression symptoms and management of diabetes (Gavin et al., 2011; Krantz et al., 2013).

The biopsychosocial theory addresses the complexity of medical issues and how multiple internal and external factors impact health outcome. By incorporating complex interacting factors that influence health outcomes as well as each other, the model addresses challenges for health care professionals, patients, and their families (Gavin et al., 2011; Krantz et al., 2013). Researchers have used the biopsychosocial model to study individuals with diabetes and depression (Byrn & Penckofer, 2015; Covinsky & Landefeld, 1996; Kruger et al., 1999; Krantz et al., 2013). The purpose of this research has been to understand how biological, psychological, and social factors directly or indirectly link to the health outcomes (Byrn & Penckofer, 2015; Covinsky & Landefeld, 1996; Kruger et al., 1999; Krantz et al., 2013). Engel's (1977) model was appropriate for the current study to improve understanding of factors related to diabetes outcomes.

How Depression Impacts Diabetes Mellitus

Researchers have debated whether depression can be linked to diabetes outcomes (Ciechanowski et al., 2003; Hudson et al., 2013; Kaltman et al., 2016; Scobie, 2014). Scobie (2014) described how the association between diabetes and depression has been highlighted in literature for many years. Byrn, Doyle, Lustman, and Penckofer (2014) and Dergance, Mouton, Lichtenstein, and Hazuda (2005) suggested that a bidirectional link between depression and type 2 diabetes mellitus exists and that numerous mediators underlie these conditions. However, there are inconsistencies in the literature, which has been criticized for the methodology used, problems with recruitment, a lack of focus on ethnicity, the use of unstandardized instruments, and the failure to analyze confounding and causal relationships (Ciechanowski et al., 2003; Hudson et al., 2013; Scobie, 2014). Due to these inconsistencies, further examination is needed to understand whether and how underlying variables are associated with diabetic outcomes. More specifically, ethnicity needs to be addressed to understand the underlying variables associated with Mexican American disparities and comorbid disease.

Hansen and Cabassa (2012) argued that disparities in minority groups need to be examined, and suggested that addressing variables distinct to Latinos may isolate practices that contribute to disparities. There has been relatively little research on the disparities of depression in minority groups (Hansen & Cabassa; Fisher-Hoch, & McCormick, Olvera, Vatcheva, Williamson, 2016). Hansen and Cabassa and Olvera et al. (2016) described how researchers have explained the importance of increasing service use, adherence to care, and successful treatment, as well as the importance of identifying

culturally appropriate interventions designed for Latino populations. By addressing the gaps and recommendations in the literature relating to the need for more research on Mexican Americans and diabetes and comorbid depression, researchers can provide new insights on depressive symptoms and diabetes outcome. This may aid in addressing deficiencies in treatment plans for ethnic populations (specifically Mexican Americans) who have a higher prevalence for comorbid disease (Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2013). There are several factors that researchers need to explore, such as depressive symptoms and comorbid disease, underdiagnosis of diabetes mellitus and depression, ethnicity and how it relates to health outcome, health habits such as cigarette smoking and alcohol consumption that may influence outcome, and whether and how gender may be related to diabetic outcome (Egede, Nietert, & Zheng, 2005; Hudson et al., 2013; Mendenhall, 2012; Kozak, Osborn, & Wagner, 2010; Petrak et al., 2013). These factors have shown possible links to diabetes outcome and adverse influences on depressive symptoms (Mendenhall, 2012; Ma et al., 2012; Petrak et al., 2013).

Scobie (2014) noted that about 60% of diabetes patients report depressive symptoms and concluded that depression is a risk factor for diabetes. Scobie and Hansen and Cabassa (2012) noted that individuals with diabetes are at increased risk of experiencing depression and anxiety. Additionally, people with mental illness such as depression are at a significant risk of developing diabetes (Hansen & Cabassa, 2012; Fisher-Hoch et al., 2016; Scobie, 2014). Egede and Ellis (2010) indicated that individuals with diabetes and depression are 2.5 times more likely to die within an 8-year span

compared to those who are diagnosed with either disorder. Egede and Ellis used data from the National Health and Nutrition Examination Survey and found that 54% of the participants who had diabetes and depression had a greater expectation for early mortality than those without depression. Learning more about the relationship between depression, health habits, and diabetes could lead to improved diabetes control (Byrn, et al., 2014; Johansson, Lindholm, Nyström, & Sahlen, 2013). Egede and Ellis noted that results from a study of 10,704 Medicare beneficiaries showed that 38% of the participants with comorbid disease experienced increased risk of death over a period of 2 years. Scobie (2014) found that people with depression and diabetes have worse outcomes and quality of life. Exploring the relationship between these variables in Mexican Americans may provide researchers with a better understanding of how ethnicity is linked to comorbid disease. There is a need for research on depression and diabetes in the Mexican American population (Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2013).

Researchers have found reasons for concern about comorbid diseases such as diabetes and depression in Latinos, and this comorbidity is prevalent in Mexican Americans as a subgroup of the Latino population (Mendenhall, 2012; Ma et al., 2012; Petrak et al., 2013). According to Ma et al., (2012), the prevalence of diabetes is alarmingly high in Latinos, and this prevalence is increasing. An in-depth exploration of influences that may impact diabetic outcome in Mexican Americans is needed, and this is clear in the research literature (Mendenhall, 2012; Ma et al., 2012; Petrak et al., 2013; The Texas Behavioral Risk Factor Surveillance System, 2015; The Texas Department of

State Health Services, 2013). The consensus view is that both depression and diabetes are prevalent and co-occurring health concerns found in Latino adults residing near the U.S.-Mexico border (Petrak et al., 2013). Petrak et al. (2013) noted that diabetes mellitus affects about 10% of the world's adult population, and Ma et al. observed that Latino Americans are 1.5 times more likely to experience diabetes than non-Latino Whites, as well as that the increasing prevalence of diabetes and comorbid depression need to be addressed. Both Ocken et al. and Petrak et al. concluded that addressing the possible links between diabetes and depressive symptoms in underrepresented ethnicities is essential in moving forward with studying this epidemic.

There are various reasons that can account for underrepresentation in the Latino population in regard to co-occurring health issues. Ma et al. (2012) and Petrak et al. (2013) stated that a lack of depression screening and inadequate referrals may account for deficits in health care and poor health outcomes. In addition, not having a clear understanding of underlying factors, disparities, or mechanisms associated with ethnicity, depression and unfavorable diabetic outcomes may leave health issues unresolved in the Mexican Americans population (Ma et al., 2012; Petrak et al., 2013).

Anderson, Clouse, Freedland, and Lustman (2014) reviewed the research and examined comorbid depression in 20 of 42 eligible studies. The prevalence of comorbid depression was relatively higher in diabetic women (28%) than in diabetic men (18%) (Anderson, Clouse, Freedland, & Lustman et al., 2014). Depression was also significantly higher in diabetic patients (30%) when compared to non-diabetic control groups included in the studies (21%) (Anderson et al., 2014). In addition, they concluded that Mexican

American adults with diabetes were about three times more likely to have comorbid depression compared with the general diabetic population (Anderson et al., 2014). Anderson et al. study concluded that 26 % of individuals with diabetes have elevated depression symptoms, and that major depression is present in 14.7% of diabetic patients. Moreover, patients with both diabetes and depression showed functional impairments, reduced quality of life, nonadherence to medical treatment, impaired glycemic control, and an increase in the risk of diabetes complications (Anderson et al., 2014).

Scobie (2014) provided ample support for the assertion that mortality is increased in those with depression regardless the level of severity (meaning even those with low and mild symptoms of depression) and identified ethnicity and cigarette smoking as key variables in need of further exploration. He also indicated that these variables are rarely acknowledged or mentioned within study designs or analyses in studies of depression. There has been an inconclusive debate about whether the physiological effects (hormones and stress) of diabetes are linked to depression (Scobie, 2014). However, Olvera et al. (2016) showed that univariate and multivariate models appear to support the view that depression symptoms are elevated in individuals undergoing treatment for diabetes compared to those without this diagnosis.

Adler's (2009) confirmed that depressive symptoms have significantly increased over time, and that comorbidity is also increasing in the 26 million Americans with diabetes. Diabetes is also more prevalent in Latinos and their subgroups than other American populations, which in turn puts them at an increased risk of comorbidity and mortality (Cuevas, Dawson, David, & Williams, 2016). About 13 million individuals

have been diagnosed with diabetes, and approximately 5.2 million have been affected but not yet diagnosed (Acee, 2010). Approximately 800,000 new cases of diabetes are diagnosed annually, and the numbers are increasing (Acee, 2010; Byrn et al., 2014).

Diabetes is a psychologically demanding chronic disease, and this both increases the odds and number of new cases of comorbid depression (Bădescu et al., 2016; et al., Byrn, 2014) and the odds of poor quality of life and health outcomes. Bădescu et al. (2016) noted that there is a gap in knowledge regarding medical care in participants who have both diabetes and depression. Only 31% of individuals in need of them have been provided sufficient anti-depression medications, and approximately 6.7% of that 31 % have received psychotherapy (Acee, 2010; Katon Von Korff et al., 2003). This is a concern to medical doctors, health care providers, and individuals who are diagnosed with diabetes (Acee, 2010). Researchers have recommended exploration of comorbid diabetes and depression to better equip medical doctors, communication between family doctor and psychologists, and clinics that specialize in diabetes and depression (Acee, 2010; Anderson et al., 2014; Bădescu et al., 2016; Katon Von Korff et al., 2003).

Both depression and depressive symptoms have gone undetected, understudied, and untreated, resulting in adverse health costs and health outcomes (Acee, 2010; Anderson et al., 2014; Bădescu et al., 2016; Katon Von Korff et al., 2003). Additionally, researchers have concluded that chronic diseases such as diabetes contribute to a negative prognosis of depression (Acee, 2010; Bădescu et al., 2016). The development of an intervention framework (screening) is needed to detect depressive symptoms (Bădescu et al., 2016; Kroenke, Spitzer, Williams, & Lōwe, 2010). The treatment of depressive

symptoms or chronic depression in individuals with diabetes may lead to recovery or avoid a relapse that affects the quality of the patients' lives (Bogner, de Vries, O'Donnell, & Morales, 2013; Kroenke et al., 2010).

The studies incorporated a review that included information about ways in which diabetes can possibly put individuals at risk for depression and other complications, thus limiting one's quality of life. These studies have led researchers to significant discussions regarding how various factors, such as comorbid depression, the use of alcohol, and cigarette smoking may impact health outcomes in diabetic patients.

How Alcohol Impacts Diabetes Mellitus

Preliminary work by Caetano and Mills (2016) on alcohol consumption focused primarily alcohol-related problems associated with individual characteristics (i.e. perceptions of violence). Caetano and Mills noted the considerable attention paid to how culture shaped drinking behavior and alcohol consumption within specific ethnicities. The authors reported that 75% of the young adult Mexicans who lived on the border went to bars to drink alcohol compared to 69% of a similar population in Mexico. They also noted that Hispanic ethnic groups along the border had a high proportion of alcohol problems such as heavy drinking, drunkenness, and alcohol-related social issues. Munukutla et al. (2016) found that healthcare professionals tend to underestimate alcohol toxicity as a component in inducing and exasperating diabetes mellitus related symptoms, which has contributed to the increasing epidemic of adverse diabetic outcomes in Mexican Americans. The work of Munukutla et al. and Caetano and Mills laid a

foundation for others to explore the issues related to alcohol consumption in the Mexican American population.

There is a considerable amount of literature on the need to research and analyze how alcohol consumption can impact diabetes management in ethnic populations (Buelens, 2013; Naughton, 2014; Vaeth, Caetano, & Durazo, 2014; Walter & Petry, 2015). A common theme is the simple fact that little is known regarding the drinking practices of Latinos (including the subgroups of Mexican- Americans, Cubans, and Puerto Ricans) with diabetes (Buelens, 2013; Naughton, 2014; Vaeth, Caetano, & Durazo, 2014; Walter & Petry, 2015). Several researchers have identified relations between ethnicity, patterns of drinking, social determinants that influence health problems (socioeconomic and psychosocial conditions), and adverse health effects (Asuzu, Walker, Williams, & Egede, 2017; Caetano et., 2014). Vaeth et al. (2014) suggested that Black (39.4%) and White (32.8%) men are less likely than Hispanic (56.8%) men to be drinkers, who also have a higher prevalence of liver cancer. White women (11.5%) were less likely to be consistent or heavy drinkers compared to Mexican women (24.1%; Caetano et., 2014). The authors reported that Latino men consumed more drinks per week and had higher rates of diabetes than White or Black men, and concluded that alcohol consumption may be connected to diabetes and health outcome in Mexican Americans.

Bastani, Flores, Lang, and Salmeron (2012) and Vaeth et al. (2014) indicated that alcohol consumption may impact diabetes outcome and liver disease in some ethnic groups compared to the general population. These authors provided evidence to support

their arguments that Mexican American men were at twice the risk for binge drinking and acquiring chronic liver diseases compared to White men Bastani et al., 2012; Caetano et., 2014). The conclusions of Flores et al. and Vaeth et al. rested on the assumption that alcohol consumption may impact diabetes outcomes and other alcohol-related diseases such as cirrhosis of the liver and heart disease.

Approximately 70% of the individuals with diabetes in the Vaeth et al. (2014) study had two or more comorbid conditions linked to their condition like heart disease and liver issues (Caetano et., 2014). A number of authors have studied the relation of diabetes outcomes to comorbid medical conditions (Buelens, 2013; Naughton, 2014; Caetano et., 2014). More recently, researchers have proposed that diabetes patients with poor health may possibly drink excessively, which can also be associated with depression (Buelens, 2013; Bastani et al., 2012; Naughton, 2014; Caetano et., 2014). Vaeth et al. noted that a Centers of Disease Control report included information about how only one in six adults mentioned their drinking status with their primary care physicians. Vaeth et al. (2014) Beulens et al. (2013) and Naughton (2014) put emphasis on the need to inquire about drinking practices in patients and to explain the health risks linked to alcohol consumption, since most adults do not report their drinking status.

