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Access to Preventive Health Care Services and Effects on Health Outcomes for Hispanic Older Adults With Type 2 Diabetes

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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MA, Walden University, 2014

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Despite elevated prevalence of diabetes among Hispanic, Hispanic older adults face challenges in self-control and management of their glucose levels, and they have less access to preventive health care services. The purpose of this retrospective quantitative cross-sectional study was to examine the associations between access to preventive health care services and Type 2 diabetes outcomes among Hispanic adults aged 65 years and older. The social-ecological model provided the framework for the study. The research question for this study examined the extent to which doctor visits, diabetes education and blood sugar checks correlate with HbA1c levels. Data were collected from 566 participants using the 2015–2016 and 2017–2018 National Health and Nutrition Examination Survey. Chi-square tests of independence and binomial logistic regression analyses were conducted to determine whether there was an association between HbA1c levels and doctor visits, diabetes education, and blood sugar checks and the extent to which a participant's diabetes status could be predicted based on the independent variables, respectively. The results showed statistically significant associations between access to preventive health care services and Type 2 diabetes-related outcomes among Hispanic adults age 65 years and older. After controlling for age, gender, income, and language spoken at home, the results of binomial logistic regression analyses indicated that older Hispanic adults with diabetes were significantly more likely to receive preventive health care services than those with no diabetes. The findings suggested that culturally appropriate preventive health care services might have positive implications for diabetes-related outcomes in older Hispanic adults.

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Dedication

I dedicate this achievement to my mother for her continued support, love, and prayers. I will always be thankful for your continuous sacrifices and endless love that you have given us. I also want to dedicate this achievement to my greatest champion, my husband. When I did not see the light, he was there with a torch; when I did not believe, his belief was big enough for the both of us. Thank you for your support, love, and commitment to our family. Finally, I also want to dedicate this achievement to my daughter, my aspiration! You all inspired me, pushed me forward, and lifted me to realize my greatest potential. I will forever be grateful to you.

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Chapter 1: Introduction

Diabetes is a complex metabolic disorder that causes a lack of insulin production, insulin use, or both. This metabolic disorder is a primary cause of hypoglycemia in affected patients (American Diabetes Association, 2014). The prevalence of diabetes increased from 9.8% to 12.4% per 100 adults between 1988 and 2012 (Menke et al., 2015). According to Fang (2018), diabetes affects 13.3% of the Unites States (U.S.) population. Racial and ethnic disparities exist in the U.S. regarding Type 2 diabetes (Babamoto et al., 2009). Hispanic adults have higher odds of suffering from diabetes (Purnell et al., 2016). Research has shown that Hispanics confront challenges in accessing health care services in the United States, which affects their quality of life (Ortega et al., 2015). However, the access to and use of preventive health care services to improve diabetes outcomes, especially among Hispanic adults aged 65 years and older, remains a gap in the scientific literature (Babamoto et al., 2009; Ortega et al., 2015; Purnell et al., 2016).

The current study addressed the extent to which access to preventive health care services affects diabetes-related outcomes among Hispanic adults aged 65 years and older. Specifically, I examined the association between diabetes status, as measured by HbA1c levels, and several independent variables, including doctor visits, diabetes education, and blood sugar checks. Additionally, I analyzed the relationship between the variables in the presence of confounding factors, such as age, gender, and language spoken at home.

From the perspective of social change, this research project may contribute to the understanding of how older Hispanic adults access preventive health care services. For people with diabetes, the cost of medical expenditure has reached 57% of the total individual medical expenditure (American Diabetes Association, 2018). Identifying effective mechanisms to prevent and control diabetes may help those at higher risk of or with diabetes to decrease the economic burden associated with this health condition. In this chapter, the background, problem statement, purpose of the study, and research questions and hypotheses are discussed.

Background

Primarily, diabetes manifests in two forms: Type 1 and Type 2 (American Diabetes Association, 2016; Zaccardi et al., 2016). Type 1 diabetes is characterized by insulin deficiency, which is the body's inability to produce insulin hormone as a result of loss of pancreatic β cells (Katsarou et al., 2017). The metabolic system presents challenges in transporting glucose from the blood to the cells in the body (Katsarou et al., 2017). Symptoms associated with Type 1 diabetes commonly appear during childhood or adolescence (Katsarou et al., 2017). Today, almost 1% of the U.S. adult population is diagnosed with Type 1 diabetes, which represents 5.6% of those diagnosed with diabetes (Xu et al., 2018). Type 1 diabetes is highest among young and non-Hispanic Whites (Xu et al., 2018). However, Type 2 is the most common type of diabetes affecting the U.S. adult population (Xu et al., 2018). Type 2 diabetes affects almost 10% of the U.S. adult population, and 95% of those diagnosed with diabetes. In Type 2 diabetes, metabolic mechanisms do not properly utilize insulin, producing insulin deficiency (American

Diabetes Association, 2016; Zaccardi et al., 2016). Gestational diabetes is a less common type, affecting about 4% of women during pregnancy (Lavery et al., 2017). Diabetes has also become a significant health concern for Hispanics in the United States because of its increasing prevalence in recent decades (Centers for Disease Control and Prevention [CDC], 2017).

The proportion of Hispanic adults with diabetes is higher than that of non-Hispanic Whites (Gaskin et al., 2014). According to Walker et al. (2016), 13% of the Hispanic adult population has been diagnosed with Type 2 diabetes. Among Hispanics from different backgrounds, about 10% of South Americans are diagnosed with diabetes, but the prevalence of diabetes among Dominicans, Mexicans, and Puerto Ricans has reached 18% of the U.S. population (Schneiderman et al., 2014). The mortality rate from diabetes in Mexicans and Puerto Ricans is 80% higher than in non-Hispanic Whites (Dominguez et al., 2015). Because of the life expectancy of Hispanics, the prevalence of diabetes has become a major public health concern, especially among those over 64 years of age.

In 2012, the total prevalence of diabetes among Hispanic adults over 64 years was 2 times higher than in the U.S. population between the ages of 45 and 64 years (Menke et al., 2015). The increase in the prevalence of prediabetes (50%) combined with the lack of early detection and treatment might lead to the development of diabetes (Mainous et al., 2016; Menke et al., 2015). Compared with the U.S. population, similar patterns have been observed, in which almost half of Hispanic adults with diabetes are over 65 years of age (Xu, 2018; Schneiderman et al., 2014).

At the individual level, Hispanics are less likely to check their HbA1c levels routinely, and they face challenges in self-control and management of their glucose levels (McCurley et al., 2017). The late detection of diabetes also increases the risk of other health conditions, including cardiovascular disease, depression, and organ failure (McCurley et al., 2017). However, evidence showed that Hispanic adults who engaged in diabetes self-management education and preventive health care services had better diabetes outcomes, specifically improvements in HbA1c levels (Ferguson et al., 2015). Many social determinants of health deter Hispanics from receiving early diagnosis and adequate diabetes treatment (Clark & Utz, 2014; Gallo et al., 2014). Hispanics experience a lack of access to health care and a higher rate of health insurance than other racial/ethnic groups (Afable-Munsuz et al., 2014; Canedo et al., 2018). The future of health care services for Hispanic adults aged 65 and older is compromised because the prevalence of those younger than 65 years is 133% higher compared with their White counterparts, and they are less likely to seek preventive health care services associated with diabetes (Dominguez et al., 2015). Therefore, a better understanding of the mechanisms related to preventive health care services is needed to improve diabetes outcomes and lead to better quality of life and life expectations in older Hispanics.

Problem Statement

In 2019, the U.S. Census Bureau estimated that the number of Hispanic older adults living in the United States had reached 4 million, which represented 7% of the total Hispanic population. According to the Office of Minority Health (OMH, 2016), in 2010, Hispanic older adults had higher diabetes prevalence compared with other age groups.

Despite the high prevalence of diabetes among Hispanics 65 years and older, this population continues to experience difficulties in controlling their HbA1c levels and improving their diabetes outcomes (Little et al., 2014). Traditionally, Hispanics have had less access to health insurance and have utilized fewer preventive health care services (Velasco-Mondragon et al., 2016). In addition, Hispanics diagnosed with diabetes have been shown to have an average medical expenditure of $8,513 per year compared with $2,170 for Hispanics without diabetes (Leung et al., 2017). To mitigate health care costs and expenditures, it is vital to understand the association between access to preventive health care services and diabetes disparities in Hispanics age 65 and older. Several studies have addressed ways of improving preventive health care services utilization, but there is limited evidence on Hispanic adults 65 years of age and older (Adepoju et al., 2015). It is unclear whether the findings of previous research can be extrapolated to Hispanic older adults because of the limited inclusion of this population in studies related to preventive health care services, especially those examining diabetes outcomes. Furthermore, most research on preventive health care has addressed Hispanics as a homogenous group, thereby increasing the scientific gap in preventive health care services in Hispanics, especially those diagnosed with Type 2 diabetes (Ortega et al., 2015). As research on health disparities advances, such evidence magnifies the lack of understanding of culturally relevant mechanisms that can contribute to diabetes improvement in Hispanics as a heterogeneous ethnic group, especially among adults 65 years of age and older (Kim et al., 2014; Wagner et al., 2016). The current study was

needed to understand the access to preventive health care services among Hispanic older adults.

Purpose of the Study

The purpose of this retrospective quantitative study was to examine the association between access to preventive health care services and Type 2 diabetes-related outcomes among Hispanic adults aged 65 years and older. I investigated the extent to which Hispanic individuals age 65 years and older access preventive health care for diabetes. In addition, I explored the potential effects of access to preventive health care services on diabetes-related outcomes in Hispanics age 65 years and older.

I analyzed data collected from the 2015–2018 National Health and Nutrition Examination Survey (NHANES). Diabetes status as measured by HbA1c levels was the dependent variable. The independent variables included doctor visits, diabetes education, and number of blood sugar checks. Additionally, I examined the extent to which the independent variables could predict diabetes status in the presence of confounding factors, such as age, gender, and language spoken at home, because the literature demonstrated the influence of these factors on Hispanic health.

Research Questions and Hypotheses

The four research questions and corresponding hypotheses were the following:

RQ1: What is the association between frequent doctor visits and Type 2 diabetes outcome in Hispanic adults?

H_o1: There is no statistically significant association between frequent doctor visits and HbA1c level in Hispanic adults.

H_a1: There is a statistically significant association between frequent doctor visits and HbA1c levels in Hispanic adults.

RQ2: What is the association between diabetes education and Type 2 diabetes outcomes in Hispanic adults?

H_o2: There is no statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

H_a2: There is a statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

RQ3: What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?

H_o3: There is no statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

H_a3: There is a statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

RQ4: What is the association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home?

H_o4: There is no statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home.

H_a4: There is a statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors such as age, gender, income, and language spoken at home.

Theoretical Framework

The theory that guided this research was the social-ecological model (SEM). The SEM has been used to understand individual and environmental factors from various perspectives, including biological, behavioral, environmental, and social determinants of the problem (Hancock et al., 2015). Since the SEM enables understanding of the impacts of organizations (i.e., workplace and schools), interactions with persons (i.e., family, friends, and peers), and public policies, the model was an appropriate theoretical framework for the current study. The SEM can be divided into three subsections: individuals and their behavior, the physical environment, and the social environment (McCormack et al., 2017). These dimensions can be analyzed on five levels: intra-personal, interpersonal, organizational, community, and society (McCormack et al., 2017). The interactions of Hispanic adults with health care providers and services affect their risk or treatment of diabetes. The access to and utilization of preventive health care services for diabetes could impact the ability of Hispanic adults to adhere to appropriate diabetes care practices and behaviors, including maintaining healthy levels of HbA1c, access to diabetes education, frequent doctor visits, and frequent blood sugar checks. In the present study, the use of the SEM allowed for investigation of the determinants of health that contribute to access to and utilization of diabetes preventive health care in

older Hispanic adults. Furthermore, the model enabled the discovery of social and physical environment challenges that could affect such constructs, including cultural and policy factors.