Naughton (2014) and Sadava (1978) suggested drinking alcohol may be related to negative health outcomes such as high blood pressure as well as obesity, which is a significant risk factor in diabetes health outcomes. Researchers and the Texas Department of State Health Services (2015) have proposed that alcohol consumption (both low and high consumption levels) can increase the risk of common diseases like chronic

macrovascular damage in the eyes, kidneys, nerves, and the cardiovascular systems (Bastani et al., 2012; Naughton, 2014; Caetano et., 2014). Other health disparities linked to alcohol consumption include retinopathy, neuropathy, and nephropathy (Flores et al., 2012; Naughton, 2014; Caetano et., 2014). Naughton (2014) noted that alcohol intake for individuals with diabetes is similar to the general population, which is a cause for concern. This evidence aligns with the research questions presented in this study. The suggested alcohol amount is 17 drinks per week for men and about 11 for women. Naughton (2014) observed a link between drinking excess alcohol to high blood pressure and obesity, which are risk factors for diabetes. Drinking increases, the risk of acute and chronic pancreatitis (Naughton, 2014). About "70% of cases of chronic pancreatitis are due to long term heavy drinking, whereas 50% of people who have chronic pancreatitis go on to develop diabetes" (Naughton, 2014, p. 59). All of this evidence supports the need for this research and the research questions presented by this study. Further exploration of the association between alcohol use and diabetes outcomes is needed, particularly in the Mexican American population.

As Naughton (2014) discussed, 90 to 95% of glucose is metabolized in the liver, which is also responsible for gluconeogenesis. Gluconeogenesis is a process that involves the formation of glucose from non-carbohydrate sources (Naughton, 2014). Alcohol can increase the "risk of hypoglycemia by impairing hepatic glucose release" (Naughton, 2014, p. 60). Given this association, various researchers have recommended investigation of how alcohol predicts health outcomes in individuals with diabetes (Bastani et al., 2012; Buelens, 2013; Naughton, 2014; Caetano et., 2014).

Even moderate alcohol consumption is associated with an increased risk in type 2 diabetes (Buelens, 2013; Naughton, 2014). Buelens (2013) used biomarkers such as HDL cholesterol, triglycerides, and adiponectin to clarify the association between alcohol consumption and diabetes outcomes. Buelens found that increased HDL cholesterol in large amounts could explain the relationship between alcohol consumption and diabetes at a rate of 78% in comparison to adiponectin that could only explained about 25% of the relations between alcohol and diabetes. However, the biomarker triglyceride could not explain any relationship between diabetes and alcohol consumption (Buelens, 2013). The researcher concluded that some biomarkers could explain that alcohol consumption was significantly associated with diabetes (Buelens, 2013). In contrast, Afable-Munsuz, Gregorich, Markides, and Pérez-Stable (2013) provided empirical support consistent with past studies to support the assertion that the relation of alcohol to diabetes outcome implies a causal role for behavioral or environmental factors. Buelen and Afable-Munsuz et al. (2013) supported the finding that alcohol consumption can be associated with adverse health outcomes (specifically diabetes) in Mexican- Americans.

Anderson et al. (2014) mentioned that alcohol consumption can related to psychiatric symptoms such as anxiety and depression. Anderson et al. found that when alcohol is removed from the equation and replaced with nutritional components, there was a decrease in negative psychiatric symptoms. Cowry et al. (2016) noted that when alcohol is consumed, regardless of the amount, minerals and vitamins are lost, which has a direct link to psychiatric mood disorders such as depression. These results supported Anderson's claims regarding how alcohol and depression may impact diabetes outcomes.

Anderson et al., Cowry et al., and Bastani et al. all supported the claim that alcohol use is linked to both psychological and physiological problems.

Engler, Ramsey, and Smith (2013) observed that diabetes self-care behaviors tend to be associated with disease progression. The authors identified alcohol usage as a barrier to adherence (Engler, Ramsey, & Smith, 2013). Engler et al. (2013) noticed that diabetic patients who were at risk for drinking were more likely to have "poor diabetes treatment adherence," which leads to increased risk of morbidity and mortality (p. 93). Engler et al. also noted that heavy drinking is associated with poor insulin adherence and decreased motivation to participate in health care regimens. The author found that 17% of the diabetic patients in his study seeking severe hypoglycemia treatment had been drinking, and 31% had long histories of alcohol abuse.

Although long-term use of alcohol was found to be associated with diabetes complications, the short-term impact of alcohol usage on diabetes is not known and the findings of researchers has been conflicting (Engler et al., 2013). One factor that may alter the relation between alcohol use and diabetes outcomes is whether alcohol is consumed with or without a meal (Engler et al., 2013). Another factor that can impact diabetes outcome is whether or not a fasting glucose level is measured before the consumption of alcohol (Engler et al., 2013). Even the smallest amount of alcohol may impact diabetic control negatively in ethnic minority samples like Hispanics (61%) compared to African Americans (29 %) (Engler et al., 2013). Researchers have demonstrated a possible link between alcohol consumption psychological problems and self-care adherence behaviors to diabetic outcomes (Anderson et al., 2014; Buelens,

2013; Cherpitel & Cook, 2012; Flores et al., 2012; Naughton, 2014; Caetano et., 2014). Further investigation is needed regarding alcohol consumption in ethnic minorities, particularly subgroups like Mexican Americans, and the possible impact it may have on diabetes outcomes.

There is growing support for the claim that management of a chronic disease like diabetes is dependent upon decreasing one's risks of disease, adhering to medication regiments, and abstaining from alcohol (Cherpitel & Cook, 2012; Hillson, 2015; Cowry et al., 2016). Cowry et al. (2016) and Afable-Munsuz et al. (2013) noted that reduced alcohol usage is vital in the management of diabetes because drinking may independently affect clinical outcomes and cause poor control of one's illness and increase insulin resistance, which can cause mortality. In addition, alcohol use predicts poor adherence to dietary routines, medication, physical compliance, and attachments to nicotine (Afable-Munsuz et al., 2013; Anderson et al., 2014; Cherpitel & Cook, 2012; Engler et al., 2013).

How Cigarette Smoking Impacts Diabetes Mellitus

Anderson et al. (2014) and Wakabayashi (2014) asserted that individuals who consumed alcohol and are biochemically attached to nicotine might experience problems that impact diabetes outcomes and health quality. Anderson et al. found that individuals who drank alcohol smoked cigarettes and consumed unhealthy foods at a higher rate than those who did not drink alcohol.

Wakabayashi (2014) conducted a study that involved 2,563 participants with diabetes that were divided into three groups: non-smokers, light smokers (20 or fewer cigarettes a day), and heavy smokers (more than 20 cigarettes a day). The researcher

investigated the relationship between smoking and the lipid indices in these participants. HDL cholesterol increased as amount of smoking increased and was significantly higher in heavy smokers compared to the other two groups. (Wakabayashi, 2014). Cigarette smoking was predicted to further accelerate atherosclerotic progression in individuals with diabetes, as high cholesterol has been known to cause adverse cardiovascular outcomes in individuals with diabetes (Wakabayashi, 2014). Both Anderson et al. (2014) and Wakabayashi (2014) agreed that adverse habits like cigarette consumption can predict complications in individuals with diabetes, and supported the idea of a functional analysis (a variety of techniques or strategies used to gather information that cause problem behavior) to gather data on behaviors associated with cigarette consumption.

Wakabayashi (2014) reported that HbA1c levels and cholesterol ratios were slightly higher in light smokers than non-smokers; however, the HbA1c levels and cholesterol ratios were significantly higher in heavy smokers compared to non-smokers. Researchers have showed that smoking can be linked to insulin resistance (Al Rifai et al., 2016; Wakabayashi, 2014). Wakabayashi and Al Rifai et al. (2016) suggested that diabetic patients should refrain from smoking to decrease the risk of adverse health outcomes related to diabetes. They also noted the need for further research to investigate other relationships between smoking and chronic disorders (Al Rifai et al., 2016; Wakabayashi, 2014).

Researchers have identified smoking as a risk factor for type 2 diabetes mellitus (Al Rifai et al., 2016; McClave et al., 2009; Wakabayashi, 2014; Haffner, Mitchell, Stem, & Wei, 1996). Al Rifai et al. (2016) investigated relationships between smoking and

diabetes as well as other chronic diseases and blood lipids in those who smoke. The authors did not identify a significant association between tobacco use and insulin resistance (IR) (fasting plasma glucose, insulin, HOMA-IR). Limitations of the study included the fact that the sample included a smaller percentage (21%) of Hispanic/Latino participants compared to 41% Caucasian participants, and none of the participants had type 2 diabetes. However, the researchers recommended further exploration of "multiple associated variables" connected with tobacco use (Al Rifai et al., 2016, p. 2). Al Rifai et al. (2016) also reported that smoking trends "differ between ethnicities and genders" (p. 1).

Multiple researchers have reported possible adverse links between diabetes mellitus and smoking (Al Rifai et al., 2016; Wakabayashi, 2014; Haffner et al., 1996). Research regarding relationships between race/ethnicity, social habits (like alcohol ingestion, smoking), and chronic disease such as diabetes are now considered a renewed importance (Al Rifai et al., 2016; Wakabayashi, 2014; Haffner et al., 1996). Wakabayashi (2014) contended that cigarette smoking is strongly affected by social influences during childhood and adolescence, which contributes to the initiation and maintenance of cigarette smoking behavior. This phenomenon has not been fully examined in Hispanic/ Latino population (including their subgroups) but needs to be targeted in future studies and is beyond the scope of this study. Overall, the relation between alcohol, smoking, depression, and diabetes has become a critical issue in ethnic minorities and further research needs to be pursued (Al Rifai et al., 2016; Wakabayashi, 2014; Haffner et al., 1996).

Effects of Depression, Cigarette Use, and Alcohol Consumption on Diabetes Outcome

There is a rapidly growing body of literature regarding Latinos and their subgroups (Mexican- Americans, Puerto-Ricans, and Cubans), including a focus on depression symptoms, alcohol and nicotine misuse, rapid growth in population, comorbidity, and poor diabetes self-management indicating that Latinos are at an increased risk of adverse health outcomes related to diabetes (Afable-Munsuz, Gregorich, Markides, & Pérez-Stable, 2013; Bauer et al., 2017; Engler, Ramsey, Smith, 2013; Johnson, 2013; Caetano & Mills, 2016; Lewis, Lewis, & Parker-Dominguez, 2003; Salinas, Su, & Al Snih, 2013). Salinas, Su, and Al Snih (2013) confirmed that Latinos along the border of Texas are experiencing challenges related to chronic and infectious disease. The authors reported that there is one general practitioner doctor for every 6,159 people in this area (Salinas et al., 2013). This indicates a critical need for medical care along the U.S. border region similar to many developing countries that struggle with chronic disease while combating increasing rates of diabetes and obesity (Salinas & Sheffield, 2011; Mastana & Singh, 2015).

Afable-Munsuz, Gregorich, Markides, and Pérez-Stable (2013) observed rates of diabetes increasing in the U. S. and in countries that contribute the most immigrants such as Mexico. Afable-Munsuz et al. (2013) stated that “Latinos and those of Mexican-origin in particular, bear a disproportionate burden of diabetes” (p. 360). The authors noticed an interest in understanding what influences contribute to increased diabetes risk experienced by Mexican Americans. They referred to The Hispanic Established

Population for the Epidemiologic Study of the Elderly (HEPESE), which included Mexican Americans 65 years and older, 3,050 of whom had concerns related to diabetes (690 individuals had diabetes and 155 borderline diabetes). The authors concluded that the risk of developing diabetes increased with low socioeconomic status and generational status (when comparing 1st to 3rd and 2nd to 3rd generation).

Lewis, Lewis, and Parker-Dominguez (2003) indicated that by the year 2030, 14.4 % of the populations are expected to be African American, 18.9 % Hispanic, 7.0% Asian, and 1.0 % Native American. By the year 2050 ethnic minorities are expected to make up 50% of the U.S. population (Lewis et al., 2003). Due to this predicted population change, Lewis et al. (2003) recommended "equal attention, appreciation, and representation in educational, research, political, and human services environments (p.13). Lewis et al. (2003), Engler et al. (2013), and Afable-Munsuz et al. (2013) expressed concern for Latinos and their subgroups (Mexican- Americans, Puerto-Ricans, and Cubans), as there is a higher prevalence of adverse health concerns related to diabetes in this population. Although, it is clear that the ethnic minorities are at higher prevalence of developing diabetes, more research is needed to better understand the strength of this relationship and the factors that may influence Latinos and their subgroups, specifically Mexican Americans.

Engler et al. (2013) found that alcohol use negatively affected diabetes self-care behaviors in a study of predominately Hispanic (61%) and African American (29%) diabetes patients. These authors found that individuals with diabetes are at higher risk of experiencing comorbid diseases, including but not limited to hypertension,

gastrointestinal bleeding, sleep disorders, major depression, hemorrhagic stroke, cirrhosis of the liver, and cancer (Engler et al., 2013). Engler and colleagues reported that 13.4% of patients with diabetes met criteria for current at-risk drinking, and of those, 11.1% met diagnostic criteria for current alcohol dependence (Engler et al., 2013).

Caetano and Mills (2016) confirmed that more than 75% of border residents reported not traveling to Mexico at all in the past year, and young adults (border residents) report more drinking than other groups, regardless of whether they cross into Mexico to drink. Furthermore, Caetano and Mills reported that border residents were at higher risk for some negative alcohol outcomes compared to those who were not border residents. These patterns increase the risk of negative consequences in border residents that are predominately Mexican- American (Caetano & Mills, 2016).

Researchers have agreed that comorbid disease can significantly impact health outcomes in subgroups like Mexican Americans (Engler et al., 2013; Johnson, 2013). Johnson (2013) noted that seven in 10 Americans die because of chronic diseases, which accounts for 75% of the health care costs. Johnson also stated that approximately 40% of medical patients also have a mental health disorder. In addition, as many as 75% of seriously mentally ill patients are at higher risk for developing a physical disorder (Johnson, 2013). Patients with comorbid physical and mental disorders can be extremely costly, with health care expenditures that are twice as high compared to patients with a medical or mental illness alone (Johnson, 2013).

Hudson et al. (2013) explored a gap in the literature regarding depression in patients with diabetes and how it differs across racial/ethnic groups in a community-

based study. The authors examined the likelihood of racial and ethnic groups to be clinically recognized for depression (diagnosis and/ or treatment) in 910 patients with diabetes who had elevated scores on a measure of depression. Hudson et al. noted that racial/ethnic minorities were less likely to be clinically recognized for depression compared with Whites. The authors recommended the need for more research to understand the factors that influence clinical recognition of depression in patients from different racial/ethnic groups.