Nature of the Study

This retrospective quantitative study included survey data from the 2015–2018 NHANES. The National Center for Health Statistics annually makes available to the public a continuous 2-year dataset of the NHANES (Chen et al., 2020). Although the datasets are publicly available, the National Center for Health Statistics protects and maintains the confidentiality of each participant. Therefore, there were several established steps to follow in downloading and accessing the data. Multiple datasets were downloaded through the NHANES website and combined for analytical purposes. The data were kept in a secure place at the home office and stored in an external hard drive designated only for this particular purpose using password protection. The data analysis included descriptive analyses, such as proportions, percentages of categorical variables, means, and standard deviations for a continuous outcome. The dependent variable was a categorical outcome for diabetes on three levels. The independent variables of interest were doctor visits (categorical), diabetes education (dichotomous), and number of blood sugar checks (dichotomous). The chi-square test of independence statistical analysis was used to examine associations between the dependent and independent variables (see Creswell, 2014). A binomial logistic regression analysis was used to determine the extent to which the participant's diabetes status could be predicted based on doctor visits, diabetes education, and blood sugar checks. In the binominal logistic regression model,

age, gender, income, and language spoken at home were used as controlling variables in the statistical analysis.

Operational Definitions

Access to diabetes education: Time at which Hispanic adults 65 years of age and older saw a nurse educator.

Acculturation: Cultural modification of an individual, group, or population by adapting to or borrowing traits from another culture (Concha, Kelly, & Mezuk, 2021). In this study, acculturation referred to the language usually used at home.

Diabetes: A complex metabolic disorder causing lack of insulin production, insulin use, or both, with HbA1c levels above 6.4%. Diabetes outcome, within the study, also refers to levels of HbA1c higher than 6.4%.

Frequent blood sugar checks: Hispanic adults 65 years of age and older having blood tests for high blood sugar or diabetes within the past 3 years.

Frequent doctor visits: Number of times Hispanic adults 65 years of age and older saw a doctor or other health professional in the past 12 months.

HbA1c: A blood test used to determine the average blood sugar levels during the previous 2 to 3 months (Ferguson et al., 2015).

Hispanic: A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (U.S. Census Bureau, 2000).

Level of HbA1c: The HbA1c test in which the range of values is between 2 and 18.5.

Prediabetes: A condition diagnosed in people who might exhibit diabetes symptoms but have only slightly elevated blood sugar levels.

Type 1 diabetes: A condition characterized by insulin deficiency, which is the body's inability to produce insulin hormone as a result of loss of pancreatic β cells (Katsarou et al., 2017).

Type 2 diabetes: A condition characterized by insulin deficiency in which metabolic mechanisms do not utilize insulin properly (American Diabetes Association, 2016).

Assumptions

I assume that the data used in this study were a fair representation of the U.S. Hispanic population. This assumption was based on the CDC approaches to applying a multistage sampling methodology to select participants for the NHANES. Another assumption was that participants provided accurate information based on their understanding of the survey questions and their recollection of the information when the survey was administered. In addition, because I lacked access to the original survey and the CDC follows a rigorous protocol in collecting and entering data, I assumed that the data entry and coding of the participants' responses were accurate. Finally, because the CDC conducts rigorous testing of the protocols to validate surveys, I assumed that the survey instruments had strong reliability and validity coefficients.

Scope and Delimitations

This study had several delimitations. First, the study was conducted using preexisting or secondary data collected between 2015 and 2018 through the NHANES.

The annual NHANES uses random sampling to select participants in which more than 19,000 people were randomly selected to participate between 2015 and 2018 (Chen et al., 2020). Among them, about 5,000 Hispanics were included in the sample, representing approximately 28% of the sample size. After the data were weighted, the study sample was representative of Hispanic adults living in the United States. More specifically, the sample included participants over the age of 65 years who self-identified as being of Hispanic ethnicity as defined by the U.S. Census (Humes et al., 2011). I excluded participants who were between 18 and 65 years of age at the time of the data collection. Non-Hispanic participants of other races were also excluded from the study.

Limitations

One of the limitations of secondary data analysis is that the researcher has no control over the research design or research methodology (Creswell, 2014). In addition, secondary data analyses can lead to internal and external validity challenges, which can jeopardize the ability to extrapolate important findings (Creswell, 2014). However, because of the sample selection strategies used in NHANES, internal and external validity were not a concern. I did not include an analysis of datasets other than the 2015–2018 NHANES. To mitigate this sampling issue, researchers can use national representative datasets that were compiled using complex sampling methodologies. This study has several limitations that are inherent in analyzing large datasets. The study was conducted using retrospective cross-sectional data, which limited the ability to establish causation. Psychosocial constructs, such as the ability to recall and retrieve past experiences, impose bias on self-report surveys, and under- or overestimations might

have been reported. In addition, the use of subjective metrics (e.g., self-reports) in many cases impedes researchers in establishing true estimates of the variables (Johnston et al., 2017).

Significance

To my knowledge, this study was the first to address the association between Type 2 diabetes status and access to health care among Hispanic adults over 65 years of age. I identified effective approaches that support the improvement of diabetes-related outcomes through access to preventive health care in Hispanics age 65 and older. The findings of this study may be used to prioritize mechanisms that inhibit or promote the access to and utilization of preventive health care services to decrease the prevalence and onset of diabetes in this population. Furthermore, this research contributed to the scientific knowledge by filling the gap in the understanding of explicit contributors that promote or hinder improvements in HbA1c levels. The findings of the study also confirmed and/or revealed elements that are relevant in implementing effective, culturally appropriate public health programs for at-risk populations. The absence of effective public health programs that promote the utilization of preventive health care services to improve diabetes-related outcomes is a significant obstacle to developing the healthy lifestyles of older Hispanic adults. The findings of this study may help in the development and implementation of effective and culturally responsive programs and policies. Finally, the findings of this research may be used to reverse the steady increase in diabetes among vulnerable and disadvantaged populations.

Summary

The purpose of this quantitative cross-sectional retrospective study was to examine the association between diabetes status and access to preventive health care services among Hispanic older adults age 65 years and older. This study included descriptive and complex analyses of 2015–2018 NHANES datasets. The literature review presented in Chapter 2, I discuss previous evidence of access to diabetes preventive health care services among Hispanic older adults.

Chapter 2: Literature Review

In the United States, the high cost of health care affects historically disadvantaged and vulnerable populations. It therefore has become imperative to address access to and opportunities for achieving health equity. In 2017, the total health care expenditure of diabetes among adults age 65 years and older reached almost $150 million, which was primarily spent on prescription medication (American Diabetes Association, 2018). With over 3.5 million Hispanic adults with diabetes, the total health care expenditure is about $29 million (American Diabetes Association, 2018). Recently, the CDC (2019, as cited in Y. J. Cheng et al., 2019) reported that the prevalence of diagnosed and undiagnosed Hispanics with diabetes ranged from 12% (i.e., South Americans) to 25% (i.e., Mexicans). Despite nationwide efforts to prevent and control Type 2 diabetes, Hispanics face challenges in accessing preventive health care services that contribute to a better quality of life, thereby decreasing the risks of diabetes complications (Coffman, et al., 2012). Preventive health care services are promising approaches to improving Type 2 diabetes outcomes in Hispanic adults. However, little is known about how the diverse mechanisms related to preventive health care services can impact diabetes outcomes in Hispanic adults age 65 years and older. Therefore, I examined the degree to which access to preventive health care services improved diabetes-related outcomes among Hispanic adults age 65 years and older. This study may assist in identifying multilevel approaches to enhance diabetes outcomes and may provide a better understanding of how mechanisms associated with access to preventive health care could improve diabetes outcomes in Hispanics aged 65 and older.

Today, almost 328 million Hispanics live in the United States, representing 18.3% of the total U.S. population (U.S. Census, 2018). Hispanics are defined as persons of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (U.S. Census, 2018). The terms Hispanic and Latino are commonly interchanged in the scientific literature. Predominantly, Hispanics are of Mexican origin, but the migration dynamics of other Hispanics have produced major changes to the demographic distribution within the Hispanic population (Flores, 2017). Hispanics age 65 and older benefit from lower mortality rates compared with other racial groups, but their socioeconomic status is a contributing factor in their health insurance coverage and health outcomes (Lariscy et al., 2015). Through the Affordable Care Act, the prevalence of those with insurance increased among Hispanics (Buchmueller et al., 2016; Cohen et al., 2016; McMorrow et al., 2015).

Diabetes has become one of the most significant health concerns in the United States. The prevalence of diabetes has been increasing in recent decades, and it has significantly contributed to the mortality rate (Purnell et al., 2016). Furthermore, diabetes imposes a high risk of other long-term health conditions, including cardiovascular disease, hypertension, and amputation (Ortega et al., 2015). Although genetic and behavioral factors play an essential role in the prevalence of Type 2 diabetes, social determinants of health cannot be ignored because of their impact on Type 2 diabetes. Social determinants of health are major factors that affect the ability of Hispanics to effectively address the risks of diabetes (Babamoto et al., 2009; Ortega et al., 2015; Purnell et al., 2016).

Chapter 2 includes a review of the relevant research, including discussions and analyses of findings. Major sections include the following: (a) doctor visits, (b) diabetes education, (c) number of blood sugar checks, and (d) Hispanic population. Chapter 2 also includes a discussion of the theoretical foundation that served as a framework for this study. The chapter concludes with an analysis of the gap in the literature that was addressed by this study, as well as a summary of the key findings.

Literature Search Strategy

This section provides an overview of the literature search strategy used to gain an understanding of current findings and identification of scientific gaps. To better understand the current literature and to frame this study, a systematic search of several electronic databases was conducted using EBSCO, PubMed, and Google Scholar. To the greatest extent possible, the literature review comprised studies published within the past 5 years (2014–2019). In the presence of the lack of evidence from that period, the literature search was expanded to 10 years (2009–2019). The search for articles was based on terminology used to examine the literature on Hispanics' health. The terms *doctor visits* and *diabetes*, *diabetes education*, *number of blood checks* and *diabetes*, *Hispanic* or *Latino*, and *HbA1c* were used to identify relevant studies conducted to understand the current literature on diabetes among Hispanic populations in the United States. The literature review relied on primary sources of studies on diabetes in Hispanic adults in the United States. The selected studies included prospective and retrospective quantitative, qualitative, or mixed-methods methodologies and diverse research designs. The literature search included scientific studies published in both English and Spanish. I

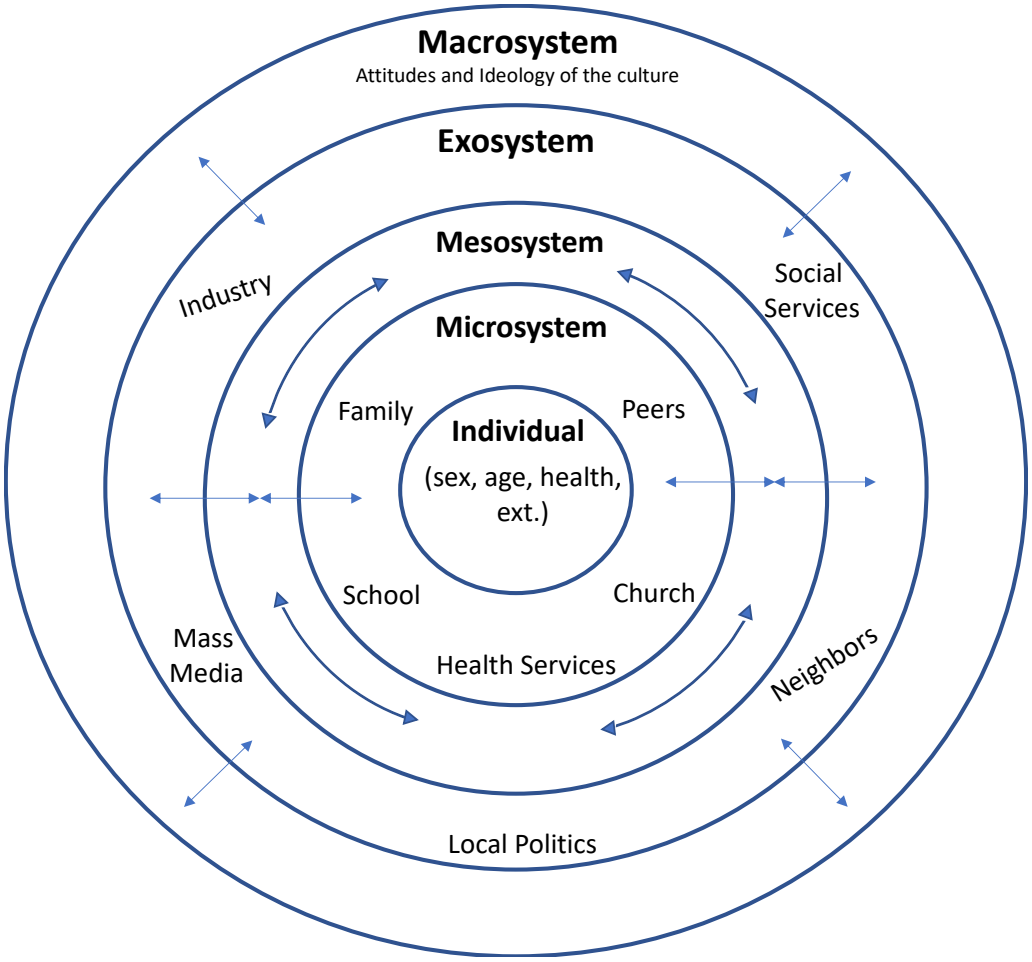
did not include commentaries, reports, conference posters/presentations, or studies conducted outside of the United States, and studies that focused on other health outcomes were also excluded from the literature search.

Theoretical Foundation

Through the SEM, Bronfenbrenner (1977) described a bidirectional process in which various levels of influence could affect people's behaviors. Specifically, the SEM emphasizes the intersectionality between environmental factors and human development. Bronfenbrenner (1986) argued that interactions with and perceptions of the environment have direct and indirect consequences for people's behaviors. For instance, the ways in which patients interact with their peers, family, and doctors, as well as their perceptions of health care service programs and policies, could hinder or promote preventive health behaviors. The SEM is a unique framework that embraces the connectivity and reciprocal influence of multiple subsystems (Bronfenbrenner, 1980; Glanz et al., 1990). According to Bronfenbrenner (1977), the (a) microsystem, (b) mesosystem, (c) exosystem, and (d) macrosystem play substantial roles in the conceptualization of the SEM (see Figure 1). The SEM can be understood according to three subsections: the individual and their behavior, the physical environment, and the social environment (Hancock, et al., 2015; McCormack et al., 2017). Moreover, dimensions can then be analyzed on five levels: intra-personal, interpersonal, organizational, community, and society (McCormack et al., 2017; McLeroy et al., 1988). The SEM also provides a better understanding of the impact of organizations (i.e., workplaces and schools), interactions between persons (i.e., family, friends, and peers), and public policies.

Figure 1

Social Ecology Model (SEM) Subsystems



Delays in diagnosis and treatment, lack of access to health insurance, and Hispanic adults' interactions with health care providers and services affect their risk for or treatment of diabetes (Babamoto et al., 2009). The access to and utilization of preventive health care services for diabetes could impact the ability of Hispanic adults to adhere to appropriate diabetes care practices and behaviors, including their ability to maintain healthy levels of HbA1c, access to diabetes education, frequent doctor visits,

and frequent blood sugar checks. Furthermore, the associations between diabetes education by clinical nurses might affect Hispanic adults understanding of and readiness to take specific steps toward improving diabetes outcomes. In the current study, the use of the SEM allowed me to investigate determinants of health that contribute to access to and utilization of diabetes preventive health care in older Hispanic adults. Furthermore, the use of this model contributed to revealing the social and physical environment challenges that affect such variables. Possible cultural and policy factors could be identified as potential variables.

The SEM has been used to establish the influence of multilevel factors that influence people's health status. Usman and Pamungkas (2018) used the SEM to provide a better understanding of multilevel mechanisms that affect diabetes management in patients with Type 2 diabetes. At the individual level, Usman and Pamungkas found that the lack of knowledge, influenced by language barriers, affected a patient's ability to be fully informed about Type 2 diabetes. The lack of knowledge might include misunderstandings about insulin risks, blood glucose, and blood pressure, as well as misconceptions about the impact of the type of food on blood glucose levels. Soto et al. (2015) conducted a cross-sectional study to determine how the application of different levels of the SEM enable diabetes self-management behaviors and HbA1c in Hispanic adults with Type 2 diabetes living in rural communities. Their randomized controlled trial included a sample of 336 Hispanic adults in California. A major finding of the study was that Hispanics with higher levels of self-support were more likely to engage in healthier behaviors that resulted in lower HbA1c. Soto et al. also found that, with greater

family/peer support, Hispanic adults improved dietary behaviors and physical activity levels. However, the study also showed increased fat intake associated with health care support.

The SEM has been used to identify the potential influence of culture on people's behaviors and health outcomes. As a macrosystem factor, acculturation is a scientific measure used to determine the degree to which people adopt norms and cultural elements from a different culture (O'Brien et al., 2014). In a qualitative study, Plasencia et al. (2017) examined the degree to which acculturation and cultural identity might affect Type 2 diabetes self-management. Plasencia et al. found that Hispanics with Type 2 diabetes participating in the study did not have a clear understanding of the role and impact of cultural food on Type 2 diabetes self-management. However, Hispanics with Type 2 diabetes and higher levels of acculturation reported an increased consumption of pork and French fries, while lower levels of acculturation were associated with a higher intake of fiber.

In the current study, the microsystem was reflected in the diabetes outcomes and behaviors of Hispanic adults aged 65 years or older. Several tests were used to examine the association between independent variables and HbA1c levels. Bronfenbrenner (1986) argued that people's ability to engage in behaviors that impact their health status is conditioned by their interactions with the mesosystem. In the present study, health education provided by nurses represented an element of the mesosystem.

Doctor Visits and Diabetes

Studies on the impact of doctor visits appeared to be limited in the diabetes scientific literature. Ashman and Taylor (2014) reported that office-based physicians were visited by 113.3 million patients with diabetes, which represented a 20% increase in doctor visits since 2005. Ashman and Taylor also found that about 11% of total doctor visits in 2010 were by patients with diabetes. The findings showed a significant increase in doctor visits by adults age 65 and older. Evidence on the effects of doctor visits on diabetes showed that diabetes outcomes can improve based on the frequency of doctor visits. Asao et al. (2014) examined the effects of doctor visits on diabetes outcomes in adults. Using a retrospective observational study approach, Asao et al. included 6,040 participants with Type 2 diabetes who had had at least one doctor visit in the last 18 months. Asao et al. found that on average, participants had four doctor visits per year, but Hispanic adults were less likely to visit doctors compared with other racial and ethnic groups. An interesting finding was that level of education, socioeconomic status, and body composition were significantly associated with the number of doctor visits. For example, those who had a high school education or less or those with an annual household income of less than $10,000 had more doctor visits in an 18-month period. Asao et al. also observed that improvements in diabetes outcomes (HbA1c) could be obtained by increasing the number of doctor visits. Nevertheless, Asao et al. found no significant benefits for diabetes outcomes among those who had more than six doctor visits.

In a prospective study, Al Nozha (2014) examined the impact of the frequency of doctor visits on diabetes care. This study included 100 patients with diabetes mellitus who visited a diabetes care center. Al Nozha also collected diabetes outcome measures, such as glycosylated hemoglobin (HbA1c), blood pressure, and plasma low-density lipoprotein cholesterol. The results of this study indicated that frequent doctor visits could lead to improvement in diabetes outcomes. Specifically, greater improvements in diabetes outcomes were observed among patients who had more than six visits during a 21-month period. Patients with a visit gap of less than 1 month showed significant improvements in diabetes outcomes compared with those who had a visit gap of more than 1 month. However, this study was limited by the small sample size and a lack of representation in the sample of the U.S. population. Despite this promising evidence, the use of the survey methodology and a cross-sectional research design might have limited the ability to determine the effects of doctor visits over time. It is evident that a gap still exists regarding the impact of doctor visits on diabetes outcomes, especially among Hispanic adults.

Diabetes Education and Diabetes

The lack of diabetes self-management and associated complications might increase the risk of mortality in the Hispanic population (Walker et al., 2016). Many researchers investigated how diabetes education could improve patients' diabetes outcomes. Recently, Surucu et al. (2017) conducted a randomized controlled trial study to determine whether a diabetes education program delivered by nurses affected HbA1c levels in adult patients. Seventy participants were exposed to a 6-month diabetes

education program that included individualized and group training. The findings showed that participants in the intervention group had significantly lower levels of HbA1c at the end of the program compared with those in the control group. The evidence demonstrated that clinical education interventions are a potential mechanism for engaging patients with diabetes in self-management behavior that results in better diabetes outcomes. However, the limitations of this study included participant selection bias, dropout rates, absence of follow-ups, and exclusion of a diverse adult population, which limited the ability to extrapolate the results to Hispanic adults, especially those age 65 and older.

Among Hispanics, cultural beliefs and practices might play an important role in controlling diabetes outcomes in Hispanic communities (Cunningham et al., 2018). Because of the increased prevalence of Type 2 diabetes in Hispanic adults, diabetes self-management education has become an effective approach to improving their quality of life and diabetes outcomes. Nonetheless, the lack of cultural competency discourages Hispanics from joining and benefiting from health education programs (Aponte et al., 2015). In many instances, diabetes self-management programs produce unintended gaps between interventions and cultural competency, preventing programs from achieving anticipated outcomes (Page-Reeves et al., 2017). Page-Reeves et al. (2017) recognized that patient success at diabetes self-management programs that are culturally and contextually situated are more likely to engage Hispanic adults in health behaviors that lead to lower HbA1c. Rotberg et al. (2016) examined the impact of a culturally competent diabetes self-management intervention on HbA1c in a cohort of Hispanic adults residing in the state of Georgia. Using a quasi-experimental study, Spanish-

speaking participants were exposed to several culturally competent lessons that focused on personal, behavioral, and environmental factors. At the end of the program, the researchers found that the participants enrolled in the intervention experienced significantly lower HbA1c levels compared with the baseline. Although the findings of this study highlighted the potential impact of culturally competent diabetes self-management programs, additional studies using true experimental designs are necessary to determine the magnitude of such interventions in Hispanic adults. Furthermore, this study was based on a convenience sample in a particular state, which limited the ability to generalize the results to a nationally representative sample of Hispanic adults across the US.