Several researchers have recommended the exploration of bidirectional relationships between disease and comorbid conditions in Mexican Americans (Hudson et al., 2013; Smith & Uchino, 2008; Caetano, Durazo, & Vaeth, 2014). Caetano, Durazo, and Vaeth (2014) observed that high rates of binge drinking in Hispanic men, including subgroups such as Mexican Americans, are concerning. The authors found that approximately 70% of the individuals with diabetes in their sample had two or more comorbid conditions in addition to their diabetes (Caetano et al., 2014). The authors argued that exploration of a bidirectional relationship between smoking, alcohol binging, poor diet, ethnicity, and depression symptoms is needed (Smith & Uchino, 2008; Caetano et al., 2014). Smith and Uchino (2008) emphasized the importance of studying mind, body, and behavior (biopsychosocial approach) when trying to understand underlying mechanisms that predict disease. Comorbid disease is complex in nature and for this reason requires a theoretical framework that addresses the individual as a whole (Smith & Uchino, 2008; Caetano et al., 2014). A multifaceted biopsychosocial approach allows for

the interpretation of physiological and psychosocial influences (e.g., stress, personality, and social relationships) in future research (Smith & Uchino, 2008).

Further research is needed on how comorbid conditions associate with health outcomes that relate to diabetes, especially in minority populations (Cooper, 2005; Hudson et al., 2013; Lewis et al., 2003; Smith & Uchino, 2008; Caetano et al., 2014). Health outcomes are significantly poor in areas predominately occupied by Mexican Americans (Smith & Uchino, 2008). Researchers have provided ample support for the assertion that ethnicity, health habits like alcohol and cigarette usage, and depression symptomatology can substantially influence diabetes outcome (Cooper, 2005; Hudson et al., 2013; Lewis et al., 2003; Smith & Uchino, 2008; Caetano et al., 2014). Implementing a biopsychosocial model allows for the examination of a continuum of influences to better understand depression symptoms, the implications of cigarette and alcohol use), and health outcomes related to diabetes, which can impact how clinicians and mental health workers approach diverse ethnicities like Mexican Americans (Smith & Uchino, 2008).

Addiction

Many experts agree that addiction is a multifaceted disorder (Buelens, 2013; Heyman, 2009; Naughton, 2014; O'Driscoll, 2014). One widely talked about cause for addiction is genetics (Heyman, 2009). There is a 25 % percent chance of both fraternal twins having an addiction, whereas a 40 % chance exists for identical twins (Heyman, 2009). Given this difference as well as the fact that identical twins do not have a 100% concordance rate, it is clear that the pathway from DNA to addiction can be indirect and

the genes for programming proteins can affect the probability of addiction rather than the presence of addiction (Heyman, 2009).

Borges et al. (2006) found links between immigration and alcohol disorders in Latino subgroups. The authors found that the occurrence of alcohol dependence was 4.8% in Mexicans, 4.2% in Mexico-born immigrants, and 6.6% in U.S.-born Mexican Americans. Understanding addiction through the lens of ethnicity and assessing possible comorbid symptoms like depression can help researchers better understand why particular populations (Mexican Americans) have a higher prevalence of alcohol and cigarette use, and how this may be associated with medical diagnoses such as diabetes.

Etiology of Alcohol Misuse

Alcohol dependence has the potential to evolve from various factors (Abrahao, Salinas, & Lovinger, 2017; Esel & Dinc, 2017; Masiak, 2013; Bot et al., 2017; Chaudhury, Gupta, Menon, Salujha, & Srivastava, 2014). These factors include genetics, personality, physical factors, ethnicity, environment, and changes in neurotransmitter, neurohormonal systems, and cognitive function in the brain (Abrahao et al., 2017; Esel & Dinc, 2017; Harvard Women's Health Watch, 2017; Masiak, 2013; Bot et al., 2017; Chaudhury et al., 2014).

According to Phillips (2014), Latinos including Mexican Americans may exhibit a higher prevalence of problems with alcohol. From the middle ages to the present, it has been a convention for society to view alcohol as the central problem from which all other issues originate. Mencimer (2018) found that "drunk driving, alcohol poisoning, injuries, domestic violence, liver disease—alcohol is responsible for the deaths of nearly 90,000

Americans every year, more than double the estimated 40,000 US opioid deaths in 2015" (p. 47).

Recent literature on the topic provided insight on the effects ethanol can have on brain systems and cognition (Abrahao, Salinas, & Lovinger, 2017; Darkes, Goldman, Reich, 2006; Bot et al., 2017). Bot et al. (2017), Abrahao, Salinas, and Lovinger (2017), and Chaudhury, Gupta, Menon, Salujha, and Srivastava (2014) mentioned that ethanol can be responsible for changes in neurotransmitters, neuropeptides, neuroendocrine systems, and the complex interplay of biopsychosocial factors that involve genes for alcohol-metabolizing enzymes. Positive reinforcement still appears to be the motivation behind alcohol use in its early stages (Phillips, 2014). When an individual becomes dependent upon alcohol, both positive and negative reinforcements can be linked to neuro-adaptive process (Abrahao et al., 2017; Esel & Dinc, 2017; Phillips, 2014). Abrahao et al. (2017) suggested that vital neuro-adaptive changes occur from the initial stage of occasional alcohol intake to a later stage of dependence.

Alcohol and Depression

Several researchers have noted that alcohol use and depression tend to co-occur (Boden & Fergusson, 2011; Baldwin, Garner, Pasche, Sinclair, & Wood, 2016). Researchers who have conducted epidemiological and clinical studies observed that depression has close links to alcohol use (Boden & Fergusson, 2011; Baldwin et al., 2016). Boden and Fergusson (2011) examined literature linking alcohol use disorders (AUD) and major depression (MD). The authors observed variations in different levels of alcohol use and severity of depression (Boden & Fergusson, 2011). They noted that those

that binged heavily (on five or more occasions) in the past month were almost three times more likely than those that didn't to also have depression. Baldwin, Garner, Pasche, Sinclair, and Wood (2016) and Boden and Fergusson (2011) stated that exploring the topic of comorbidity can help clinicians and the medial world better understand how alcohol and depression co-occur as well as develop an understanding of the underlying variables that influence both diseases to co-exist simultaneously in subgroups like Mexican Americans.

Baker et al. (2016) specified that co-morbid issues involving alcohol misuse and mental health problems are a major health concern in the medical world. Comorbid disease impacts various components of one's quality of life. These burdens range from negative health outcomes, higher prevalence in ethnic groups, severe depressive symptoms, social functioning issues, increased service utilization, and poor treatment outcomes (Gutierrez, 2016; Baker et al., 2016; Caetano, Durazo, & Vaeth, 2014). Latino groups (Mexican Americans, Puerto Ricans, and Cubans) have elevated emotional distress (depression) compared to general population rates, which may in turn be related to an increase the use of alcohol as self-medication (Caetano et al., 2014). Alcohol use in Mexican American adults with depression has been associated with clinical and health concerns, which means this population is at high risk for health issues now and in the future (Boden & Fergusson, 2011; Holman et al., 2012; Sinclair, Garner, Baldwin, Pasche, & Wood, 2016; Caetano et al., 2014). Some of these clinical issues include metabolic changes, gender differences, and/or neurophysiological health concerns.

Liu and Satterfield (2015) found individuals who consume alcohol and have diagnoses of depression are at higher risk for experiencing medical complications, psychological concerns, and social injuries (Liu & Satterfield, 2015). Researchers have confirmed that patients who consume alcohol hazardously and have depression make up the largest population in both health care and mental health facilities (Al'Absi, Allen, Allen, Hatsukami, & Lando, 2013; Holman et al., 2012; Liu & Satterfield, 2015). For adults, the consequences of alcohol misuse can be severe. Alcohol misuse can exacerbate preexisting and existing medical conditions, social impairments, and cognitive impairments; as well as increase the risk of depression (Abrahao et al., 2017; Holman et al., 2012). It is imperative that primary care providers and mental health professionals identify these individuals, screen using a valid instrument, communicate through the use of a referral process, and help these individuals effectively lower the progression of comorbid disease (Holman et al., 2012).

According to Liu and Satterfield (2015) individuals who consume alcohol and have diagnoses of depression are at higher risk for acquiring health disparities that are associated with negative outcomes in diabetes. These health disparities include medical complications connected with addictions, bio-behaviors, depression, and social habits related to alcohol use (Liu & Satterfield, 2015). Therefore, exploring how a multi-layered framework such as the biopsychosocial model can be used to investigate the association between depression and alcohol in individuals with diabetes represents an important step in the research literature.

Alcohol, Bio-Behavior, and Biopsychosocial Model

Although some researchers have investigated how environmental and genetic factors exert influence on ethanol- related behavioral changes (use, tolerance, compulsive seeking, and dependence), few have examined these pathways in combination. Abrahao et al. (2017) noted that there are several reviews on ethanol use and abuse, and they all seem to share some key elements (use and abuse relies on understanding its effects on the brain) in common. The authors noted that both bottom-up and top-down (molecular to behavioral analyses approaches have been used to explain results of ethanol use (Abrahao et al., 2017). This review focused on current work in the field, which highlights emerging molecular, cellular, and circuit effects of the drug that impact ethanol-related behaviors. Emphasis has been placed on molecular effects in specific neurons, identifying specific brain regions, and behavioral changes across the course of acute and chronic ethanol exposure.

This review examines recent literature on the recommendation of implementing a broader and more cohesive approach of alcohol's effects on the brain (circuits and behavior). Based on these findings, interventions should be developed to directly address bio-behavior and etiological models, rather than just addressing alcohol as a single factor. Such exploration between bio-behavior and etiological models that deal with alcohol addiction can be useful to patients, health professionals, and mental health providers (Bot et al., 2017). Reviewing some of the more diverse influences associated with the pathogenesis of alcohol will help clinicians better understand its impact on specific populations (Mexican Americans) who have elevated risk of developing chronic illness

such as diabetes and depression (Abrahao et al., 2017; O' Driscoll, 2014). Although this information may be useful, it is beyond the scope of this study. Current research emphasizes the recommendation of implementing a broader/more cohesive approach like the biopsychosocial model to address problems with alcohol use, bio-behavior dependence, and possible addictions that can impact chronic illnesses like diabetes and depression (Abrahao et al., 2017; O' Driscoll, 2014; Bot et al., 2017).

Several studies support the exploration of quantitative drinking factors, which are considered necessary predictors of the development of depression (Gallo & Luecken, 2007; Matto, 2005; O'Driscoll, 2014; Bot, 2017; Smith & Uchino, 2008). Researchers have showed possible links between alcohol and depression as well as diabetes (Chaney et al., 2003; Matto, 2005; Bot et al., 2017; Smith & Uchino, 2008). The work of these researchers aligns with the two hypotheses presented in this study, although this research focused on a population of Mexican Americans. The findings of this study may help patients and clinicians find ways to motivate themselves and others towards potentially changing lifestyle factors that in the long run influence diabetic outcomes.

Smoking and Depression

Malouff, Emmerton, and Schutte (2013) stated that one of the "predominant health issues for adults are the prevalence of smoking and its detrimental health effects" (p. 388). Approximately 440,000 individuals die every year as a direct consequence of harm from smoking (Malouff, Emmerton, & Schutte, 2013). Cigarette smoking can result in both nicotine dependence and withdrawal (Holman et al., 2012; Liu & Satterfield, 2015). Researchers have found that approximately 80% of individuals meet criteria for

nicotine dependence (Liu & Satterfield, 2015). In past studies, it has been suggested cigarette smoking is common among mental health patients in an effort to self-medicate and mask emotional symptoms (Al'Absi et al., 2013; Holman et al., 2012).

Cigarette smoking is a social habit that has been linked to various health disparities, yet little is known on how it correlates to health outcomes in specific populations like Mexican Americans. Smoking accounts for more health disparities and mortalities than all other substance use (Holman et al., 2012) Prevalence rates of smoking are significantly higher in individuals who have a mental illness compared to healthy controls (Holman et al., 2012; Liu & Satterfield, 2015; McClave, 2009). Furthermore, as Holman and his colleagues (2012) have reported, depression and cigarette smoking are having interacting problems that co-occur at high rates. They mentioned that chronic depression can be associated with complications that make it difficult to treat, and such health disparities tend to associate with costly health consequences (Holman et al., 2012). There are complex interacting factors between smoking, depression, and other health issues. Several authors have suggested that nicotine dependence and populations at high risk of substance abuse should be screened, assessed, and treated due to the complexities linked to comorbid disease (Al'Absi et al., 2013; Holman et al., 2012; Liu & Satterfield, 2015). Al'Absi et al. (2013) suggested that women with depressive symptoms are at increased risk of smoking relapse due to hormones and their metabolites. Sex hormones and depressive symptoms may play an important role in smoking behavior in women, but more specifically, during attempted smoking cessation (Al'Absi et al., 2013). In addition, according to Liu and Satterfield (2015) physical, psychological, and social factors of

adults contribute to challenges associated with smoking, which means tolerance is affected by the aging process. Al'Absi et al. (2013) argued that sex hormones impact smoking behaviors (specifically in women), whereas Liu and Satterfield (2015) focused on multiple interacting factors that may be responsible for smoking behavior. Both hazardous use alcohol and smoking complicate health and increase the chance of a co-occurrence of depression (Liu & Satterfield, 2015). Consuming and using substances like alcohol and cigarettes can lead to negative health habits, which can possibly play a role in mental health issues and poor overall health outcomes (Holman et al., 2012; Liu & Satterfield, 2015). Given the way that these factors may link together, researchers have discussed the importance of examining factors such as cigarette smoking as contributing to the health disparities in racial minorities such as Mexican Americans and African Americans (Fernander, Shavers, & Hammons, 2007).

Biopsychosocial Model and Cigarette Smoking on Diabetic Outcome

Researchers have found links to smoking and impairment in psychological, neurobiological, and behavioral issues that can lead to a higher risk of comorbid disease like diabetes and depression (Cohen, Mcchargue, Cortez-Garland, Prensky, & Emery, 2003; Cooper, 2005; Green & Johnson, 2013; Griffiths, 2005). Many researchers have investigated how chronic nicotine use is linked to significant impairment on the body (psychological and neurobiological; Cohen et al., 2003; Cooper, 2005). The harmful effects of cigarette smoking have been well documented in both voluntary and involuntary exposure (Cohen et al., 2003; Cooper, 2005). In 2006, the surgeon general released a report that included information about the risks and possible effects cigarette

smoking can have on chronic illnesses such as diabetes and depression (Cooper, 2005). Additionally, Cohen, Mcchargue, Cortez-Garland, Prensky, & Emery (2003) indicated that cigarette smoking is associated with both emotional (depression mood and anxiety) and other substance problems (alcohol, caffeine, and illegal drugs). These problems include socio-cultural, biological, and physiological components, which are consistent with the biopsychosocial model (Cohen et al., 2003; Cooper, 2005; Habtewold et al., 2016; Lewis et al., 2003; Purdy, 2013; Smith & Uchino, 2008). Further evaluation was recommended on how cigarette smoking relates to comorbid disease in specific populations (Cohen et al., 2003; Cooper, 2005).

Researchers have noted that healthcare providers failed to mention to patients the importance of not engaging in cigarette use (Bockian, 2006; Fernander et al., 2007). Approximately 50% of practitioners suggest that clients stop smoking (Bockian, 2006; Fernander et al., 2007). This evidence supports the need to increase awareness, research, and knowledge on the benefits of not smoking in individuals, especially those who have diabetes. As mentioned above, researchers linked various factors to the use of cigarette smoking, and realized the need to further investigate and address gaps in the literature regarding comorbidity. This evidence emphasizes the need to explore comorbid disease like diabetes and depression through a biopsychosocial lens, which also confirms the need for this study.

Researchers have used the biopsychosocial model to take numerous variables into account when exploring underlying symptomology (Bot et al., 2017). The research described above emphasized the importance of examining possible factors contributing to

the significant increase in health disparities among certain racial groups (Cohen et al., 2003; Cooper, 2005; Fernander et al., 2007). A biopsychosocial approach has the flexibility to work with numerous factors and deal with the complexity of underlying issues related to health, and this approach fits well into research focused on health disparities in Mexican Americans (Bockian, 2006; Fernander et al., 2007; Levant, 2004; The Texas Behavioral Risk Factor Surveillance System, 2013).

The determinants of tobacco-related health disparities are not understood clearly; therefore, further research in the area of smoking within a biopsychosocial model needs to be further investigated or analyzed (Bockian, 2006; Fernander et al., 2007; Levant, 2005; Bot et al., 2017). Levant (2005) proposed that factors like obesity, alcohol consumption, presence of other diseases, and cigarette smoking can play a vital role in health outcomes. Incorporating the biopsychosocial approach can address some of the gaps and inconsistencies found in the literature.

Further Advancements

In spite of the earlier literature found on biopsychosocial models, much more information on the potential risks of psychosocial inputs have on disease are still needed in various disciplines. Authors have noted that further advances are needed specifically in biomedical science and health care (Lewis et al., 2003; Smith & Uchino, 2008). The past decade has seen a renewed focus in evaluating behavior, social, and physiological function (Byrn et al.,2014; Smith & Uchino, 2008). It is well known by researchers that the biopsychosocial approach encompasses an integrative research approach that requires psychological attributes, physiological processes, and health habits related to social

settings (Byrn et al.,2014; Smith & Uchino, 2008). The central use of the biopsychosocial theory for researchers is to provide various levels of analysis to provide insight into the underlying themes associated with health disparities (Cooper, 2005; Byrn et al.,2014; Smith & Uchino, 2008). Health disparities are at a rise in Mexican Americans, who present a high risk for comorbid disease, so utilizing this approach can help provide mental health providers and clinicians a clear understanding of how they can minimize adverse health outcomes (Enguidanos et al., 2015).

The biopsychosocial model has become a widespread influence due to its associated theoretical and empirical developments (Smith & Uchino, 2008). There has been a rapid rise in the need for an integrative and transdisciplinary approach in the realms of research. This need has been narrowed to targeting dynamically intertwined variables that include biological, psychological and social-cultural influences (Kroenke et al., 2013; Byrn et al.,2014; Smith & Uchino, 2008).

Many questions regarding health outcomes in Mexican Americans have not been addressed. Conducting a study exploring the relation between diabetes outcomes, smoking, alcohol ingestion, and depression in this population can help provide insight on whether the biopsychosocial approach can help understand the relations among these factors in a Mexican American population. Smith and Uchino (2008) suggested that using a holistic assessment can give one a more comprehensive understanding of the role psychosocial factors play on general health and health disparities. Researchers have specified a comprehensive examination of psychological, physiological, and health habits to advance knowledge about the underlying etiology in chronic health problems (Cooper,

2005; Chaney, Hoff, Mullins, & Wagner, 2003; Lewis et al., 2003; Smith & Uchino, 2008). As mentioned throughout this chapter, Mexican Americans have shown an increase in chronic health problems that range from diabetes mellitus, to depression symptomatology, and alcohol and cigarette misuse (Enguidanos et al., 2015; Caetano et al., 2014). For that reason, recent research points future scientists to move forward with a biopsychosocial model so that multiple levels of (psychological, biological, and social) analysis can be established to better understand health and disease, even across ethnicity (Cooper, 2005; Lewis et al., 2003; Byrn et al.,2014; Smith & Uchino, 2008; Caetano et al., 2014).

Summary

Chapter 2 included an overview of the study, an organization of review, the sources used for review, research terms used for research, health habits like alcohol and cigarette usage, gaps in the research that require further investigation, theoretical framework (biopsychosocial approach), advances in research, underlying themes associated with chronic diseases and overall health, etiologies of alcohol and cigarette usage, how Mexican Americans are affected by health habits like alcohol and cigarette usage, limitations within past and present studies, and further advancements in the literature. The chapter encompassed the empirical literature that states that further research is required on how health habits (alcohol and cigarette consumption) associate with depressive symptoms and diabetes directly or indirectly. In addition, Chapter 2 also encompassed an in-depth description of research and literature that is relevant to the study variables presented within this study. The research presented within this chapter

gathers all literature associated with the predictor variables (depression symptoms, alcohol (quantity and frequency), cigarette smoking (quantity and frequency), and criterion variable (diabetes outcomes through one's HbA1c).

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to examine de-identified archived data from a diabetic clinic in Southern Texas to determine whether alcohol use, cigarette smoking, and depression predict diabetes outcomes in Mexican American adults treated for diabetes between 2011 and 2016. I examined the relationship between HbA1c test results, depression symptoms, alcohol use, and cigarette smoking. Findings may provide health care practitioners and mental health professionals with more knowledge and understanding of the relationship between the variables associated with diabetic outcomes in Mexican Americans. Health care clinicians may use the findings to change health care practices, implement preventive measures, and explore possible links to diabetic outcome in underserved populations.

I used the PHQ-9 score to measure depression severity (independent variable) and the questionnaire items addressing alcohol use and smoking status (independent variables) from the archived data to test whether these variables predict diabetes outcomes (dependent variable) as measured by the most recent HbA1c (see Kroenke, Spitzer, & Williams, 1999; Malcarne, Merz, Riley, Roesch, & Sadler, 2011). This chapter includes a review of the study's purpose and research questions. I also describe the research design, the rationale for selecting the design, and the methods including information about the target population, sampling procedures, data collection, and data analysis plan. Finally, the chapter includes details about the instrumentation and

operationalization of constructs, threats to validity, and ethical procedures. The chapter concludes with a summary.

Research Design and Rationale

Quantitative methodology allows researchers to "generalize from a sample to a population" (Gravetter & Wallnau, 2008, p. 4). I study used a correlational design that involved collecting data on multiple variables from the same group of participants and predicting the degree of relationship between those variables (see Creswell, 2003). Using a quantitative approach allowed me to examine how the criterion variable was associated with multiple predictor variables. I used a correlational design to examine the relationship between predictor variables (depression severity as measure by the PHQ-9 score, and frequency and quantity of alcohol and cigarette consumption) to examine whether they predict the outcome variable (diabetes outcome as assessed by HbA1c level) in a group of Mexican Americans who had been diagnosed with diabetes (see Kroenke et al., 1999; Malcarne et al., 2011).

By using a quantitative design, I was able to examine the relationships between the variables of interest. My goal in selecting this quantitative design was to describe the predictive relationship between the variables. The design was appropriate for the research questions, which focused on statistical relations between numerical, binomial, and continuous variables. This design is less costly than primary research because data can be collected in a shorter amount of time to save time and money (Creswell, 2003). Qualitative methodologies do not allow for the examination of relationships between variables and constructs (Creswell, 2003). A qualitative study does not allow for

sampling a larger population as is done in a quantitative study (Crewswell, 2013). This methodology would take longer and cost more money to complete (Creswell, 2003). I selected this design because of the limited research and because of recommendations by researchers who used the design. I did not examine causal relationships in diabetic outcomes, but rather relationships between predictor variables and diabetic outcome (as measured by the HbA1c).

Methodology

Population

The archival data set included data on all patients who had been examined or treated at the diabetic center in South Texas. The population of interest for this study was people who identify as Mexican Americans and have been diagnosed with diabetes. The sample of people drawn from the archival data at the Diabetic Center included Mexican Americans 18 years and older who had completed the descriptive demographics and were located along the southern border of Texas between 2013 and 2016. The research coordinator provided me with data for participants who had all data completed. It was important to study this population because in the study site region 1 in 3 Mexican Americans have diabetes (see Ma et al., 2012).

Sampling and Sampling Procedures

I obtained the sample through the database from a Diabetic Center in South Texas. The selected data met criteria for inclusion. The inclusion and exclusion criteria guided the research coordinator in obtaining the appropriate sample for this study. The inclusion criteria consisted of participants who identified as Mexican American, were

diagnosed with diabetes, and had descriptive demographics and health habits completed within the database. Demographics from the archival data set included age, gender, education, and frequency and quantity of cigarette smoking and alcohol use. I excluded data on participants who were borderline diabetic (i.e., prediabetic but had not been given an official diagnosis), had gestational diabetes (diabetes due to pregnancy), had incomplete descriptive demographics, or had incomplete information on health habits. I also excluded any patient under the age of 18 years.

I requested that the research coordinator randomly select cases from records that were computerized for patients who already had consent forms in place. From this sample, the research coordinator selected participants who fit the inclusion criteria. The coordinator also ensured de-identification of all data. The research coordinator did not download personally identifying information, only the variables of interest for the study. The research coordinator obtained 120 completed cases with assigned numbers provided in Excel format to me for the study.

Although the sample was obtained through the database, the sample size was determined by a statistical calculation. According to Cohen, Cohen, West, and Aiken (2003), it is essential to use a power analysis tool to determine sample size. I used four factors to perform a power analysis to establish an appropriate sample size for the study. The *p* value is the obtained value and the alpha level is the predetermined *p* value at which a value is declared statistically significant (Cohen et al., 2003). Cohen et al. specified that a researcher can claim statistical significance when the alpha level is the willingness to accept rejecting a true null hypothesis. The *p* value is the probability of

obtaining this result given the sample size (Cohen et al., 2013). When the *p* value is less than alpha, the researcher rejects the null hypothesis (Cohen et al., 2003; Green & Salkind, 2008, 2011).

I used G* Power to determine the probability of appropriately rejecting a false null hypothesis (see Cohen et al., 2003). Power level is usually set at greater or equal to .80 (Cohen et al., 2013). The power is the probability of rejecting a false null hypothesis (Cohen et al., 2003). To determine the needed sample size for this study, I used G *Power 3 with a multiple regression with three predictors, an alpha of .05, a medium effect size, and a power of .80 (see Cohen et al., 2003; see Creswell, 2003; Buchner, Erdfelder, Faul, & Lang, & 2007). The recommended sample size was 97 participants; however, I used larger sample of 120.

Procedures for Recruitment, Participation, and Data Collection

The Diabetic Clinic prepared the sample for this study by accessing archived patient data between 2013 and 2016. A sample of 120 was more than adequate to meet the minimum sample of 97 participants indicated by the power analysis based on recommendations from Creswell (2003) and Buchner et al. (2007).

Procedure for Recruitment

To obtain the sample of randomly selected Mexican Americans with diabetes, I completed inclusion and exclusion forms provided by the Diabetes Center. The inclusion and exclusion forms had a checklist that confirmed criteria for study. The random sample selected met the form guidelines. The inclusion section met all of the following standards: 18 years of age, completed consent form, existing diagnosis of diabetes, PHQ-

9 form on file, and a demographic form including complete data on frequency and quantity of alcohol and cigarette use. The exclusion section had a section for criteria that excluded patients with gestational diabetes, those under 18 years of age, and patients lacking a PHQ- 9 questionnaire or demographic survey explaining use of alcohol and cigarettes. The research coordinator verified that data met the guidelines listed on the inclusion and exclusion form.

Data Collection

The procedure for data collection involved data that were already in the database. To access potential participants for the study, the Diabetic Clinic's research coordinator reviewed and screened patient files to ensure proper completion. The research coordinator provided at least 120 completed files selected from the clinic's database of routinely collected information, and prepared a zip file of 120 patient files with identifying information removed and replaced with an identification number from 001 and to 120. The research coordinator provided me with a zip file in Excel format. I transferred the file to a password-protected hard drive and will preserve the file for 5 years. Appendix A contains the data solicitation letter. Appendix B contains the IRB approval number for the study. Appendix C contains the data use agreement letter provided by the clinic.

Instrumentation

To conduct this study, I used archived information from a demographic survey, patient information from the PHQ-9 instrument, and the results from the glycated hemoglobin HbA1c. The facility that provided the data also created the self-reported

demographic survey to gather patient information on alcohol consumption and cigarette smoking for each patient.

Demographic Survey

Demographic data gathered on the participants included gender, frequency and/or quantity of alcohol consumption, and cigarette smoking. Frequency in this study reflected how many alcoholic drinks a participant consumed or the number of cigarettes smoked in a typical week. Quantity was defined as a frequency measure. A frequency measure quantifies average or typical consumption patterns, usually over a specific time period. Quantity in the current study indicated the number of alcoholic drinks and cigarettes smoked per day within a typical week (Monday through Sunday). I analyzed the archival data to determine whether depressive symptoms, alcohol consumption (frequency and quantity), and cigarette smoking (frequency and quantity) were associated with diabetes outcome as manifested by the HbA1c. The demographic information assisted with selection eligibility and provided general information about the history of the participants.

Patient Health Questionnaire

The PHQ-9 is a well-known instrument used by clinicians and researchers to screen for depression symptoms. Professional health care staff at the Diabetic Clinic in South Texas use this instrument to assess patient depression symptoms. The Patient Health Questionnaire-9 (see Kroenke, Spitzer, & Williams, 1999) is a 9-item self-report questionnaire used to assess depression with responses on a 4 –point scale. Respondents describe their experiences of the nine symptoms (anhedonia, depressed mood, sleep

difficulties, fatigue, changes in appetite, feelings of worthlessness or guilt, difficulty concentrating, motor agitation, suicidality) over a 2- week period. According to Kroenke, Spitzer, and Williams (1999), depression remains a significant issue amongst ethnic minorities that have been understudied, due to the lack of available measures that are both reliable and valid. The cutoffs include PHQ-9 scores of 5, 10, 15, and 20, which represent mild, moderate, moderately severe, and severe depression, respectively (Kroenke et al., 1999). The range of possible total points is 20. Researchers conducted a study using meta-analysis and concluded that through the interpretation of Cronbach's range alphas, utilizing the PHQ-9 provided a good internal consistency for both English and Spanish versions (Kroenke et al., 1999; Malcarne et al., 2011). Malcarne et al. (2011) noted that the results provided by Cronbach's alphas indicated that there was good internal consistency for both the English and Spanish-language versions. Additionally, Kroenke et al. (1999) used a multi-group confirmatory factor analysis to evaluate structural validity, and concluded that there were similar one-factor structures and variances for both English/Spanish speaking Latino's (Kroenke et al., 1999). Basically, research implies that the PHQ- 9 can be used with confidence for both languages (English and Spanish) and screening for depression symptoms (Kroenke et al., 1999; Malcarne et al., 2011). Data findings from other studies have revealed that the PHQ-9 has excellent test-retest reliability, construct validity, and criterion validity (Kroenke et al., 1999).