Baig et al. (2015) implemented a church-based diabetes self-management education program grounded in self-determination theory. Employing community-based participatory research, the authors hypothesized that a church-based diabetes self-management program could have positive implications for diabetes outcomes in Hispanic adults. After the eight-week intervention, the results of the study showed that changes in HbA1c levels among Hispanic adults enrolled in the church-based diabetes self-management program were not significantly better than those enrolled in the control group. Despite some beliefs regarding cultural competency, this study revealed that church-based interventions in Hispanics might not have the same impact on health outcomes compared with other racial and ethnic groups.

Within the Hispanic community, diabetes self-management education has been offered mainly through the Promotores de Salud program. In a systematic review, Little

et al. (2014) examined whether diabetes outcomes could improve in Hispanic adults through diabetes self-management education programs led by community health workers known as *promotores de salud*. The authors evaluated a total of 12 randomized controlled trials, among which seven showed significant improvements in HbA1c. However, it remains unclear whether advancement in HbA1c could be maintained post-intervention. In fact, some studies showed no significant differences in HbA1c levels between Hispanic adults enrolled in the intervention compared with those in the control group at 12 to 24 months post-intervention. These findings imply that Hispanic adults should continue self-management education programs to maintain acceptable levels of HbA1c. One of the major challenges in this study was that it did not include different Hispanic populations.

Blood Sugar Check and Diabetes

A study conducted by Chandler and Monnat (2015) aimed at understanding racial and ethnic differences in the utilization of diabetes health care services, such as number of doctor visits, number of visits for blood sugar checks, and number of visits to check their feet. The authors used data from the 2008–2012 Behavioral Risk Factor Surveillance System (BRFSS), which included a diverse US representation of older adults with diabetes. This study showed that, compared with Whites, Blacks, and Hispanics had more doctor visits and blood sugar checks. In addition, Blacks and Native Americans had more doctor visits for foot evaluation. Furthermore, the study findings showed that Blacks, Hispanics, and American Indians/Alaska Natives were more likely to experience financial hardship due to medical expenses and less likely to have insurance

coverage and a health care provider. The underrepresentation of the Hispanic population was a major limitation of the study. Despite the use of national representative data, it excluded the states of California and New York, both of which have large populations of Hispanics. Additionally, since the BRFSS data were based on self-reports, recollection as well as underestimation or overestimation were potential internal validity threats in this study.

Salinas, de Heer et al. (2015) evaluated the influence of income, insurance, and acculturation on the use of diabetes preventive health care services, including blood sugar checks. The authors accessed data from 2009–2010 in the Household Survey to Explore Health Disparities Domains in the US–Mexico Border. The findings indicated that the socioeconomic status of Hispanics might influence the number of blood sugar checks. In other words, Hispanics with lower socioeconomic status were less likely to have blood sugar checks more frequently than those with higher socioeconomic status. However, acculturation was not significantly associated with blood sugar checks. The sample representation was a limitation of the study because the survey participants resided in the US–Mexico border region. The sample also had a higher representation of women than men, which may have affected the findings on how acculturation influenced the use of preventive health care services. Because of the use of descriptive cross-sectional and retrospective methodologies, gaps still exist in our understanding of the effects of factors such as income, insurance, and acculturation on blood sugar checks.

Age and Diabetes

Several sociodemographic factors, such as sex, age, race/ethnicity, family income, education level, and body mass index, have been associated with Type 2 diabetes. Recently, Bullard et al. (2018) conducted a study to determine the prevalence of diagnosed diabetes in adults based on the 2016 National Health Interview Survey dataset. They found that the rates of Type 2 diabetes increased with age but tended to decrease with education. In fact, the highest prevalence of Type 2 diabetes was among adults over 65 years of age. Among Hispanics, the findings showed the highest prevalence of Type 2 diabetes in the US. These findings are consistent with Xu et al. (2018), who found that diabetes was the highest among US adults over 65 years of age, men, and Hispanic adults.

Sun and Smith (2017) examined the association between self-perceptions of aging (SPA) and delays in the utilization of health care services. Using two independent samples from the Health and Retirement Study (HRS), they examined reasons for the delay in health care, such as the lack of access and psychosocial concerns related to self-perceptions of aging. The findings showed that older adults with negative self-perceptions of aging tended to have limited access to providers, be in poor health, and be socioeconomically challenged. In addition, other factors, such as prolonged wait times or busy schedules, also impacted access to health care services. The study results demonstrated that negative aging stereotypes significantly impacted older adults' intentions of seeking medical care. The authors concluded that negative aging was correlated with preventive health care delay. Older adults with adverse perceptions of

aging delayed preventive health care and were more likely to perceive barriers to care. Understanding self-perceptions of aging and health care utilization patterns is key in the development of educational programs that address negative stereotypes of aging. However, this study did not include other racial/ethnic groups, and it did not consider how self-perceptions of aging could impact their access to preventive health care services.

Income and Diabetes

Clark and Utz (2014) conducted a systematic review to examine socio-ecological factors that contribute to increased odds of developing Type 2 diabetes. The findings of this study suggest that socioeconomic status and education level might hinder or promote the development of Type 2 diabetes. The researchers found that patients with Type 2 diabetes who faced financial difficulties had many challenges in accessing or adhering to diabetes medications. The findings of this systematic review were consistent with the studies discussed previously in this chapter. An individual's education level can influence socioeconomic status. Bullard et al. (2018) demonstrated that the education level of adults in the US might affect the prevalence of Type 2 diabetes. For example, compared with those with at least high school degrees, the prevalence of Type 2 diabetes was lower than those with less than high school education. Members of Puerto Rican population with less than a high school level of education tended to have a higher prevalence of diabetes compared with other Hispanic groups. However, in all Hispanic subgroups, the prevalence of diabetes decreased as the level of education increased (Arroyo-Johnson et al., 2016).

Hispanic Adults and Diabetes

Compared with other racial and ethnic groups, Hispanic adults have shown one of the highest prevalences of Type 2 diabetes (Xu et al., 2018). According to Arroyo-Johnson et al. (2016), who explored racial and ethnic heterogeneity in self-reported diabetes prevalence trends across Hispanic subgroups, Puerto Ricans have a higher prevalence of diabetes compared with other Hispanics in the US (Arroyo-Johnson et al., 2016). Clark and Utz (2014) also found that patients of Hispanic origins with Type 2 diabetes might perceive high levels of stress.

An important aspect of the Hispanic population concerns the heterogeneous characteristics of this ethnic group. The immigration status of Hispanics has become a significant variable of study in public health research, especially in examining the Hispanic paradox. Bustamante et al. (2012) examined the differences in health care access and utilization among documented and undocumented Mexican immigrants. The aim of the study was to address whether the immigration status of Mexicans was associated with the access to and utilization of health care services as in relation to diabetes outcomes. The findings of this study revealed a negative association between immigration status and the access to and utilization of health care services. Mexican immigrants with undocumented status were less likely to have access to or to utilize health care services. Sociodemographic factors, such as sex, marital status, education level, and socioeconomic status, also influenced the access to and utilization of health care by undocumented Mexican immigrants. Importantly, language proficiency was found to affect the access and utilization of health care services. It is vital to understand

the various disparities that impact the access to and utilization of health care services in diverse Hispanic populations to ensure that public health diabetes interventions are culturally relevant for Hispanics.

Scientific evidence has shown that the social determinants of the health of racial/ethnic groups can increase the risk of diabetes. Walker et al. (2016) conducted a systematic review to increase the scientific knowledge about the mechanisms that link race/ethnicity and the social determinants of diabetes. A better understanding of these mechanisms should lead to culturally appropriate interventions and practices that prevent and control diabetes outcomes in Hispanic populations. The findings of this systematic review showed that Hispanics were more likely to have higher levels of HbA1c compared with non-Hispanic Whites. Whites had about 0.5% lower HbA1c levels compared with Hispanics. In addition to the social determinants of health, Walker et al. (2016) also found that financial distress, community disadvantage, low health literacy, depression symptoms, and social isolation might impact HbA1c levels. While this systematic review highlighted that people with diabetes were more likely to experience other health conditions, and it provided a better understanding of the association between social determinants of health and diabetes among Hispanics, it did not provide evidence of the extent to which access to health care and utilization could improve HbA1c levels in Hispanic older adults.

Liang, Zhu et al. (2017) explored the association between patient-centered care (PCC) and the use of preventive care services based on a nationally representative sample. Using data from the 2009–2013 Medical Expenditure Panel Survey, they found

that participants with PCC received a higher number of preventive care services compared with groups with partial PCC and no PCC. Similarly, respondents with higher socioeconomic status were more likely to receive comprehensive care. Primary health care providers did not follow the patient-centered care model in practice. For older adults with chronic conditions, this type of care model has proven to be effective in engaging patients and increasing the utilization of preventive care services. Unfortunately, this study did not evaluate PCC in older adults from different racial/ethnic backgrounds. Assessing the data on different racial/ethnic groups could shed light on the effectiveness of the PCC model in a particular racial/ethnic group, especially among Hispanic populations.

Summary

The findings of previous studies in the literature are relevant because they have provided a better understanding of diabetes in Hispanic adults; however, there is limited evidence about factors that could contribute to the prevention and improvement of diabetes in different Hispanic populations. For example, the review performed in the present study showed that research on access to preventive health care for services such as blood sugar checks in the Hispanic population remains a gap in the scientific literature. The majority of the reviewed studies examined diabetes self-management at home but not preventive care by providers. In addition, there is a lack of recent studies that focused on preventive health care services such as blood sugar checks, and the Hispanic population has been under-represented. Furthermore, socioeconomic status was revealed as another factor that could influence the risk of diabetes, which needs further investigation. Finally,

to date, there remains a need to better understand how diabetes-related preventive health care services are associated with Hispanic subgroups. Furthermore, the prevalence of Type 2 diabetes among different Hispanic populations has not been highlighted in the scientific literature. Therefore, examining data on subgroups is vital in providing tailored and direct preventive programs. Education level is another factor that could be utilized to develop targeted messaging about diabetes preventive care. In general, the prevention and treatment of Type 2 diabetes in Hispanics should emphasize social determinants of health beyond individual factors. More importantly, cultural factors are imperative, and they must be embraced and embedded in diabetes prevention programs.

Chapter 3: Research Method

Chapter 3 includes a description of the research methodology, data sources, respondents, independent and dependent variables, surveillance system, and data analysis procedures used in this study. Over the past several decades, the prevalence of diabetes among the Hispanic population, especially those 65 years of age and older, has become a major concern in the public health field (Ortega et al., 2015). Therefore, I explored access to preventive health care services and diabetes-related outcomes among Hispanic adults age 65 years and older. Specifically, I examined the association between HbA1c levels and several independent variables, including doctor visits, diabetes education, and blood sugar checks. Furthermore, because the literature review demonstrated the influence of several factors on Hispanic health, I analyzed the association between these variables in the presence of confounding factors, such as age, gender, and language spoken at home. Lastly, evidence-based strategies and recommendations were articulated to help Hispanic adults 65 years of age and older improve their diabetes outcomes.

Research Design and Rationale

This retrospective quantitative study included secondary data drawn from preexisting datasets in the 2015–2018 NHANES. A nonexperimental approach was applied to examine the associations between the variables. Secondary data analyses were conducted on several measures, including diabetes outcomes (dependent variable) and doctor visits, diabetes education, and blood sugar checks (independent variables). Secondary data analysis refers to the reanalysis of existing data that have been collected for other research purposes (Johnston, 2017). Data are gathered from other sources, and

analyses are conducted for purposes other than the original study. Secondary data analysis is used to respond to research questions and to address additional questions that were not part of the primary purpose of the data collection (Nicholl & Beyea, 1999). Conducting a secondary analysis of existing data has several strengths and limitations. One advantage is the low cost of performing an analysis of existing data compared with performing a primary study (Johnston, 2017). Researchers do not have to allocate financial and human resources during the collection of data, which allows them to examine innovative research ideas (H. G. Cheng & Phillips, 2014). Additionally, data collection and data cleaning procedures are widely available for researchers (Johnston, 2017). In most cases, large existing datasets include a national representative sample, and they are weighted based on the population of interest (H. G. Cheng & Phillips, 2014). One of the disadvantages of secondary data analysis is that the data were collected to address other research questions (H. G. Cheng & Phillips, 2014). Therefore, particular populations or geographical areas might not have been included in the data collection (Johnston, 2017).