Glycated Hemoglobin A1C Marker

Dasgupta, Deb, Dudhe, Dutta, and Sarkar (2016) and Mangala, Shrabani, Supriya, and Venkata Bharat Kumar (2016) reported that the Glycated hemoglobin (HbA1C) is a

screener that has been widely used to monitor glycemic control in patients diagnosed with diabetes. Dasgupta et al. confirmed that an HbA1c result of ≥ 6.5 % is recommended as the cut-off range for diagnosis of diabetes. However, recent studies have included information on controversy regarding the cut-off point, and the ethnic variations found in the HbA1c range (Dasgupta et al., 2016). Therefore, it is highly suggested that researchers further analyze the differences in HbA1c ranges between ethnic groups. As a result, this test was utilized to evaluate various variables that can be linked to Mexican American diabetic outcomes. According to Dasgupta et al. (2016) and Wakabayashi (2014), the standard HbA1c ranges associated with the average amount of blood sugar combined with hemoglobin A1c level for adults are as follows: Normal Range (4% and 5.6%), Borderline with increased risk of diabetes (5.7-6.4), and Diabetes (6.5 and above).

Data Analysis Plan

Software

The research coordinator for the Diabetic Clinic provided me with de-identified archival data collected from patients in the form of a spreadsheet. I imported the excel spreadsheet into the SPSS software to perform data analysis and manipulation of the dataset for statistical findings, such as demographic statistics, correlations, and stepwise regression analysis.

Data Cleaning and Screening Procedures

The research coordinator screened the archival data for accuracy using inclusions and exclusions report provided to the Diabetic Clinic by myself. Secondly, the research coordinator screened the dataset for missing data. In the case of missing demographics,

categorical data, and consent forms, cases were deleted using pairwise exclusion (Eisinga, Heskes, Pelzer, & Te Grotenhuis, 2017). In pairwise exclusion, if any participant is missing data for any variable, that participant was excluded from analysis. This is only applied on analyses involving variables for which a participant was missing data (Eisinga et al., 2017). Simply, if a participant is missing data from the PHQ-9 questionnaire he or she was excluded from analysis for that variable.

I created scores for the criterion and predictor variables using the continuous variable for the PHQ-9 questionnaire, the glycated hemoglobin A1C biomarker (continuous variable), and responses on the demographic survey. I utilized the PHQ-9 questionnaire to quantify depressive symptoms (continuous numerical variable) in this study. The biomarker was used to establish a continuous numerical variable to predict a relationship between the independent variables presented in the study.

I used SPSS to create descriptive statistics for relevant demographics. The utilization of various frequency tables allowed me to display numerical summaries and percentages for demographics for gender, frequency and quantity of alcohol consumption, and frequency and quantity of cigarette consumption. I measured all data for the PHQ-9 questionnaire and HbA1c range at the scale level.

To calculate statistics for research question 1, 2, and 3, I used a Step-wise regression analysis. This procedure allowed me to specify a fixed order of entry for variables and to test the effects of certain predictors independent of the influence of others (Field, 2013). I used a Step-wise regression to measure the associations of the predictor variables (frequency and quantity of smoking, frequency and quantity of

alcohol, and the PHQ-9 Score on depression symptoms) upon the criterion variable (diabetes outcome). Step-wise analysis of the variables typically adds to my understanding of the phenomena studied. It requires my thoughtful input in determining the order of entry of IVs and yields successive tests of the validity of the hypotheses which determine the order (Field, 2013). This method also allowed me to test predictors independently presented in this study until all predictors were explored (Field, 2013).

The research questions that were investigated are as follows.

RQ1: Does depression severity predict diabetes outcome in Mexican American adults with diabetes?

$H_0$1: Depression, as assessed by the Patient Health Questionnaire-9, did not predict diabetes outcome as measured by the HbA1c test in Mexican American adults with diabetes.

H_a1: There was a significant association between diabetes outcomes and depression severity in Mexican American adults with diabetes as assessed by the Patient Health Questionnaire-9 score and diabetes outcome as measured by the HbA1c score.

RQ2: Does frequency and quantity of alcohol use predict diabetes outcome in Mexican American adults with diabetes?

$H_0$2: Frequency and quantity of alcohol consumption, as assessed by the demographic questions, did not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a2: There is a statistically significant association between frequency and quantity of alcohol consumption and diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

RQ3: Does frequency and quantity of cigarette smoking predict diabetes outcome in Mexican American adults with diabetes?

H_03: Frequency and quantity of cigarette smoking, as assessed by the demographic questions, did not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a3: There is a statistically significant association between frequency and quantity of cigarette smoking and diabetes outcome as measured by the HbA1c Score in Mexican American adults with diabetes.

Table 1

Operationalization of Variables and Coding

Variable category	Variable	Level of measurement	Description	Code
Independent	PHQ-9 score	Interval	Continuous numerical variable	Depression symptoms (DS)
Independent	Frequency X quantity alcoholic drinks	Interval	Continuous numerical variable	Frequency multiplied by quantity (F X Q)
Independent	Frequency X quantity of cigarette smoking	Interval	Continuous numerical variable	Frequency multiplied by quantity (F X Q)
Dependent	HbA1c score	Interval	Continuous numerical variable	Range (Rnge)

Table 2

Statistical Analyses Conducted per Research Question and Corresponding Null

Research question	Null hypothesis	Statistical procedure
RQ 1: Does depression severity predict diabetes outcome in Mexican American adults with diabetes?	Null hypothesis 1: Depression, as assessed by the PHQ-9, will not predict diabetes outcome as measured by the HbA1c test in Mexican American adults with diabetes.	Step-wise Regression Moderator Regression
RQ 2: Does frequency and quantity of alcohol predict with diabetes outcome in Mexican American adults with diabetes?	Null hypothesis 3: Frequency and quantity of alcohol consumption, as assessed by the demographic questions, will not predict diabetes outcome as measured by the HbA1c Score.	Step-wise Regression Moderator Regression
RQ 3: Does frequency and quantity of cigarette smoking predict diabetes outcome in Mexican American adults with diabetes?	Null hypothesis: Frequency and quantity of cigarette smoking, as assessed by the demographic questions, will not predict diabetes outcome as measured by the HbA1c Score.	Step-wise Regression Moderator Regression

Threats to Validity

The primary validity issue in the study came from the research instrument, the Patient Health Questionnaire- 9 (Kroenke, Spitzer, & Williams, 1999), the self-reported health habit questionnaire, and the Glycated hemoglobin A1C biomarker. The PHQ-9 provided well-established content, test-retest reliability, construct validity, and criterion as previously described.

Threats to internal validity that may get in the way of our confidence between the researcher's IVs and DV include selection and client reliability in his/her responses is a concern. Selection may be controlled using randomization. Lastly, a possible concern exists with the clients potentially not telling the truth on the questionnaires about alcohol and cigarette usage.

Experts who initially administered surveys and questionnaires have explained how confidentiality would be preserved before consent form was signed. Experts explained thoroughly that they were volunteers and may withdraw from using their data for research at any time with no ramifications before participants signed consent forms. At the start of the random selection for this study, the research coordinator contacted each patient by email as part of the research protocol of informing them that their information will be used for research purposes.

The item validity for this study was high. Item validity means that the test items deal only with the subject being addressed. The sampling validity in this study was high. Sampling validity means that the ranges of item topics in this study are appropriate to the subjects who will be studied. Additionally, testing was conducted in a typical health care

setting with experts administering the questions on the demographic survey, PHQ-9 questionnaire, and the readings of ranges for the Glycated hemoglobin A1C marker. The consent form assured the participants that the records will remain confidential, which minimized the risk of overly positive or negatives responses. The nature of the survey and questionnaire relied on self-reported data. The researcher assumed that participants answered honestly. The use of self-reported data on demographic surveys and questionnaires is an accepted practice; however, can cause issues with validity since it will be assumed that participants have been truthful about his/or her responses (Andrew Zhou et al., 2013).

The generalizability within this study allowed the researcher to obtain a larger sample than one could collect as an individual. Additionally, the single institution sample limits generalizability, too. Internal validity will be more of an issue if this study would have been experimental based. Another limitation in this study is time. A study conducted over a certain interval of time is a snapshot dependent on conditions occurring during that time. Therefore, the researcher made sure that participants that were used in the study were only those that had readings for the most current 3 months, all participants were consistent with the same time interval; thus, not to affect the outcome of the study. Delimitations in this study were limited to Mexican Americans, a specific geographical region, and participants diagnosed with diabetes. Results from this study could not be applied to borderline diabetes, or gestational diabetes. Due to the selected population sample the generalizability will be limited.

Ethical Procedures

After being granted Walden University's Institutional Review Board approval, the initiation of the study was promptly put in action by me to investigate the impact depression symptomology, frequency and/or quantity of alcohol and cigarette smoking usage to predict diabetes outcome in Mexican American adults with diabetes. The research coordinator assisted the researcher to obtain the target population through random selection from the participant's database. To use the Diabetic Clinics' archival data, the researcher signed a confidentiality agreement provided by the research Diabetic Clinic. The research coordinator adhered to HIPPA law. Under HIPPA law, representatives of the U.S. Department of Health & Human Services Office for Civil Rights (OCR) handle and oversee the enforcement of protections granted to individuals regarding their personal medical information (Cascardo, 2012). Information was all archival and anonymous. The surveys were already administered; therefore, I used the data provided to me. There was no pre or post-test, and there was no intervention or treatment administered. The plan for incomplete data was to exclude the potential participant from the data set. If relevant data has already been collected, the most ethical decision is to use the existing data rather than burden participants with an additional study (Engberg, Heine, & Knorr, 2014). The information is stored on a password protected hard drive computer and an external drive. The data will be stored for five years and destroyed at the expiration of five years. A data agreement provided by University will also be signed.

Summary

This chapter included comprehensive information on the methodology of the quantitative archived survey. The researcher included information on research design and rationale, methodology, target population, sampling and sampling procedure, data collection, confidentiality protection of the participants, and the survey instruments. In addition, the data analysis plan will be presented to address the research questions and its hypothesis (Engberg, Heine, & Knorr, 2014). Lastly, this chapter addressed threats to validity, and ethical procedures related to the study. In summary, this quantitative study sought to enhance the literature and close the gap between Mexican Americans and diabetic outcome. The next chapter will include the results of the study.

Chapter 4: Results

Introduction

Most of the studies on diabetes, depressive symptoms, and alcohol and cigarette use have included state and national samples (Beckles & Chou, 2016; CDC, 2011; Texas Behavioral Risk Factor Surveillance, 2015; Texas Department of State Health Services, 2013). The purpose of this study was to investigate potential predictors of diabetes outcome in a region that predominantly consists of Mexican Americans. Three research questions guided this study, and secondary data were collected to conduct the analyses. The research questions and hypotheses that guided this study were as follows:

RQ1: Does depression severity predict diabetes outcome in Mexican American adults with diabetes?

$H_0$1: Depression, as assessed by the Patient Health Questionnaire-9, does not predict diabetes outcome as measured by the HbA1c test in Mexican American adults with diabetes.

H_a1: There is a significant association between diabetes outcomes and depression severity in Mexican American adults with diabetes as assessed by the Patient Health Questionnaire-9 score and diabetes outcome as measured by the HbA1c score.

RQ2: Does frequency and quantity of alcohol consumption predict diabetes outcome in Mexican American adults with diabetes?

$H_0$2: Frequency and quantity of alcohol consumption, as assessed by the demographic questions, does not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a2: There is a statistically significant association between frequency and quantity of alcohol consumption and diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

RQ3: Does frequency and quantity of cigarette smoking predict diabetes outcome in Mexican American adults with diabetes?

H_03: Frequency and quantity of cigarette smoking, as assessed by the demographic questions, does not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

H_a3: There is a statistically significant association between frequency and quantity of cigarette smoking and diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes.

This chapter provides a description of the data collection procedures that were implemented, such as the time frames for data collection as well as participant recruitment and the inclusion and exclusion criteria. In addition, a detailed description of the sample is provided. The descriptive statistics and the statistical assumptions for the data analyses procedures are addressed. Further, the results from the statistical procedures are provided, including the stepwise analyses, results from forced entry, and moderator multiple regression analyses that were conducted.

Data Collection and Analysis Process

Data collection occurred across a 1-week period from September 15, 2019 through September 20th, 2019, which was approximately a week after IRB approval. During this time period, the research coordinator from the diabetic clinic where data were

collected provided me with de-identified data from 120 randomly selected patients consisting of 79 women and 41 men. A stepwise multiple regression was conducted to evaluate whether predictor variables (PHQ-9 score, Alcohol/Week, and Cigarettes/Week) predicted the criterion variable (HbA1c). At Step 1 of the analysis, I uploaded the Excel file to SPSS. At Step 2, I ensured all data transferred correctly, variables were labeled accurately, and no missing data were detected. At Step 3, I entered the variables into the equation in a specific order (PHQ-9, Alcoholic Drinks/Week, and Cigarette/Week), which were aligned with the research questions and theory. At Step 4, I conducted the stepwise multiple regression model. At Step 5, I observed that the PHQ-9, Alcoholic Drinks/Week, and Cigarette/Week did not enter into the equation. As a result, I entered each variable using the enter method to obtain the descriptive and inferential statistics (gender variable was included for exploratory purposes) needed to interpret the data. I chose the forced enter method to test my theory; however, I was left with no assumptions about which was the best predictor. For this reason, I determined that the forced entry method was the best approach for my study. At Step 6, I explored the variable gender further and reviewed how run a moderator multiple regression. At Step 7, I centralized (same as standardized values under descriptive statistics) all four of the variables (PHQ-9, Alcoholic Drinks/ Week, Cigarettes/Week, and the exploratory variable Gender). At Step 8, I conducted a moderator analysis to determine whether the relationship between two variables depended on (was moderated by) the value of a third variable. This relationship commonly exists between a continuous dependent variable (HbA1c range) and continuous independent variables (PHQ-9, Alcoholic Drinks/ Week,

Cigarettes/Week), which is modified by a dichotomous moderator variable (like Gender). Table 3 provides the mean and standard deviation of both the criterion and predictor variables.

Table 3

Descriptive Statistics by Variable

	N	Minimum	Maximum	Mean	Std. deviation
HbA1c	120	6	13	8.04	1.67
PHQ-9 score	120	0	21	1.60	4.067
Alcoholic drinks/week	120	0	42	3.44	6.630
Cigarettes /week	120	0	161	3.63	18.508
Valid N (listwise)	120				

The archival data provided by the diabetic clinic was limited in how alcohol (the term social drinker was used instead of a numerical value) and cigarette use (packs of cigarettes instead of a numerical value) was conceptualized by the patient. This left no specific number to use for data interpretation. Due to these limits in the data, I was left to research how others operationalized a social drinker and packs of cigarettes. According to the National Institute on Alcohol Abuse and Alcoholism (see Hewitt & Warren, 2010) and Centers for Disease Control (2015) and other studies, a social drinker is defined as

consuming 14 drinks a week for men and seven drinks a week for women. The Texas Department of State Health Services (2013) specified that on average a pack of cigarettes in the United States contains between 20 and 25 cigarettes, with the number of cigarettes varying according to brand. Therefore, I used the average of 20 and 25 to represent a pack of cigarettes as a numerical value. This was confirmed with my chair and committee member to ensure we agreed on how to proceed. Independent samples t-tests were conducted to evaluate the relation between gender and the predictor variables, as shown in Table 4.

Table 4

Independent Samples Test for Gender

		Levene's test for equality of variances		T-test for equality of means						
									95% Confidence interval of the difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean difference	Std. error difference	Lower	Upper
HbA1c range	Equal variances assumed	2.892	.092	.551	118	.582	.1781	.3230	-.4615	.8178
	Equal variances not assumed			.503	63.499	.617	.1781	.3544	-.5300	.8862
PHQ-9 score	Equal variances assumed	18.077	.000	2.242	118	*.027	1.726	.770	.202	3.251
	Equal variances not assumed			2.710	117.986	.008	1.726	.637	.465	2.988
Alcoholic drinks/week	Equal variances assumed	121.307	.000	-7.468	118	.000	-7.887	1.056	-9.979	-5.796
	Equal variances not assumed			-5.568	42.394	.000	-7.887	1.416	-10.745	-5.030
Cigarettes /week	Equal variances assumed	23.684	.000	-2.632	118	.010	-9.152[a]	3.477	-16.037	-2.267
	Equal variances not assumed			-1.903	40.441	.064	-9.152	4.809	-18.868	.564

Note. * p <.05, two tailed

HbA1c range was not significantly different between the gender groups (*t* [118] =.551, *p* =.58). The 95% confidence interval for the difference in means was quite wide, ranging from -.4615 to .8862 for HbA1c range. PHQ-9 score was significantly different by gender (*t* [118] = 2.24, *p* =.03), with men scoring significantly higher than women. The 95% confidence interval for the difference in means was quite wide, ranging from .202 to 2.988 for PHQ-9 score. The test for Gender and Alcoholic Drinks/ Week was significant (*t* [118] = -7.47, *p*=.00). The 95% confidence interval for the difference in means varied slightly, ranging from -9.979 to -5.030 for Alcoholic Drinks/ Week. The test for Gender and Cigarettes/Week was significant (*t* [118] = -2.63, *p* = .01). The 95% confidence interval for the difference in means was quite wide, ranging from -16.037 to .564 Cigarettes/Week. These results were utilized for exploratory purposes and were not included in answering the research questions.

Assumptions

Prior to conducting the regression analysis, I tested a number of assumptions. First, in a standard multiple regression, the researcher assumes that the sample size will be sufficient for the results to be generalizable to other samples (Field, 2013; Green & Salkind, 2011). To ensure a sufficient sample size would be gathered, I conducted a power analysis to determine the minimum number of participants needed for this study. Results from the G*Power analysis indicated that a minimum of 97 individuals would be required. Additionally, multiple regression assumptions include checking for normality, multicollinearity, linearity, homoscedascity, and independence of residuals (Field, 2013;

Green & Salkind, 2011). The dependent variable (HbA1c) was also examined for normality.

Data analysis was conducted using SPSS 15 software. An exploratory data analysis including the Shapiro-Wilk's test for univariate normality indicated that all three measures (PHQ-9, Alcoholic Drinks/Week, Cigarettes/Week) were normally distributed (*p* values were above .05). No univariate outliers were identified using a criterion of +/- 2.58 standard scores on any of the measures. An examination of Mahalanobis distances (Fidell & Tabachnick, 2007) computed from the regression of HbA1c on the PHQ-9, Alcoholic Drinks/Week, and Cigarette/Week did not indicate any significant multivariate outliers at the 1% significance level. Collinearity between the three continuous predictor variables (PHQ-9, Alcoholic Drinks/Week, Cigarette/Week) was assessed and ruled out based on the tolerance statistic (*T* = .462) and the squared multiple correlation between all variables (.69), which was well below the .90 criteria (see Field, 2013). In addition, the variance inflation factor was 4.90, which was within an acceptable level (see Field, 2013).

Homoscedasticity was confirmed through an examination of a plot of the standardized residuals (see Figure 1 and Figure 2) and a scatterplot (see Figure 3). As shown in Figure 1 and Figure 2, standardized residual scores were evenly distributed over predicted standardized HbA1c ranges. A Kolmogorov Smirnov value of .079, *p* = .20 was obtained, which indicated the presence of a normal distribution of scores (see Field, 2013; Green & Salkind, 2011). In addition, the general normality of this distribution can also be noted in Figure 1 and Figure 2.

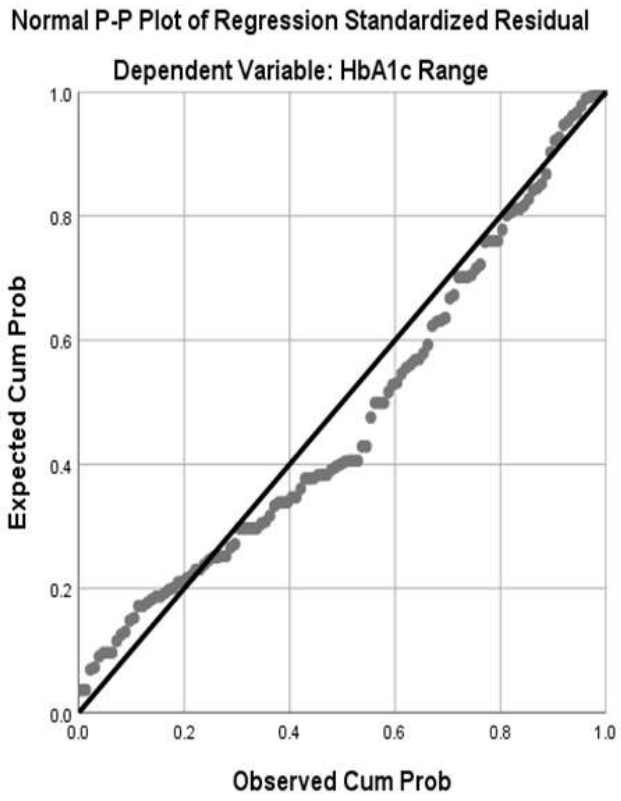

Figure 1. Normal P-Plot of regression standardized residual.

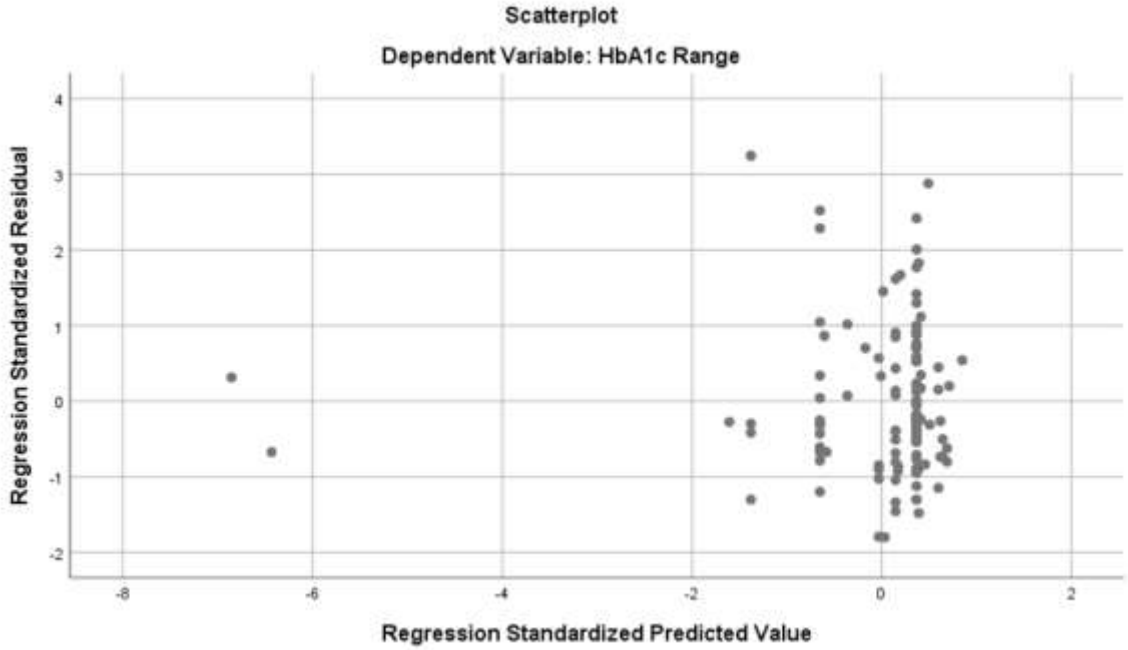

Figure 2. Scatterplot of dependent variable HbA1c range.

Table 5 provides the correlation coefficients that were computed among the three variables and the exploratory variable Gender. The results of the correlational analyses before adding the exploratory variable Gender showed that all three correlations were low and not significant. Each of the predictor variables represented small effect size indices, since most were below 0.10. According to Piaw (2006) the value strength between the three predictor variables appear to have a weak value strength, respectively.

However, once I added the exploratory variable gender the correlational analyses reflected a moderating impact of that variable. The correlation between PHQ-9 and HbA1c became significant, (r [198] = .41, $p < 0.01$), as did the correlation between Cigarettes/Week and Alcoholic Drinks/Week, (r [198] = .46, $p < 0.01$).

Table 5

Correlations With Exploratory Variable Gender

Gender			PHQ9 score	Alcohol	Smoker	HbA1c
Male	PHQ9 score	Pearson correlation	1	-.154	-.098	.418**
		Sig. (2-tailed)		.335	.542	.006
		N	41	41	41	41
	Alcohol	Pearson correlation	-.154	1	.467**	-.058
		Sig. (2-tailed)	.335		.002	.719
		N	41	41	41	41
	Cigarettes	Pearson correlation	-.098	.467**	1	-.087
		Sig. (2-tailed)	.542	.002		.588
		N	41	41	41	41
	HbA1c	Pearson correlation	.418**	-.058	-.087	1
		Sig. (2-tailed)	.006	.719	.588	
		N	41	41	41	41
Female	PHQ9 score	Pearson correlation	1	-.059	-.077	-.127
		Sig. (2-tailed)		.608	.501	.264
		N	79	79	79	79
	Alcohol	Pearson correlation	-.059	1	-.057	-.128
		Sig. (2-tailed)	.608		.620	.262
		N	79	79	79	79
	Smoker	Pearson correlation	-.077	-.057	1	.087
		Sig. (2-tailed)	.501	.620		.446
		N	79	79	79	79
	HbA1c	Pearson correlation	-.127	-.128	.087	1
		Sig. (2-tailed)	.264	.262	.446	
		N	79	79	79	79

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

Table 6

Correlations With Exploratory Variable Gender

Gender			PHQ9 score	Alcohol	Smoker	HbA1c
Male	PHQ9Score	Pearson correlation	1	-.154	-.098	.418**
		Sig. (2-tailed)		.335	.542	.006
		N	41	41	41	41
	Alcohol	Pearson correlation	-.154	1	.467**	-.058
		Sig. (2-tailed)	.335		.002	.719
		N	41	41	41	41
	Cigarettes	Pearson correlation	-.098	.467**	1	-.087
		Sig. (2-tailed)	.542	.002		.588
		N	41	41	41	41
	HbA1c	Pearson correlation	.418**	-.058	-.087	1
		Sig. (2-tailed)	.006	.719	.588	
		N	41	41	41	41
Female	PHQ9Score	Pearson correlation	1	-.059	-.077	-.127
		Sig. (2-tailed)		.608	.501	.264
		N	79	79	79	79
	Alcohol	Pearson correlation	-.059	1	-.057	-.128
		Sig. (2-tailed)	.608		.620	.262
		N	79	79	79	79
	Smoker	Pearson correlation	-.077	-.057	1	.087
		Sig. (2-tailed)	.501	.620		.446
		N	79	79	79	79
	HbA1c	Pearson correlation	-.127	-.128	.087	1
		Sig. (2-tailed)	.264	.262	.446	
		N	79	79	79	79

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

Table 6 provides the model summary for the regression shows the value for R^2 is .010, which indicates that there was a 1.0% (R=.102) change in the predictor variables (PHQ-9, Alcoholic Drinks/ Week, and Cigarettes/Week). Thus, the predictor variables (PHQ-9, alcohol and cigarette consumption) did not significantly predict the criterion variable (HbA1c).

The model summary presented in Table 6 showed that gender did influence the impact predictor variables had on outcome. The .175 value for R^2 male shows that there was a 41% (R=.418) change in the predictor variable PHQ-9's influence on the criterion variable (HbA1c) when gender is added to the model. In contrast, the .016 value for R^2 female shows a 12% (R=.127) change in the predictor variable PHQ-9, and did not predict significant influence on the criterion variable (HbA1c).

Table 7

ANOVA With the Moderator Gender

Gender	Model		Sum of squares	Df	Mean square	F	Sig.
Male	1	Regression	28.043	1	28.043	8.278	.006[b]
		Residual	132.113	39	3.388		
		Total	160.156	40			
Female	1	Regression	2.787	1	2.787	1.267	.264[b]
		Residual	169.393	77	2.200		
		Total	172.179	78			

Note. a. Dependent Variable: HbA1c

b. Predictors: (Constant), PHQ9

Table 7 provides data for the moderator Gender. PHQ-9 score, Alcoholic Drinks/Week, and Cigarettes/Week were entered into the regression equation using the force enter method and did not significantly predict HbA1c (F [3, 116] = .405, p <.001). However, when gender was entered as a moderator into the regression equation PHQ-9 score was significantly related to HbA1c for men (F [1, 39] = .006, p <.001). PHQ-9 score was not significantly related to HbA1c for women (F [1, 77] = .264, p < .001).