Research Questions

The four research questions and corresponding hypotheses were the following:

RQ1: What is the association between frequent doctor visits and Type 2 diabetes outcome in Hispanic adults?

H_o1: There is no statistically significant association between frequent doctor visits and HbA1c level in Hispanic adults.

H_a1: There is a statistically significant association between frequent doctor visits and HbA1c levels in Hispanic adults.

RQ2: What is the association between diabetes education and Type 2 diabetes outcomes in Hispanic adults?

H_o2: There is no statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

H_a2: There is a statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

RQ3: What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?

H_o3: There is no statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

H_a3: There is a statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

RQ4: What is the association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home?

H_o4: There is no statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home.

H_a4: There is a statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors such as age, gender, income, and language spoken at home.

Table 1

Alignment of Research Questions With Data Variables and Analysis

Research question	Data variable	Data analysis
What is the association between frequent doctor visits and Type 2 diabetes outcome in Hispanic adults?	IV: Frequent doctor visits (dichotomous) DV: HbA1c (categorical)	Chi-square test of independence
What is the association between diabetes education, and Type 2 diabetes outcomes in Hispanic adults?	IV: Diabetes education (dichotomous) DV: HbA1c (categorical)	Chi-square test of independence
What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?	IV: Blood sugar checks (dichotomous) DV: HbA1c (categorical)	Chi-square test of independence
What is the association between frequent doctor visits, diabetes education, the number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults in controlling for confounding factors such as age, gender, income, and language spoken at home?	IV: Frequent doctor visits, diabetes education, blood sugar checks DV: HbA1c (categorical)	Multinomial logistic regression

Methodology

Population

In this study, the population of interest comprised Hispanic adults age 65 years and older. In the NHANES questionnaires, participants are asked whether they consider themselves of Hispanic, Latino, or Spanish origin. Then they are asked to select one or more categories from a list of 27 categories that represent Hispanic, Latino, or Spanish origin or ancestry and to list their country of origin.

According to the U.S. Office of Management and Budget (OMB, 2020), Hispanic/Latino is considered an ethnic category that includes a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race. Hispanic is a social construct that includes people whose origins are in regions in which Spanish is the primary language (Gratton & Gutmann, 2000). Although the Hispanic population is considered a homogeneous group, it is composed of diverse populations with racial and cultural similarities and differences (Gratton & Gutmann, 2000). Since 2010, the U.S. Census population survey has allowed Hispanics to self-identify their place of origin. By 2060, the Hispanic population will be one of the largest ethnic groups in the United States (U.S. Census, 2018).

More than 60 million Hispanics represent 18.5% of the U.S. population (Flores, 2017). Mexican Americans represent most of the Hispanic population, at about 37 million (60%). Puerto Ricans are the second largest group, comprising about 9% of the total Hispanic population. In addition, Cubans and Dominicans combined were found to

represent 6% of the population (Flores, 2017). Hispanic older adult males numbered 1,900,000, and female older adults numbered 2,492,000 (Flores, 2017).

Sampling and Sampling Procedures

For the purpose of the NHANES, participants are randomly selected across the United States based on a multistage sampling protocol (Chen et al., 2020). First, counties in the United States are divided into 15 groups based on their characteristics. Counties are selected from each large group, which comprise the 15 counties in the annual NHANES surveys (Chen et al., 2020). Segment sampling is then performed to create smaller groups with many households. A sample of about 30 households is selected within each group from all the houses or apartments within which the selected small groups are identified. Lastly, interviews are conducted in each selected household. Participation in the NHANES is voluntary and confidential, and data are combined to protect the confidentiality of all participants. Estimates in the NHANES from 2015–2016 showed response rates of 61% and 59% for the interviewed and examined samples, respectively (CDC, 2017).

Power Analysis to Determine Sample Size

In the 2015–2016 period, the American Community Survey estimated that there were about 55,750,392 noninstitutionalized Hispanics across the U.S. Data from the 2015–2018 NHANES included a total of 10,082 participants of Hispanic origin. The minimum sample size for the current study was determined based on confidence level, margin of error, and population proportion (see Kadam & Bhalerao, 2010). The confidence interval was set at 95%, which indicated the probability that the true value fell

within a set of specific range of values. The margin of error was determined at 5% to express the sampling error in the survey (see Kadam & Bhalerao, 2010). The population proportion was 13% because it represented the percentage of Hispanics with diabetes (see Kadam & Bhalerao, 2010). Using this information, I determined that the sample size in this study should be at least 385 participants to reach the desired statistical significance.

Instrumentation and Operationalization of Constructs

Published Instrument Provider

The NHANES is a program designed to assess the health and nutritional status of adults and children in the United States. The survey combines interviews and physical examinations, which makes it unique. NHANES was authorized by the National Health Survey Act in 1956, and it has been in existence since 1960 (Chen et al., 2020). The NHANES data collection began in early 1999 and remains a continuous annual survey. Approximately 7,000 individuals are randomly selected to participate in the NHANES survey each year. The NHANES is composed of home interviews and health examinations. The home interview gathers information about health disease history and diet. The health examination component includes health measurements such as height, weight, and glucose, which are performed at a mobile examination center. The CDC produces annual reports that present estimates about the health and nutritional status of adults and children in the United States. NHANES data are publicly available, and they can be accessed using questionnaires, datasets, and related documentation pertaining to each survey cycle. For the current study, Institutional Review Board (IRB) approval was obtained after my committee approved the study's proposal. The CDC established that

the survey data are publicly available on the internet for data users and researchers. Previous researchers examined the validity and reliability of the NHANES survey, showing that it provides moderate to strong reliability (r = 0.47–2.71) and validity (r = 0.57–0.94) (Rawal et al., 2015).

Operational Definitions

This section includes descriptions of the dependent and independent variables used in the present study.

Dependent Variable

There are racial and ethnic disparities regarding HbA1c, and researchers have raised some concerns about its status in Hispanic adults. For example, the disparities between Hispanic and non-Hispanic Whites could lead to a 0.5% difference in HbA1c levels (Walker et al., 2016). Sherwani et al. (2016) identified that HbA1c has become a crucial test to determine long-term glycemic control. HbA1c allows physicians to explore the glycemic history within the past 2 to 3 months. First, to determine HbA1c levels, NHANES asks the respondents, “What was your last A one C level?” In the present study, the HbA1c variable was changed from the questionnaires to laboratory results collected for each individual who participated in the 2015–2016 and 2017–2018 NHANES data collections to provide additional findings on participants’ health and nutritional information. This modification eliminated the issue of missing data on the HbA1c variable in the survey component of the NHANES. HbA1c is considered a continuous variable in which the score ranges from 2% to 18.5% based on blood sugar levels over time (American Diabetes Association, 2016). These percentages are also used

to classify people on the spectrum of normal blood sugar levels compared with those with elevated blood sugars. Based on the literature, HbA1c scores were classified as follows: no diabetes, diabetes, and do not know (e.g., missing data). No diabetes referred to HbA1c levels ranging from 2% to 6.4% (see Table 2). The diabetes category was defined by HbA1c levels above 6.4%.

Table 2

Description of Type 2 Diabetes Status Based on HbA1c Levels

Diabetes classification	Blood sugar level	Code
Do not know	Category not included	
Diabetes	> 6.4%	0
No diabetes	2%–6.4%	1

Independent Variables

Doctor Visits

An increase in doctor visits has been shown to improve diabetes outcomes (Ashman & Taylor, 2014). Therefore, it is vital to understand how the frequency of doctor visits affects diabetes outcomes in older adults. The number of doctor visits was obtained from the 2015–2018 NHANES dataset through the question, "During the past 12 months, how many times (have you/has SP) seen a doctor or other health care professional about (your/his/her) health at a doctor's office, a clinic or some other place? Do not include times (you were/s/he was) hospitalized overnight, visits to hospital emergency rooms, home visits or telephone calls." As a continuous variable, the respondents provided the number of times they had seen a doctor or other health care professional.

First, I classified as "Never" participants who had not visited a doctor. Participants who visited a doctor within the last 12 months were classified as "Yes." Participants who refused to respond (e.g., missing data) to this question or did not know were included in the "None" category. The coding for doctor visits was recoded from "0" for "Refused or Do not know" to "1–2 visits," and "1" from "one or more" to "3 or more" visits. Doctor visits were distributed mainly around one to two visits and three or more visits (see Table 3).

Table 3

Description of Participants' Classification of Who Visited the Doctor

Doctor visits	Classification	Code
Refused and do not know	None	-
1–2 visits	Yes	0
3 or more visits	No	1

Diabetes Education

In addition, recent studies have shown that diabetes education can have a significant impact on diabetes outcomes (Surucu et al., 2017). Therefore, understanding how diabetes education influences older adult diabetes outcomes is essential. Diabetes education was assessed by using the question, "When was the last time (you/SP) saw a diabetes nurse educator or dietitian or nutritionist for (your/his/her) diabetes? Do not include doctors or other health professionals." Currently, responses in the NHANES are coded using the values shown in Table 4.

Table 4

Descriptions of Diabetes Education Values

Value or code	Value description
1	1 year ago or less
2	More than 1 year ago but no more than 2 years ago
3	More than 2 years ago but no more than 5 years ago
4	More than 5 years ago
5	Never
7	Refused
9	Do not know

For the purpose of this study, I classified as "Never" participants who had not received a diabetes education. Participants who received diabetes education within the last five years were classified as "Yes." In addition, participants that refused to respond (e.g., missing data) to this question or did not know was included in the "None" category.

Table 5

Description of Participants' Classification of Having Received Diabetes Education

Diabetes education	Classification	Code
Refused and do not know	None	0
Received education in the past five years	Yes	1
Never	No	2

Number of Blood Sugar Checks

Previous studies have shown that socioeconomic status could influence the number of blood sugar checks by Hispanics (Salinas et al., 2015). Therefore, it is important to understand the effects of checking blood sugar levels on diabetes outcomes

in Hispanic older adults. The number of blood sugar blood checks was measured by the question, “How often {do you check your/does SP check his/her} blood for glucose or sugar?” Currently, responses in the NHANES are coded using the values shown in Table 6.

Table 6

Description of NHANES Response Coding

Value or code	Value description
1 to 15	Range of values
0	Never
777	Refused
999	Do not know

For the purpose of this study, I classified as “Never” participants who had not checked their blood sugar levels. I classified as “Yes” participants who checked their blood sugar levels 1 to 15 times per day. In addition, participants that refused to respond (e.g., missing data) to this question or did not know was included in the “None” category.

Table 7

Description of Blood Sugar Test Classification

Blood sugar checks	Classification of blood sugar checks	Code
Refused or do not know	None	0
1–15 time per day	Yes	1
Never	No	2

Statistical Analysis

The data analysis included descriptive analysis, such as proportions, percentages for categorical variables, and confidence intervals. The datasets in the 2015–2016 and the 2017–2018 cycles were retrieved, and demographics, diabetes, and the lab mobile exam

unit questionnaires were merged independently using the Sequence Number in Statistical Package for Social Science (SPSS). Following the CDC NHANES guidelines on weighted variables (Chen et al., 2020), I used the Weight Medical Examination Center 2 Year variable included in the demographic dataset of each cycle to combine the weighted variables. Participants who did not meet the inclusion criteria were excluded from the analysis. The study population comprised Hispanics aged 65 years and older with Type 2 diabetes. The initial sample size was 2,878 without the exclusion criteria. After respondents that were 18–64 years of age and non-Hispanic were excluded, the remaining sample size was 566. Missing data and participants who answered "do not know" to the survey questions were also excluded from the analysis.

The dependent variable was recoded into a bivariate diabetes outcome: no diabetes and diabetes. No diabetes category referred to HbA1c levels ranging from 2–6.4% (Table 3.1). HbA1c scores above 6.4% were classified as diabetes.

The independent variables of interest were the number of doctor visits (continuous variable), diabetes education (dichotomous), and the number of blood sugar checks (dichotomous). The number of doctor visits was coded as a continuous variable (i.e., number of times they had seen a doctor or other health care professional). Diabetes education was classified as either "Never" (not received diabetes education) or "Yes" (received diabetes education). Two categories were used to code the number of blood sugar checks. Never (1) was coded for participants who had not checked their blood sugar levels. Participants who had checked their blood sugar levels 1 to 15 times per day were coded as yes (0). The covariates were age, gender, income, and language spoken at

home. The chi-square test of independence statistical analysis was used to examine statistically significant associations between the dependent and independent variables (Creswell, 2014). A chi-square test of dependence analysis was conducted to determine whether there was an association between HbA1c levels and the independent variables described previously. A binomial logistic regression analysis was used to determine the extent to which a participant's diabetes status could be predicted based on doctor visits, diabetes education, and blood sugar checks. In the multinomial logistic regression, age, gender, income, and language spoken at home were used as controlling variables in the statistical analysis. The dependent variable was HbA1c level. The independent variables were doctor visit, diabetes education, and number of blood sugar checks. The level of significance was set at $p < 0.05$. We conducted statistical analysis using SPSS 27.0. The data were weighted in accordance with the final weight developed for and provided with the NHANES guidelines.

Threats to Validity

This study was conducted to minimize internal validity threats. The CDC addresses selection bias by conducting a multistage random selection of participants Chen et al., 2020). Because the participants completed the NHANES survey only once, internal validity, such as maturation, regression to the mean, experimental mortality, and repeated testing threats, did not significantly impact the results of the study. The established acceptable reliability of the NHANES survey provided an opportunity for minimizing the effects of instrumentation threats on the study results.

The external validity threat of sampling bias is addressed by using a dataset in which the study sample is representative of the targeted population. In this study, the dataset contained a representative sample of Hispanics in the U.S. The sampling methodology was conducted using a random sampling selection of participants each year.

Summary

This retrospective quantitative research study used a secondary data analysis of preexisting datasets from the NHANES conducted from 2015–2018. This study applied a non-experimental approach to determine associations between the variables. The population of interest in this study comprised Hispanic adults aged 65 years and older. The data analysis included descriptive analysis, such as proportions, percentages of categorical variables, and confidence intervals. In addition, a chi-square test of dependence analysis was conducted to determine whether there was an association between HbA1c levels and the independent variables of doctor visits, diabetes education, and number of blood sugar checks. I conducted the analysis using SPSS 27.0. The results of the data analysis are presented and discussed in Chapter 4.

Chapter 4: Results

The purpose of this retrospective quantitative study was to examine the association between access to preventive health care services and Type 2 diabetes-related outcomes among Hispanic adults age 65 years and older. I investigated the extent to which Hispanic populations aged 65 years and older accessed preventive health care for diabetes. I also explored the potential effects of access to preventive health care services on diabetes-related outcomes in Hispanics age 65 years and older. Chapter 4 includes the research questions and a discussion of the results of the data analysis. I also discuss data management and other recoding strategies used to conduct a successful analysis.

I analyzed data drawn from the 2015–2016 and 2017–2018 NHANES. Diabetes status as measured by HbA1c levels was the dependent variable. The independent variables included doctor visits, diabetes education, and number of blood sugar checks. Because the literature review demonstrated the influence of these factors on Hispanic health, I also examined the extent to which the independent variables could predict diabetes status in the presence of confounding factors, such as age, gender, and language spoken at home.

The four research questions and corresponding hypotheses were the following:

RQ1: What is the association between frequent doctor visits and Type 2 diabetes outcome in Hispanic adults?

H_o1: There is no statistically significant association between frequent doctor visits and HbA1c level in Hispanic adults.

H_a1: There is a statistically significant association between frequent doctor visits and HbA1c levels in Hispanic adults.

RQ2: What is the association between diabetes education and Type 2 diabetes outcomes in Hispanic adults?

H_o2: There is no statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

H_a2: There is a statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

RQ3: What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?

H_o3: There is no statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

H_a3: There is a statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

RQ4: What is the association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home?

H_o4: There is no statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home.

H_a4: There is a statistically significant association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors such as age, gender, income, and language spoken at home.

Data Collection

This study included data collected from the 2015–2016 and 2017–2018 NHANES. The CDC publishes the data 1 year after the data collection is complete. Therefore, the 2017–2018 cycle was the most recently published dataset. The 2017–2018 data were combined with the 2015–2016 data to ensure that the minimum sample size was reached and weighted in accordance with CDC NHANES guidelines.

IRB approval was obtained prior to accessing the data; the IRB number was 12-09-20-0331281. Following this approval, the NHANES data were retrieved from the demographics, diabetes questionnaire, and laboratory data. The datasets for the 2015–2016 and 2017–2018 cycles were retrieved, and the demographics, diabetes, and lab mobile exam unit questionnaires were merged independently using the Sequence Number in SPSS. Following the CDC NHANES guidelines on weighted variables, I used the Weight Medical Examination Center 2 Year variable included in the demographic dataset of each cycle to combine the weighted variables. Participants who did not meet the inclusion criteria were excluded from the analysis.

The study population comprised Hispanics age 65 years and older with Type 2 diabetes. The initial sample size was 2,878 without the exclusion criteria. After exclusion of respondents who were 18–64 years of age and non-Hispanic, the remaining sample

size was 566. Missing data and participants who answered "do not know" to the survey questions were also excluded from the analysis. Several strategies of data management were conducted to achieve a successful data analysis and thereby determine whether having access to preventive health care services could impact diabetes outcomes. Specifically, I recoded the variables of HbA1c levels and doctor visits, which helped meet the needs of the project.

Type 2 Diabetes Status

Table 8 shows differences between Chapter 3 (proposed) and Chapter 4 (modified) variables used in the data analysis. The HbA1c variable was changed from the questionnaires to the laboratory results collected for each individual who participated in the 2015–2016 and 2017–2018 NHANES data collection to provide additional findings on the study participants' health and nutritional information. This modification eliminated the issue of missing data on the HbA1c variable collected in the survey component of NHANES.

Table 8

Recoded Data on HbA1c

Proposed HbA1c			Modified HbA1c		
Classification	Blood sugar level	Code	Classification	Blood sugar level	Code
Do not know	Unknown	0	Do not know	Category not included	
No diabetes	2%–6.4%	1	Diabetes	> 6.4%	0
Diabetes	> 6.4%	2	No diabetes	2%–4.6%	1

Doctor Visits

Table 9 shows the differences between Chapter 3 (proposed) and Chapter 4 (modified) variables used in the data analysis. Doctor visits were recoded from "0" for "refused or Do not know" to "1–2 visits," and "1" from "one or more" to "3 and more" visits. The distribution of doctor visits was mainly around one to two visits and three or more visits.

Table 9

Recode of Data on Doctor Visits

Proposed doctor visit			Modified doctor visit	
Doctor visit	Classification	Code	Classification	Code
Refused and do not know	none	0	Refused and do not know	-
One or more	yes	1	1 - 2 visit	0
Never	no	2	3 and more	1

Results

Descriptive Statistics

The unweighted sample of Hispanics included 616 respondents age 64 years and older. Table 10 shows the descriptive characteristics of the sample by diabetes status. The descriptive statistics included gender, age, family income, and language spoken at home. More than half (n = 313, 55.3%) of the sample were females. Almost three quarters of the respondents (n = 407, 71.9%) were between the ages of 65 and 74 years. Most of the respondents (n = 376, 66.4%) were born outside of the United States, and most reported speaking primarily Spanish at home (n = 340, 60.5%). Additionally, the majority (n = 416, 87.6%) of older Hispanics had a family income less than $75,000 per year. The

examination of data on participants with diabetes (i.e., HbA1c levels above 6.4%) revealed that females and those born outside of the United States had greater proportions of diabetes compared with males and U.S.-born participants. Most participants with diabetes were between the ages of 65 and 74 years and reported a household income of $74,999 or less.

Table 10

Unweighted Frequency and Percentage of Demographic Characteristics of Older Hispanic Adults

Variable		HbA1c levels					
		2-6.4 (No diabetes)		> 6.4 (Diabetes)		Total	
		n	%	*n*	%	*n*	%
Gender	Female	218	56.8%	95	52.2%	313	55.3%
	Male	166	43.2%	87	47.8%	253	44.7%
Age	65–74	264	68.8%	143	78.6%	407	71.9%
	> 75	120	31.3%	39	21.4%	159	28.1%
Family income	$0–$74,999	271	86.6%	145	89.5%	416	87.6%
	$75,000 and over	42	13.4%	17	10.5%	59	12.4%
Language spoken at home	Primarily Spanish	219	57.5%	121	66.9%	340	60.5%
	Primarily English or both	162	42.5%	60	33.1%	222	39.5%

The total number of participants included in the study was 566. Table 11 includes the frequency and percentage of the independent variables by diabetes status. For doctor visits, 25 (21.4%) participants with diabetes reported between one and two visits, while 23 participants who did not have Type 2 diabetes reported three or more visits. Moreover, 92 (78.6%) of participants with diabetes reported three or more visits. Similarly, 86 participants (60.1%) who had diabetes had received diabetes education in the last 5 years,

while only 21 (42.0%) of those who did not have diabetes reported receiving diabetes education in the last 5 years. Fifty-seven participants with diabetes (39.9%) reported never receiving diabetes education. Finally, participants who had diabetes checked their blood sugar levels one to 15 times per day. More than 100 of the participants who did not have diabetes (93.3%) checked their blood sugar levels one to 15 times per day. Ten (6.8%) participants with diabetes had never checked their blood sugar levels.

Table 11

Frequency and Percentage of Diabetes Status, Doctor Visits, Diabetes Education, and Blood Sugar Check

Variable		HbA1c levels					
		2–6.4 (No diabetes)		> 6.4 (Diabetes)		Total	
		n	%	*n*	%	*n*	%
Doctor visits	1–2 visits	11	32.4%	25	21.4%	36	23.8%
	3 and over	23	67.6%	92	78.6%	115	76.2%
Diabetes education	Received education in the past 5 years	21	42.0%	86	60.1%	107	55.4%
	Never	29	58.0%	57	39.9%	86	44.6%
Blood sugar check	1–15 per day	38	73.1%	137	93.2%	175	87.9%
	Never	14	26.9%	10	6.8%	24	12.1%

Results per Research Question

RQ1: What is the association between frequent doctor visits and Type 2 diabetes outcomes in Hispanic adults?

H_o1: There is no statistically significant association between frequent doctor visits and HbA1c levels in Hispanic adults

H_a1: There is a statistically significant association between frequent doctor visits and HbA1c levels in Hispanic adults.