Table 8

Coefficients by Gender

Gender	Model		Unstandardized coefficients B	Std. error	Beta	t	Sig.	95.0% Confidence Interval for B Lower bound	Upper bound
Male	1	(Constant)	7.760	.293		26.477	.000	7.167	8.353
		PHQ9	.355	.123	.418	2.877	.006	.106	.605
Female	1	(Constant)	8.192	.185		44.311	.000	.7824	8.560
		PHQ9	-.041	0.036	-.127	-1.125	.264	-.113	.031

Note. A. Dependent Variable: HbA1c
*p<.05

As shown in Table 8, when the moderator gender was added to the model, the standardized coefficients for PHQ-9 score (β = - .418, p <.05) was significant for men. The standardized coefficients for PHQ- 9 score (β = -.127, p <.05) was not significant for women.

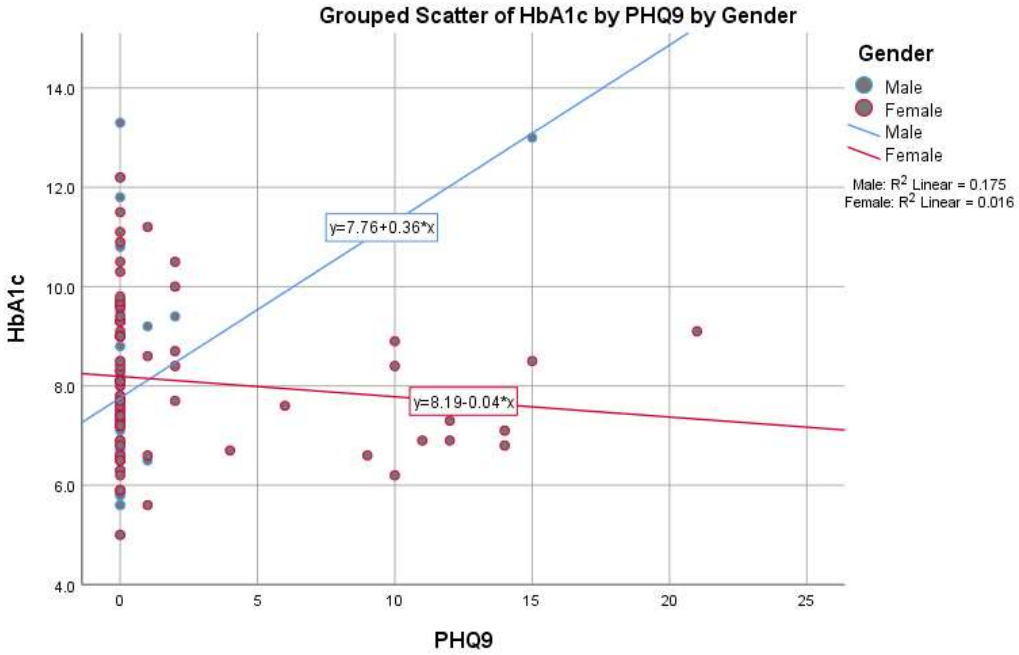

Figure 3. Grouped scatter of HbA1c by PHQ-9 by gender.

Summary and Transition

Chapter 4 focused on addressing three research questions by examining the associations between glycated hemoglobin A1C Marker (HbA1c) and the PHQ-9 score, Alcoholic Drinks/Week, and Cigarettes/Week among adults being treated for diabetes in Southern Texas. A forced entry approach to regression was implemented to obtain descriptive and inferential statistics to interpret. Based on those results, a moderator multiple regression was conducted to report the product between the interacting factors. The dependent variable was the glycated hemoglobin A1C Marker (HbA1c), the independent variables were PHQ-9 score, Alcoholic Drinks/Week, and Cigarettes/Week. Most notably, after controlling for the significant main effects of PHQ-9 score and HbA1c range, the interaction of PHQ-9 score and HbA1c in men was significant (b = .418, p < .006, $sr2$ = .175). Gender moderated the relationship between PHQ-9 score and HbA1c for men but not women. The "buffering" effect of gender on the relationship between PHQ-9 score- and HbA1c range was most evident in men (Cohen & Wills, 1985). In women, the relationship between PHQ-9 score and HbA1c was not significant. That is, for women, PHQ-9 score had no significant impact on HbA1c (b = -.127, p = .264, $sr2$ = .016), accounting for a trivial portion of the variability in glycated hemoglobin.

To address RQ1, depression, as assessed by the PHQ-9, did not predict diabetes outcome as measured by the HbA1c test in Mexican American adults with diabetes. For RQ2, frequency and quantity of alcohol consumption, as assessed by the demographic questions, did not predict diabetes outcome as measured by the HbA1c score in Mexican

American adults with diabetes. For RQ3, frequency and quantity of cigarette smoking, as assessed by the demographic questions, did not predict diabetes outcome as measured by the HbA1c score in Mexican American adults with diabetes. Further, to investigate whether there was a relationship between any of the predictor variables (PHQ-9, frequency and quantity of alcohol and cigarette usage) and the criterion variable (HbA1c), a series of Pearson correlations were conducted. These analyses revealed that neither of the three predictor variables had a significant positive relationship with each of the three variables. Further, gender was noted to have a significant difference with predictor variables in Table 2 as presented by the *Group Statistics by Variable for Gender*. Findings also show that Gender moderated the relationship between PHQ- 9 score and HbA1c range in men.

In Chapter 5, these results are interpreted through the lens of the theoretical framework. In addition, the findings are compared to the existing research literature and the limitations of this current study are discussed. Finally, the potential impact that these findings could have for positive social change are considered and recommendations for further research are provided.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to examine whether alcohol use, cigarette smoking, and/or depression symptoms predict diabetes outcome measures in Mexican American adult patients. Despite the variety of predictors that were explored in the study, no one factor was highly predictive of diabetic outcome in Mexican Americans. However, when the moderator gender (exploratory variable) was entered in the regression equation, one interaction between PHQ-9 score and HbA1c was predictive of diabetic outcome in Mexican Americans. The variety of research into multiple factors associated with diabetes outcome has become a concern in both county and state agencies (CDC, 2011; The Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2013). This quantitative study was undertaken because the relative contribution of the PHQ-9 score, Alcoholic Drinks/Week, Cigarettes/Week in Mexican Americans, as a group, had not been studied, particularly where prevalence, comorbidity, and death rates in diabetes are higher than the state and national average (CDC, 2011; The Texas Behavioral Risk Factor Surveillance System, 2015). In this chapter, I interpret the results presented in Chapter 4 using the theoretical framework of the biopsychosocial model. In addition, the findings are compared to the existing literature, and the limitations of the current study are discussed (see Baquero et al., 2009; Enguidanos et al., 2015; Halligan & Wade, 2017). Finally, the potential impact of these findings on positive social change is considered, and recommendations for further research are provided.

To examine which variable (PHQ-9 score, Alcoholic Drinks/ Week, Cigarettes/Week, Gender) was the best predictor of diabetes outcome in Mexican American adult patients, and to examine the relative contribution of each of the variables and diabetes outcome, I conducted a stepwise and moderator multiple regression. The results of the multiple regression analysis indicated that approximately 10% of the variance in the HbA1c range was accounted for by depression as measured by the PHQ-9 score, Alcoholic Drinks/Week, and Cigarettes/Week. In addition, when the moderator Gender was added to the equation, the interaction between PHQ- 9 and HbA1c indicated that approximately 41% of the variance in the HbA1c range was accounted for by the PHQ-9 score/HbA1c interaction. To examine whether there was a bivariate relationship between any of the predictor variables and the criterion variable HbA1c range, I conducted a series of Pearson correlations. These analyses revealed that the PHQ-9 score had a significant medium positive relationship with the criterion variable HbA1c when Gender was added to the model.

Interpretation of Findings

Although researchers have investigated the relationship between each of the predictor variables and diabetes outcome (Anderson et al., 2014; CDC, 2011; Mendenhall, 2012; Ma et al., 2012; Petrak et al., 2013; Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2013), such predictors in Mexican Americans had not been explored. This study extended the published research by presenting a model that explained approximately 41% of the variance in the relationship between PHQ-9 score and HbA1c range by Gender. In this

sample, men with high depressive severity scores tended to have high HbA1c levels, but this relationship did not exist for the women in the sample. The results indicated that the Mexican American men with diabetes may need tailored prevention programs that address this possible relationship. The results indicated that influence on diabetic outcome may vary by gender. Individual needs change over time, and addressing health in diabetic Mexican Americans may have varying points of emphasis. Prevention techniques, interventions, and treatment must be evaluated periodically to meet the unique needs of minority groups like Mexican Americans. More specifically, evaluating the different needs of men and women in this population may be an important component of assessment.

The biopsychosocial model posits that depression symptoms, alcohol use, and cigarette smoking are factors that interact with each other to promote adverse health outcomes. Although in this study alcohol and cigarette use were not found to be significant predictors of diabetic outcome in Mexican American adults, the relationship between alcohol use and health outcomes in Mexican Americans has been investigated with varying results, particularly related to moderating variables such as gender and ethnicity (Anderson et al., 2014; CDC, 2011; Ma et al., 2012; Petrak et al., 2013; Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2013). Findings from the current study did not align with previous research in which alcohol and cigarette use was found to impact health outcomes in Mexican American men.

The literature on health and disease indicated that a multilayered method is needed to explore possible factors that can influence health outcomes using the biopsychosocial model (Smith & Uchino, 2008; Halligan & Wade, 2017). Wade and Halligan (2017) and The Texas Behavioral Risk Factor Surveillance System (2015) have observed that chronic disease appears to account for the most morbidity and death in Western culture and specific regions in Texas. Wade and Halligan suggested the use of a biopsychosocial model to explore chronic disorders, improve patient outcomes, and control health care cost. Approximately 25% of hospital outpatients have issues that are not accounted for by any specific disease (Texas Department of State Health Services, 2015; Halligan & Wade, 2017). Researchers have shown that illness and disease emerge and advance from intertwined biological predispositions, psychological states, and health habits like smoking and alcohol consumption (Cooper, 2005; Habtewold et al., 2016; Lewis et al., 2003; Purdy, 2013; Texas Behavioral Risk Factor Surveillance System, 2015).

The findings of the current study showed a small positive correlation between the predictor variables (PHQ-9, Alcohol and/or Cigarette use, and Gender) and the criterion variable (HbA1c range) in Mexican Americans, which supports the claim there is a correlation between Alcohol and Gender in Mexican Americans by various researchers (Baquero et al., 2009; Caetano et., 2014). Further analysis of the relationship between alcohol and cigarettes in Mexican Americans can have potential impact on minority groups who have diabetes (Caetano et., 2014). Exploration of the potential relationship between alcohol/cigarettes and diabetes outcome is useful for researchers who should use

these findings to explore the impact of such interactions in Mexican American adults as (Cengiz, Petry, Tamborlane, Wagner, & Walter, 2016) well as in other geographic regions. This view is shared by Baquero et al. (2009) who discussed how researchers continue to gather data on Hispanic subgroups (Mexican Americans, Puerto Rican, and Cubans) to develop an understanding of relationships among variables that may impact Hispanic health (specifically diabetes outcome) given the growth and diversity in this population.

Researchers have recommended the use of the biopsychosocial model when trying to understand the interaction between internal and external factors in complex diseases in populations such as Mexican Americans (Baquero et al., 2009; Texas Behavioral Risk Factor Surveillance System, 2015; Halligan & Wade, 2017). Findings from the current study and other studies provide support for the need for further research that addresses the potential of PHQ-9 and/or gender as a mediator in the relationship between complex disease (like diabetes, depressive symptoms, alcohol/cigarette use) and outcome in Mexican American adults. My findings indicated the need for patients to communicate their individual needs to clinicians and for clinicians to understand the needs that are unique to Mexican American adults and how they might differ by gender. Understanding the individual needs of Mexican American males is in line with the literature that comorbidity and morbidity vary across gender and culture (Baquero et al., 2009; Texas Behavioral Risk Factor Surveillance System, 2015). It is important for organizations to focus on internal and external factors that may influence how complex disease is influenced by different factors in Mexican American adults. The findings in this study

support the conclusion that prevention, treatment, and adherence in diabetic plans may vary by gender. Depressive symptoms were significantly related to diabetes outcome in the men in the sample but not in the women. Assessment and treatment of depressive symptoms needs to be a priority regardless of gender; however, these symptoms appear to have a stronger health outcome impact in men compared to women. Although the needs of men and women in this population are slightly different, the overall goal to decrease adverse diabetic outcome and address mental health issues is still a priority.

Baquero et al. (2009) and The Texas Behavioral Risk Factor Surveillance System (2015) suggested that given the continuous growth and diversity of the Hispanic population and their subgroups (e.g., Mexican Americans, Puerto Ricans, and Cubans), further investigation is needed to expand the knowledge and understanding of health outcomes in this population. Baquero et al. reported that non-Hispanic Black (14.5%) and Mexican American (15.0%) adults had a higher age-adjusted prevalence of diabetes than non-Hispanic White adults (8.8%). The current study was developed in response to Baquero et al.'s call for exploration of health outcomes in this population, and the findings hold significant implications for future research as well as for clinical work.

The Texas Behavioral Risk Factor Surveillance System (2015) supported the conclusion that developmental processes, along with ethnicity, are likely to be involved with health outcome. The findings of the current study supported the findings of The Texas Behavioral Risk Factor Surveillance System that men are more likely than women to experience adverse diabetes and/or health outcomes. Engler (1977) indicated that psychological, biological, and social experiences influence disease prevalence through

health-related risk behaviors, and chronic health conditions can emerge as a result of those behaviors. It is from this theoretical perspective regarding understanding complex disease that the results of this study can be understood.

The findings of the current study support the previous research as well as extend that research to more broadly address the relationship between gender and depressive symptoms and diabetic outcome in Mexican Americans. Other researchers have supported the claim that both gender and depressive symptoms may impact diabetes outcome, and more specifically that Mexican American men had a higher prevalence of adverse health outcomes in general (Baquero et al., 2009; Caetano et., 2014). The current study focused more specifically on diabetic outcomes. In addition, the current study demonstrated a correlation between depressive symptoms, alcohol, and cigarette use. This supports the previous research and suggests that other areas of biopsychosocial influences may be related to health outcome. Although there has been little research on the role of gender on diabetic adherence, Geisel-Marbaise and Stummer (2010) found a small effect of gender on adherence behavior. Even though this finding was small, it supported my findings and the conclusion that prevention, intervention, and treatment may be more effectively implemented by gender in this population.

Theoretical Framework

The biopsychosocial model posits that the use of an alternative framework that encompasses multiple influences can provide in-depth knowledge of underlying factors related to health outcome (Engel, 1977). Engel (1977) claimed that this model could be used to identify appropriate interventions to treat complex health issues, and presented

the notion that health reflects a paradigm that includes complex interactions of physiological, psychological, and social factors. Engel and others (Purdy, 2013; Smith & Uchino, 2008) noted that this model has been adopted for use in the areas of medical practice, intervention, research, and training. Additionally, this model allows practitioners to comprehend patients with multiple comorbidities (Engel, 1977). This can be seen in Engel's description of the model, which addresses internal/external factors on health outcomes and comorbid relationships (Gavin et al., 2011; Krantz et al., 2013).

The modern biopsychosocial model views all three variables (PHQ-9 score, Alcoholic Drinks/Week, Cigarettes/Week) as factors that address key components of a comprehensive and integrative perspective of conceptualizing patients' minds and bodies (Gavin et al., 2011; Krantz et al., 2013). Malhi et al. (2013) claimed that the model integrates a systematic conceptual framework that takes advantage of diverse systems independently of their biological, psychological, and sociological nature. As practitioners and mental health providers begin to implement this model, a better understanding of comorbid relationships between diabetes and depression. The current study found that a high depressive symptom scores as measured by the PHQ-9 score negatively influences a patients HbA1c score. The data also implied that depressive symptoms can impact quality of life and overall health outcome in Mexican American men (Ciechanowski, Katon, Russo, & Hirsch, 2003; Hudson et al., 2013; Scobie, 2014). Hansen and Cabassa (2012) stated that disparities in health outcomes in minority groups still need to be examined, especially variables distinct to Latinos may isolate practices that contribute to disparities. Hansen and Cabassa (2012) and Olvera et al. (2016) described how researchers

emphasized the importance of service use, adherence to care, successful treatment, and culturally appropriate interventions designed uniquely for Latino populations. Building on this theme, Penckofer et al. (2014) also observed that effective treatment is a three-way process (e.g., biological, psychological, and sociological), and if clinicians and mental health providers address health outcomes via this three- way process this can have exponentially more effect on a patient's overall health. The value of this knowledge lies in the fact that if clinicians and mental health providers address the patient as a whole, it may be easier to improve quality of life and health outcomes in Mexican Americans with a high prevalence of comorbid disease and morbidity (Gavin et al., 2011; Krantz et al., 2013; The Texas Behavioral Risk Factor Surveillance System, 2015). Biopsychosocial theory provides a theoretical context in which the potential relationship between PHQ-9 score, Alcoholic Drinks/Week, Cigarettes/ Week, and Gender can be made clear.

Drawing from the principles of biopsychosocial theory, it was hypothesized that the severity of PHQ-9 score, Alcoholic Drinks/ Week, Cigarettes/Week, and Gender would each uniquely support a more successful understanding and together would provide a greater ability to predict diabetic outcome in Mexican Americans. While the results of this study present a model in which all three independent variables (e.g., PHQ-9 score, Alcoholic Drinks/Week, Cigarettes/ Week) explain approximately 1% of the variance in glycated hemoglobin A1C Marker (HbA1c), none of the three predictors were found to be a significant predictor of a glycated hemoglobin A1C Marker (HbA1c). However, a bivariate analysis indicated that a positive relationship did exist between the PHQ-9 score and HbA1c in men. In addition, Alcoholic Drinks/Week and

Cigarettes/Week were noted to be positively related in men. Moreover, the study was specifically conducted in a collectivist setting (Southern Texas-predominately a setting where minorities like Mexican American), which it was further summarized in the literature review by CDC (2011), The Texas Behavioral Risk Factor Surveillance System (2015), Texas Department of State Health Services (2015) agencies who confirm that groups like Mexican American men are more likely to use alcohol and cigarettes.

The Biopsychosocial theory views PHQ-9 score, Alcoholic Drinks/Week, Cigarettes/ Week, and Gender as essential factors conceptualizing patients' minds and bodies (Engel, 1977). This research supports a significant predictive role for depressive symptoms in glycated hemoglobin A1C Marker (HbA1c) outcomes in Mexican American males. Further, the potential exists for mediator influences (like ethnicity, hormonal imbalance, BMI, diagnosis of liver disease, and/or other mental disorders) to be present between these factors and should be an area of further exploration.

Limitations

Due to the nature of this study there were several limitations. This study was limited in nature by its correlational design. The variables that were included in the study were not manipulated; therefore, no causal relationship between variables can be inferred. Because correlational rather than causal results were obtained, this also limits the inferences that were able to be drawn from the results. The population selected to participate in this study was a convenience sample limited to Mexican Americans attending a Diabetic Center in Southern Texas. Due to the selected population sample and the single institution (the diabetic clinic in Southern Texas) the lack of generalizability

impacts the extent to which these results can be applied to other populations (Green & Salkind, 2008). Additionally, this study was a time limited sampling and presents only a snapshot of the population at a specific time and data for a 3-month time frame.

Other limitations should also be considered. For example, biases due to selective deposit (biases that influence what information is recorded or deposited in the archival record) selective survival (when archival records are missing or incomplete), and archived data that does not contain detailed information about specific amounts of alcohol and cigarette consumption may have impacted the findings (see Creswell, 2003). The use of quantitative research did not allow for the researcher to interview participants to collect personal stories, which eliminates the possibility of obtaining subjective information on motivations, feelings, and personal insights (Boyd, 2016; Brown, 2014; Creswell, 2003). The use of surveys in data collection rather than interviews increases the possibility for the presence of missing data as well as unintentional wrong response selection by the participants.

To ensure missing data did not impact the results of the study, cases with missing data were identified and excluded from the final sample. While a minimum of 97 patients were sought for this study, 120 patients were provided. All of the patient data sets were complete. Despite this, the small sample size required a statistical adjustment to be made in the analyses (e.g., changing the alpha level to .10 when analyzing predictor effect so that the effect size at f 2 = .05 continued to be statistically significant), and as a result is a limitation of this study. Given these limitations, caution needs to be used when interpreting the results. Inferences can only be limited to this sample population as well

as those that can be supported through the existing research literature or are reasonable considering the theoretical framework. In addition, the Patient Health Questionnaire-9 only measures depressive severity; therefore, other psychological symptoms such as anxiety were not assessed, which was another limitation.

Recommendations for Further Study

This current study identified that approximately 1% of the variance in the HbA1c range was accounted for by the predictors PHQ-9 score, Alcoholic Drinks/ Week, and Cigarettes/Week. In addition, approximately 41% of the variance in the relation between depression and Hb A1c range is accounted for by the gender in Mexican American adults. Gender was found to be the single best predictor of diabetic outcome in Mexican American adults, with men having a more negative outcome compared to women. In sum, the data indicates that Mexican American men in Hidalgo County with high depressive severity scores also have high HbA1c ranges. This relation was not evident for Mexican American women in Hidalgo County.

Rush, Urbanoski, and Al'Absi (2003) discussed the potential to understand how self- bias may or may not play a role in reporting adverse health habits. The authors recommended that researchers further examine patients reporting the use of alcohol in a health care setting. Another potential topic for researchers to explore is the possible bias behind patients reporting adverse health habits like alcohol and/ or cigarette use and gender differences in that reporting. All of the data used in this and previous research is based on self-report, and it is not known the extent to which individuals report substance use accurately, or if this differs by culture and/or gender. Research focused on biased

self-report by gender and how it impacts the reporting of health habits like alcohol and cigarette use in health care settings versus informal settings might be useful.

Given the limitations of this study, including the small sample size, it would be important to replicate this study with a larger group of Mexican American adults, potentially from multiple diabetic clinics and other counties with a high prevalence of diabetes and comorbidity. As these data were collected between 2017 to 2019, exploring patient responses in a longer time frame across multiple clinics may yield valuable results. As the interaction between PHQ-9 score and HbA1c range were noted to be significant predictors of diabetic outcome in the men in this study, further investigation with Mexican Americans men at multiple diabetic clinics levels would be useful in better understanding the range of prediction for diabetic outcome that PHQ-9 scores and HbA1c range provides. Further, an investigation into the role that gender plays in each of these areas would deepen the understanding of these variables. There is a need for further exploration integrating a mixed-method approach to have a better understanding of the predictor variables (e.g. PHQ-9 score, Alcoholic Drinks/Week, and Cigarettes/Week, and Gender) and how they relate to diabetes outcome. Using interviews from an individual other than a health care provider may yield different results, since reporting alcohol and cigarette use to a clinician can be intimidating for patients and can produce inaccurate results (Choi, Kim, & Gruber, 2019; Rush, Urbanoski, & Allen, 2003).

Implications for Social Change

Despite the variety of factors that were explored, no one factor or set of factors were identified as highly predictive of a diabetic outcome in Mexican American adults.

The results of this study identified factors associated with the biopsychosocial theory that were predictive of diabetic outcome in Mexican American men. In utilizing a biopsychosocial theory framework, this study highlights the value of using such a theoretical lens when exploring complex disease like diabetes in Mexican American adults. Furthermore, as this gap in the literature had not previously been studied, the results of this study extend and are generally supportive of literature that has already been conducted. The interaction between PHQ-9 score and HbA1c range was found to be significantly predictive of diabetic outcome in Mexican American men. This information is important for clinicians and mental health providers to consider when seeking interventions to meet the high increase of adverse diabetic outcome in Mexican American adults in the Rio Grande Valley. While no evidenced based interventions were found in the literature that were specific to populations like Mexican Americans, incentives to decrease adverse diabetic outcome has been developed by several researchers (CDC, 2011; The Texas Behavioral Risk Factor Surveillance System, 2015; Texas Department of State Health Services, 2015). Clinicians may wish to consider the value of the awareness programs developed as a result of the research of these agencies.

Although more evidenced based interventions focused on diabetes outcome in Mexican American adults are needed, the current study provides valuable information on gender, depressive symptoms, alcohol/cigarette use, and diabetic outcome in this population. This information can help mental health providers and clinicians concentrate on the development of new interventions, incentives, and programs. Similarly, this information provides mental health practitioners with new knowledge that could be

useful when targeting intervention efforts focused on improving diabetic outcomes in Mexican American adults. While additional research is needed, clinicians and mental health providers will be able use this information to consider whether interventions focused on improving diabetic outcome and minimizing depressive symptoms would be of value in clinical work targeting populations like Mexican American adults. Such an approach with benefit individual patients, their families, and society in general by improving health outcomes.

As this study highlights factors thought to emerge from psychological, biological, and social experiences, it suggests a long-term role that these factors may play in health outcomes, which is consistent with the theoretical tenets of biopsychosocial theory (Engel, 1977). It would be beneficial for clinicians to consider programs that support a patient's overall well-being (including targeting psychological, biological, and social factors that influence health).

Summary

This study investigated the association of depressive symptoms and diabetes in Mexican American adults, and to understand how alcohol and cigarette smoking predict diabetic outcome as well as explored which of these variables was the single best predictor of diabetic outcome. I utilized de-identified data collected in a Diabetes Clinic in Hidalgo County. A regression analysis provided a model in which the independent variables accounted for one percent of the variance in the HbA1c range. However, a moderator regression analysis provided a model in which the moderator gender and interaction between PHQ-9 and HbA1c accounted for forty one percent of the variance in

the HbA1c range. Based on these findings, the present study supported the hypothesis that gender does indeed moderate, or buffer, the deleterious impact of depressive symptoms on glycated hemoglobin.

The results of this research provide additional support for some of factors underlying biopsychosocial theory. Such information can be beneficial to clinicians and/or researchers as they seek interventions to assist with prevalence, comorbidity, and death rates in Mexican Americans as well as provide mental health practitioners with new knowledge that is useful in targeting intervention efforts focused on improving diabetic outcome in Mexican American adults. For families and individuals, this information is useful in encouraging efforts focused on developing interventions and training for family medicine practitioners and mental health providers regarding the importance of the role such factors can influence patients with diabetes. Outcomes from this study also suggest opportunities for further research regarding the association between gender and the predictor variables, particularly in Mexican American adults. The results of this study suggested that depressive severity as measured by the PHQ- 9 in Mexican American male predicts adverse diabetic outcome. If clinicians want to motivate men in Mexican American populations, treatment and interventions have to be modernized so that potential health opportunities are tailored to gender needs, which results in the patient feeling like their health outcomes are a priority. If men learn new habits to prevention, as part of their health plan, options they take to adhere to diabetic outcome can improve their quality of life and decrease comorbidity disease.

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Appendix A: Letter

To Whom It May Concern:

I, Yvonne Chapa, am contacting you in search of potential archival data. I am a Walden University doctoral student living in Texas and would like the assistance of your diabetic clinic.

If you are interested in assisting me with this study, please direct your attention to the attached document (data agreement) and reply to this message by filling out the data agreement provided by the University. After receiving your reply stating your interest in providing archival data for this study, the researcher will provide you with the research criteria for the study. Thanks for your consideration, and I look forward to hearing from you.

Yvonne Chapa

Doctoral Student

Walden University

Appendix B: IRB Approval

The IRB approval number for this study is 09-13-19-0167J10

Appendix C: Data Use Agreement

DATA USE AGREEMENT

This Data Use Agreement ("Agreement"), effective as of August 27, 2019, ("Effective Date"), is entered into by and between Yvonne M. Chapa ("Data Recipient") and Nuestra Clinica del Valle, Inc. ("Data Provider"). The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS") for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with any applicable HIPAA or FERPA Regulations

Data Fields in the LDS. **No direct identifiers such as names may be included in the Limited Data Set (LDS).** The researcher will also not name the organization in the doctoral project report that is published in ProQuest. In preparing the LDS, Data Provider or designee shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research: Hemoglobin A1C, PHQ9 and substance use.

1. Responsibilities of Data Recipient. Data Recipient agrees to:

a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

1. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its research activities only.

1. Term and Termination.

a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

e. Effect of Termination. Sections 1 and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

1. Miscellaneous.

a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER
Nuestra Clinica del Valle, Inc.

Signed: [redacted]

Print Name: Lucy Torres

Print Title: CEO

DATA RECIPIENT

Signed: Yvonne M. Chapa

Print Name: Yvonne M. Chapa

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