To assess the association between Type 2 diabetes outcomes in older Hispanic adults by doctor visits (1–2 visits, 3 and over), I used a chi-square analysis. A significant relationship was found between Type 2 diabetes outcomes and doctor visits (x^2 = 23529.3, $p < 0.001$). The association between variables was small (*Cramer's V* = 0.163). Table 12 summarizes the results of the chi-square comparison.

Table 12

Chi-Square Analysis of Diabetes Status and Doctor Visits

Variable	HbA1c							
	No diabetes		Diabetes			X^2	*df*	*p*
	n	%	*n*	%				
1–2 visits	57695_a	28.1%	92178_b	13.6%	149873	23529.31	1	<
3 and over	147784_a	71.9%	586340_b	86.4%	734124			0.001

Note. Subscript letter (i.e., a or b) denotes a subset of HbA1c categories whose column proportions do not differ significantly from each other at the .05 level.

RQ2: What is the association between diabetes education and Type 2 diabetes outcomes in Hispanic adults?

H_o2: There is no statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

H_a2: There is a statistically significant association between Type 2 diabetes education and HbA1c levels in Hispanic adults.

To evaluate the association between Type 2 diabetes outcomes in older Hispanic adults by diabetes education (received diabetes education in the past 5 years; never received diabetes education), I used a chi-square analysis. The results of the chi-square analysis indicated a statistically significant association between Type 2 diabetes outcomes and those who received diabetes education ($x^2 = 79302.669$, $p < 0.001$). There was a moderate association between the variables (*Cramer's V* = 0.258). Table 13 summarizes the results of the chi-square comparison.

Table 13

Chi-Square Analysis of Diabetes Status and Diabetes Education

Variable	HbA1c						
	No diabetes		Diabetes		X^2	*df*	*p*
	n	%	*n*	%			
Received education in the past 5 years	112144_a	33.4%	527848_b	62.0%	79302.66	1	< 0.001
Never	224037_a	66.6%	324202_b	38.0%			

Note. Subscript letter (i.e., a or b) denotes a subset of HbA1c categories whose column proportions do not differ significantly from each other at the .05 level.

RQ3: What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?

H_o3: There is no statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

H_a3: There is a statistically significant association between the frequency of blood sugar checks and HbA1c levels in Hispanic adults.

To evaluate the association between Type 2 diabetes outcomes in older Hispanic adults by the frequency of blood sugar checks (participants who checked their blood sugar 1–15 times and those who never checked their blood sugar), I used a chi-square analysis. The results of the chi-square analysis indicated a statistically significant association between Type 2 diabetes outcomes and those who checked their blood sugar ($x^2 = 173374.21$, $p < 0.001$). The association between the variables was moderately strong (*Cramer's V* = 0.374). Table 14 summarizes the results of the chi-square comparison.

Table 14

Chi-Square Analysis of Diabetes Status and Blood Sugar Checks

Variable	HbA1c						
	No diabetes		Diabetes		X^2	*df*	*p*
	n	%	*n*	%			
1–15 per day	228299_a	65.9%	843473_b	94.4%	173374.21	1	< 0.001
Never	118114_a	34.1%	49811_b	5.6%			

Note. Subscript letter (i.e., a or b) denotes a subset of HbA1c categories whose column proportions do not differ significantly from each other at the .05 level.

Binomial Logistic Regression Results

Doctor Visits

RQ4: What is the association between frequent doctor visits, diabetes education, number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults in controlling for confounding factors, such as age, gender, income, and language spoken at home?

H_o4: There is no statistically significant association between frequent doctor visits, diabetes education, or the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults in controlling for confounding factors, such as age, gender, income, and language spoken at home.

H_a4: There is a statistically significant association between frequent doctor visits, diabetes education, and the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults in controlling for confounding factors, such as age, gender, income, and language spoken at home.

I conducted a binomial logistic regression analysis to examine the association between frequency of doctor visits among older Hispanic adults with diabetes in controlling for confounding factors, such as age, gender, income, and language spoken at home. Table 15 shows the results of the binomial regression model when diabetes status was the dependent variable. The results indicated a statistically significant association between diabetes status and doctor visits in controlling for the aforementioned covariates ($B = -1.133, SE = .007, \beta = .322, p < .001$). The null hypothesis was rejected. Compared with older Hispanics who did not have diabetes, older Hispanic adults with diabetes were 67.8% more likely to visit the doctor frequently.

Table 15

Binomial Logistic Regression Analysis of Diabetes Status and Doctor Visits

Variable	*B*	*S.E.*	*Wald*	*df*	*p*	Odds ratio	95% C.I. for odds ratio	
							Lower	Upper
Doctor visits	-1.133	.007	29993.309	1	.000	.322	.318	.326
Gender	-.514	.006	8096.826	1	.000	.598	.591	.605
Family income	.281	.012	581.930	1	.000	1.324	1.294	1.355
Language spoken at home	.318	.006	3300.457	1	.000	1.375	1.360	1.390
Age	-.476	.006	5823.923	1	.000	.622	.614	.629
Constant	1.100	.014	5778.194	1	.000	3.003		

Note. a. Variable(s) entered on step 1: Doctor Visits, Gender, Family Income, Language Spoken at Home, Age

Diabetes Education

A binomial logistic regression model was applied to assess the association between diabetes status and diabetes education in controlling for confounding factors, such as age, gender, income, and language spoken at home. The results indicated a statistically significant association between diabetes status and diabetes education in controlling for age, gender, income, and language spoken at home ($B = 1.393$, $SE = .005$, $\beta = 4.028$, $p < .001$). Therefore, the null hypothesis regarding diabetes status and diabetes education was rejected. The results showed that older Hispanic adults with diabetes were 4 times more likely to receive diabetes education than those with no diabetes.

Table 16

Binomial Logistic Regression Analysis of Diabetes Status and Diabetes Education

Variable	*B*	*SE*	*Wald*	*df*	*p*	Odds ratio	95% CI for odds ratio	
							Lower	Upper
Diabetes education	1.393	.005	80441.527	1	.000	4.028	3.990	4.067
Gender	-.539	.005	12297.689	1	.000	.584	.578	.589
Family income	.669	.009	5935.150	1	.000	1.953	1.920	1.986
Language spoken at home	.002	.005	.249	1	.618	1.002	.993	1.012
Age	-.760	.005	21966.923	1	.000	.468	.463	.472
Constant	.232	.012	386.455	1	.000	1.261		

Note. a. Variable(s) entered on step 1: Diabetes Education, Gender, Family Income, Language Spoken at Home, Age.

Blood Check

The binomial logistic regression model established that diabetes status and blood sugar test were statistically significantly associated in controlling for age, gender, income, and language spoken at home ($B = 2.500, SE = .007, \beta = 12.181, p < .001$). Therefore, the null hypothesis regarding diabetes status and blood sugar check was rejected. The results showed that older Hispanic adults with diabetes were 12.2 times more likely to check their blood sugar frequently compared with those without diabetes.

Table 17

Binomial Logistic Regression Analysis of Diabetes Status and Blood Sugar Checks

Variable	*B*	*S.E.*	*Wald*	*df*	*p*	Odds ratio	95% C.I. for odds ratio	
							Lower	Upper
Blood check	2.500	.007	128694.677	1	.000	12.181	12.016	12.349
Gender	-.674	.005	17701.710	1	.000	.510	.505	.515
Family income	.932	.009	9755.585	1	.000	2.539	2.492	2.586
Language spoken at home	.199	.005	1575.511	1	.000	1.220	1.208	1.232
Age	-1.025	.005	38584.222	1	.000	.359	.355	.363
Constant	-1.645	.014	13047.896	1	.000	.193		

Note. a. Variable(s) entered on step 1: Blood Check, Gender, Family Income, Language Spoken at Home, Age.

Summary

This study analyzed the effects of access to preventive health care services on Type 2 diabetes outcomes in Hispanic older adults. The results showed a significant association between HbA1c levels and doctor visits, diabetes education, and number of blood sugar checks. The demographics section described the results according to frequencies and percentages. The chi-square of independence was used to address RQ1, which asked about the association between doctor visits and Type 2 diabetes outcomes in Hispanic older adults. Overall, the findings of this analysis indicated a significant association between diabetes outcomes and those who visited the doctor 1–2 times compared with those who never visited the doctor.

A chi-square test was also applied to address RQ2, regarding the association of Type 2 diabetes outcomes and diabetes education in Hispanic older adults. The findings showed a significant association ($x^2 = 4.935, p < 0.001$) between participants who had received diabetes education in the last five years and Type 2 diabetes outcomes.

Similarly, a chi-square of independence analysis was used to evaluate the association between Type 2 diabetes outcomes in Hispanic older adults and the frequency of blood sugar checks. The results showed a significant association ($x^2 = 12.662, p < 0.001$) among those who checked their blood sugar 1–15 times per day and Type 2 diabetes outcomes.

Lastly, to address RQ4, a binomial logistic regression model was used to determine the association of doctor visits, diabetes education, and frequency of blood sugar checks on Type 2 diabetes outcomes among Hispanic older adults in controlling for age, gender, family income and language spoken at home. The results showed that Hispanics with diabetes were more likely to have doctor visits, diabetes education and frequent blood sugar checks compared with those who did not have diabetes.

In Chapter 5, I discuss in detail the findings from the chi-square analysis of independence and the binomial logistic regression model and their implications for social change. Furthermore, the findings of this study examined with existing evidence in the literature, and the limitations of the study are also discussed.

Chapter 5: Discussion, Conclusions, and Recommendations

In this study, the associations between access to preventive health care services and Type 2 diabetes-related outcomes were examined among Hispanic adults age 65 years and older. Specifically, I aimed to determine the extent to which Hispanic individuals age 65 years and older access preventive health care for diabetes, as well as the potential effects of access to preventive health care services on diabetes-related outcomes in Hispanics age 65 years and older. This study addressed the scientific gap in the association between diabetes outcomes and doctor visits, diabetes education, and number of blood sugar checks. Hispanics age 65 years and older suffer disproportionally from diabetes compared with other racial and ethnic groups; 13% of Hispanic adults have been diagnosed with Type 2 diabetes (Walker et al., 2016). The prevalence of diabetes has become a major concern for Hispanics 65 years of age and older because of its effects on their life expectancy. The findings of the study expanded scientific knowledge about the importance of access to preventive health care services among older Hispanic adults. Previous research on health disparities highlighted the lack of understanding of culturally relevant mechanisms that contribute to diabetes improvement in Hispanics as a heterogeneous ethnic group, particularly among older adults in this population (Kim, Moored, et al., 2014; Wagner et al., 2016).

Regarding RQ1 (What is the association between frequent doctor visits and Type 2 diabetes outcomes in Hispanic adults?), the results of the analysis indicated a significant association between diabetes outcomes and doctor visits. Regarding RQ2 (What is the association between diabetes education and Type 2 diabetes outcomes in

Hispanic adults?), the findings indicated a significant association between participants who received diabetes education in the last 5 years and Type 2 diabetes outcomes. The findings of RQ3 (What is the association between the number of blood sugar checks and Type 2 diabetes outcomes in Hispanic adults?) indicated a significant association between Type 2 diabetes outcomes and blood sugar checks.

Regarding RQ4 (What is the association between frequent doctor visits, diabetes education, and number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults when controlling for confounding factors, such as age, gender, income, and language spoken at home?), the findings of the binomial logistic regression model applied to evaluate the association between frequency of doctor visits among older Hispanic adults with diabetes indicated a statistically significant association between diabetes status and doctor visits. Similarly, findings indicated a statistically significant association between diabetes status and diabetes education. In addition, the findings demonstrated that diabetes status and blood sugar tests were statistically significantly associated when controlling for age, gender, income, and language spoken at home.

Interpretation of the Findings

I used a quantitative retrospective survey design that included secondary data analysis to examine the association between access to preventive health care services and Type 2 diabetes-related outcomes among Hispanic adults age 65 years and older. The 2015–2016 NHANES and 2017–2018 NHANES datasets were combined to examine the associations among the variables. Participants in the NHANES surveys are randomly selected across the U.S. based on a multistage sampling protocol (Chen et al., 2020). The

NHANES datasets are publicly available through the CDC website. The study was conducted after receiving IRB approval from Walden University.

To evaluate the association between Type 2 diabetes outcomes and the frequency of doctor visits (RQ1), I conducted a chi-square test of independence. A concern regarding the diabetes status of older Hispanic adults was the frequency of doctor visits by this population during a year. The analysis of the association between diabetes status and the frequency of doctor visits revealed a significant association between Type 2 diabetes outcomes in older Hispanic adults and the frequency of doctor visits. Similarly, Asao et al. (2014) found that doctor visits had significant implications for diabetes outcomes. Other studies also indicated that the frequency of doctor visits was significantly associated with diabetes outcomes (Ashman & Taylor, 2014). Felix et al. (2019) argued that frequent doctor visits could lead to improvements in diabetes outcomes and a reduction in diabetes-related complications. A possible explanation is that by having knowledge of existing diabetes, patients may be prompted to visit their doctors more often. Doctor visits are one of the most common self-care practices by people with diabetes (Ashman & Taylor, 2014). Asao et al. found that doctor visits had significant implications for diabetes outcomes. Peña-Purcell et al. (2019) argued that frequent doctor visits could lead to improvements in diabetes outcomes and reductions in diabetes-related complications. Another possible explanation for the association between diabetes and doctor visits is that doctors are more likely to schedule frequent visits to provide improved care for people with diabetes and maintain HbA1c levels (McDonald et al., 2009). Innovative approaches are needed to enhance communication between doctors

and Hispanic patients. Technologies such as telehealth can enable doctors to enhance access to health care and increase doctor visits in vulnerable Hispanic communities.

To evaluate the association between Type 2 diabetes outcomes and diabetes education (diabetes education received in the past 5 years versus never receiving diabetes education) in older Hispanic adults (RQ2), I conducted a chi-square analysis of independence. The results showed a significant association between diabetes outcomes in older Hispanic adults and having received diabetes education in the past 5 years. These findings were consistent with those of previous research. Surucu et al. found that participants who received diabetes education were more likely to lower their HbA1c levels than those who did not receive diabetes education. A possible explanation is that diabetes education affects individual behaviors related to diabetes outcomes. The consciousness of diabetes implications might be greater in people with diabetes education because they understand the risks of increased sugar intake, lack of physical activity, and poor diet on their diabetes outcomes. In addition, diabetes education might have the effect of patients engaging in positive behavioral practices, including self-managing behavior. However, it is imperative that this type of education be culturally relevant to the targeted population. Page-Reeves et al. found that programs that were not culturally relevant to Hispanic communities did not encourage them to engage in diabetes education programs. For example, diabetes education programs for Hispanic older adults might consider language preferences and family involvement to suit specific groups. A potential approach might be the implementation of the Promotores de Salud Program in Hispanic communities. Promotores de Salud demonstrated an increased access to diabetes

education resulting in improvements in diabetes outcomes (Burker, 2018). These programs are relevant for Hispanics because they are based on a better understanding of cultural elements that promote the engagement of Hispanic communities in healthier lifestyles, such as physical activity, food preferences, and other lifestyle choices that must be considered in culturally relevant diabetes education programs (Nwufor, 2020). Furthermore, recent studies have highlighted the importance of addressing psychological constructs through diabetes self-management education programs that are culturally relevant for older Hispanic adults. Such constructs might include language preference and family involvement, which could be used to suit specific populations (Peña-Purcell et al., 2019). Diabetes education must accentuate the importance of improving low self-efficacy and low self-care with the goal of reducing anxiety, worry, guilt, and fear in diabetes patients (Peña-Purcell et al., 2019).

To evaluate the association between diabetes outcomes and the frequency of blood sugar tests (participants who check their blood sugar 1–15 times daily versus those who never check their blood sugar) in older Hispanic adults (RQ3), I conducted a chi-square test of independence. The results showed a significant association between diabetes outcomes in older Hispanic adults who checked their blood sugar frequently. The evidence concerning blood sugar tests and older Hispanic adults is limited. To the best of my knowledge, no previous study had focused on the association between the frequency of blood sugar tests and diabetes outcomes. Although Hispanics check their blood sugar more often compared with Whites, the evidence demonstrated that the fear of hypoglycemia might prevent Hispanic adults from engaging in diabetes self-management

behaviors such as blood sugar monitoring (Wagner et al., 2017). However, existing literature is unclear on whether the lack of engagement in blood sugar checking due to fear is present in older Hispanic adults with Type 2 diabetes. Confidently, this study brings new scientific knowledge demonstrating that Hispanic adults with Type 2 diabetes might exhibit increased levels of adherence to blood sugar checking. Socioeconomic factors can also limit the number of blood sugar tests by Hispanics, as Salinas et al. (2015) reported. Therefore, it is imperative that Hispanic older adults, especially those with Type 2 diabetes, be well informed about the importance of blood sugar monitoring to help predict, prevent, detect, and treat hypoglycemia.

To evaluate the association between frequent doctor visits, diabetes education, number of blood sugar checks, and Type 2 diabetes outcomes in Hispanic adults (controlling for confounding factors, such as age, gender, income, and language spoken at home; RQ4), I used a binomial regression analysis. The results did show a significant association between the frequency of doctor visits and diabetes outcome. This result was consistent with those of previous studies, which showed that frequent doctor visits were associated with diabetes outcomes (Asao et al., 2014; Ashman & Taylor, 2014; Felix et al. 2019). The results of the binomial regression analysis, which was conducted to evaluate the association between diabetes education and diabetes outcomes in older Hispanic adults (controlling for confounding factors such as age, gender, income, and language spoken at home) showed a significant association. Despite the presence of cofounding variables, these findings were consistent with existing scientific evidence, indicating that enrolling in a diabetes education program might affect the control of

HbA1c levels (Surucu et al., 2017). Consistent with existing scientific literature (Chandler & Monnat, 2015; Salinas et al., 2015), the results of the binomial regression analysis showed a significant association between blood sugar checks and diabetes outcomes).

Limitations of the Study

This study had several limitations that were inherent in analyzing large datasets. The study was conducted using retrospective cross-sectional data, which limited the ability to establish causation between diabetes outcomes and frequent doctor visits, diabetes education, and blood sugar checks in older Hispanic adults. Psychosocial constructs, such as the ability to recall and retrieve past experiences, impose bias on self-report surveys, and under- or overestimation might have been affected by self-report bias. Moreover, the use of subjective metrics (e.g., self-report) in many cases impedes researchers in establishing true estimates of the study variables . In the current study, the data included HbA1c levels taken at one point in time, which might not have reflected regular blood sugar levels in an individual. Additional limitation of this study is a reported decrease in response rate for the NHANE survey over the last cycles (CDC, 2020). However, the CDC (2020) has also indicated that impact of the decline in response rate was minimized by enhanced weighting adjustments and by combining multiple cycles. Despite these limitations, the strengths of this study include the following: (a) the accuracy of the HbA1c levels obtained via lab testing on site; (b) the use of a large sample of older Hispanic adults by combining two datasets; and (c) the use of systematic sampling methodologies, which helped to establish findings at the national level.

This study contributed to the literature by suggesting that preventive health care services should be considered as an approach that might affect diabetes outcomes. Much of the literature on this topic was cross-sectional and retrospective in nature. Further investigations are warranted to determine the extent to which engagement in preventive health care services over time produces changes in individuals' diabetes outcomes. Additional research should be conducted, including qualitative and mixed-methods approaches, in which the researchers examine intersections of doctor visits, diabetes education, frequent blood sugar checks, and associations of diabetes outcomes with psychosocial constructs and behavioral practices leading to better health in older Hispanic adults. To the best of my knowledge, this study was the first to address the relationship between diabetes outcomes and frequent doctor visits, diabetes education, and blood sugar checks in older Hispanic adults.

Recommendations

To the best of my knowledge, no previous studies had addressed the association between preventive health care services and Type 2 diabetes outcomes. Further research is needed to determine the effects of access to preventive health care services on improving diabetes outcomes in older Hispanic adults. For example, researchers should investigate how doctor visits, diabetes education, and the frequency of blood sugar checks affect psychological factors that lead to improvement in HbA1c levels, including self-esteem, self-determination, and behavioral intention. Although the current study indicated significant associations between diabetes education, frequency of blood sugar checks, and diabetes outcomes in older Hispanic adults, further research is necessary to

establish causation. Culturally relevant programs must be developed to assess the effects of diabetes education, frequent blood sugar checks, and doctor visits on diabetes outcomes based on prospective measurements.

Future research on this topic should be grounded in a theoretical framework that includes culturally relevant constructs. For example, social cognitive theory implies that human behavior can be influenced by multiple factors, including environmental and personal aspects, using a multidirectional approach (Bandura, 2002). Human behavior is bidirectional and regulated by the influence of many factors (Rimer & Glanz, 2005), both controllable and uncontrollable. In other words, preventive health care services affect individual behaviors, which affect the ability to judge, think, and act regarding specific diabetes outcomes.

Much of the literature and recent research has relied on psychological surveys. One advantage of survey research is that it is cost effective; however, recall bias is a limiting factor, and additional research is warranted to further investigate the effects of access to preventive health care services and diabetes outcomes in older Hispanic adults. For example, observational research, in addition to the use of objective assessment tools, decreases the potential effects of internal and external validity (Grimes, & Schulz, 2002).

Implications

The findings of this study suggested that programs focused on improving diabetes outcomes are needed to significantly decrease the incidence of diabetes among older Hispanic adults. Programs and interventions are necessary to ensure that Hispanics with diabetes maintain a healthy lifestyle to prevent further complications of the disease,

which lead to additional comorbidities. The interventions developed to improve diabetes outcomes and maintain a healthy lifestyle should include individuals, family, and the community. At the individual level, diabetes programs should include cultural competencies. Specifically, programs should focus on several components, such as goal setting, self-management, and frequent individual blood monitoring. In addition, programs should improve individual health literacy and include nutritional and physical activity elements to maintain healthy lifestyles. Family-centered interventions are a relevant and culturally appropriate practice for Hispanics with diabetes. Diabetes management programs should also incorporate family-centered activities, such as engaging in healthy eating and exercise.

Promotores de Salud is a community-based program that is focused on helping Hispanics understand diabetes, identify resources within the community, and connect individuals to necessary services. In addition, at the community level, community-based programs can provide wellness interventions in activities such as exercise. In addition, community wellness centers can provide diabetes monitoring services that are accessible and trusted by community members.

Conclusion

The purpose of this study was to examine the association between doctor visits, diabetes education, and blood sugar checks, and Type 2 diabetes outcomes in older Hispanic adults. The study was conducted to fill the scientific gap regarding the high prevalence of Type 2 diabetes in older Hispanic adults, who are more likely to develop diabetes compared with their White counterparts. Scientific evidence has demonstrated

that preventive health care services, such as doctor visits, diabetes education, and blood sugar checks, might lead to improved diabetes outcomes. The findings of this study revealed significant associations between diabetes outcomes, diabetes education, and frequent blood sugar checks. Therefore, it is recommended that in future research, an experimental design be used to determine the effects of these variables on HbA1c levels in older Hispanic adults. Furthermore, culturally relevant programs, such as Promotores de Salud, should be developed and implemented at individual, family, and community levels to integrate multifactorial social and linguistic elements.

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