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Association Between Modifiable Risk Factors and Stroke Among Hispanics

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Walden University
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Abstract

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by

Shanice Williams

MPH, Morehouse School of Medicine, 2014

BS, Fort Valley State University, 2011

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Stroke is a significant public health issue that impacts the health of Hispanic adults.

Understanding the multiple risk factors of stroke is an essential strategy to control the

disease among this population. The purpose of this study was to examine the association

between modifiable risk factors and stroke among Hispanics. The public health

prevention framework guided this study. The research questions were designed to

determine whether an association exists between modifiable risk factors for stroke among

Hispanics. A quantitative, cross-sectional research design was used to conduct secondary

analysis of the pooled 2017–2019 Behavioral Risk Factor Surveillance System annual

surveys. The sample of 111,429 participants in this study was weighted to represent the

national sample of Hispanic adults aged 18 years and older. Unadjusted bivariate models

indicate that both obesity and diabetes have a significant association with the diagnosis of

stroke. An adjusted logistic regression indicated that the odds of a diagnosis of stroke

(outcome) had a statistically significant association with obesity and diabetes (exposure)

after controlling for confounding factors, alcohol consumption, smoking, and education

among Hispanics. The adjusted logistic regression model suggests that among Hispanics,

those with diabetes are 8 times more likely to be diagnosed with stroke ($OR = 7.939$, 99%

CI [7.875, 8.003], $p < .001$). The findings of this study may provide evidence for public

health professionals to propose interventions that educate Hispanics on diabetes and other

risk factors for stroke. Stroke prevention programs can consider the demographic

characteristics, socioeconomic status, and cultural norms and values that can impact the

disease management for each individual.

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Dedication

I dedicate this study to my mother, who taught me the value of an education and encouraged me to reach my full potential. You have always been a guiding light to help me along the path to pursuing my dreams. To my grandmother, I am thankful for your words of encouragement and wisdom throughout this journey. To my husband, I am grateful for your love and support during this process. I also dedicate this study to my family, who has supported me from the very beginning and taught me how to persevere.

Acknowledgements

I would like to thank my spiritual father, who made it possible to accomplish my goals. I would also like to thank my committee members for their guidance, support, and valuable feedback. I am sincerely thankful for your encouragement and compassion throughout this process.

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Chapter 1: Introduction to the Study

Stroke is a public health issue that has been the focus of many public health programs. The purpose of this study was to examine the association between risk factors and stroke among Hispanics. In the United States, the cost of stroke is more than $30 billion every year, which accounts for missed days of work, medical expenditures, and medications needed to treat patients with a stroke (Virani et al., 2020). In the United States, Hispanics have a high prevalence of stroke (Aldayel et al., 2017). In this chapter, I discuss the background of the study, problem statement and purpose of the study, research questions and hypotheses, conceptual framework, nature of the study, definition of terms, assumptions, scope and limitations, and significance of the study. The chapter concludes with a summary and transition.

Background of the Study

More than 700,000 people, every year, have a stroke in the United States (Virani et al., 2020). Strokes can cause long-term disability, brain damage, and death. According to the American Stroke Association (ASA; 2020), ischemic strokes represent 87% of all strokes and occur when a blood vessel is blocked, preventing blood flow to the brain. Obesity, diabetes, race/ethnicity, medical conditions, family history, genetics, and unhealthy lifestyle choices (i.e., smoking, unhealthy diet, and excessive alcohol consumption) are risk factors that can lead to a stroke (National Heart, Lung, and Blood Institute, 2020). There is limited evidence in the literature to explain the association between multiple risk factors and the prevalence of stroke among Hispanics.

According to the U.S. Census, between 2010 and 2019, the Hispanic population increased from 16% to 18% (Noe-Bustamante et al., 2020). In comparison to non-Hispanic Whites, Hispanics are more susceptible to have a stroke at an early age due to a higher frequency of diabetes and worse health outcomes (Nokes et al., 2015). Despite an intermittent smoking pattern, smoking-related diseases are a leading cause of death among the Hispanic population (Kaplan et al., 2014). Furthermore, education is associated with current drinking status among Hispanic and Latinx adults (Castaneda et al., 2019). Excessive alcohol consumption increases the risk of both ischemic and hemorrhagic stroke (Larsson et al., 2016). The level of acculturation, relaxed attitudes towards drinking, and the changing culture of Hispanics in the United States are all factors that predict heavy drinking patterns and alcohol-related problems in the Hispanic community. The literature has shown that alcohol consumption, obesity, smoking, education, and diabetes are risk factors that can lead to a stroke, but further research will provide insight into the association between risk factors and stroke among Hispanics. This study was needed to determine the association between modifiable risk factors (i.e., alcohol consumption, obesity, smoking, education, and diabetes) and stroke among the Hispanic population.

Problem Statement

Hispanics are the largest ethnic minority group in the United States, and this population has a higher stroke frequency compared to non-Hispanic Whites (Aldayel et al., 2017). The leading risk factors of stroke are diabetes, smoking, high cholesterol, hypertension, and obesity. The prevalence of obesity is high among Hispanic adults with

over three fourths (77.1%) overweight and almost half (47.0%) obese (Centers for

Disease Control and Prevention [CDC], 2018b; Forrest et al., 2017). Obesity is associated

with various health problems, such as diabetes and heart disease. Alcohol consumption,

obesity, smoking, and diabetes are all risk factors for stroke among the Hispanic

population (Guzik & Bushnell, 2017). Individuals with multiple risk factors have an

increased risk of having a stroke (Guzik et al., 2017). Due to an intermittent smoking

pattern, most Hispanics do not smoke cigarettes every day. Hispanic men have a higher

smoking prevalence compared to Hispanic women; however, the prevalence of cigarette

smoking among Hispanics has decreased from 16.2% in 2005 to 9.8% in 2018 (CDC,

2020b; Kaplan et al., 2014). Despite the decline in smoking, smoking-related diseases are

a leading cause of death among this population (Kaplan et al., 2014).

According to Boehme et al. (2017), diabetes and smoking are the major

attributable risk factors for stroke. Light to moderate alcohol consumption is protective

against ischemic stroke but increases the risk of hemorrhagic stroke (Boehme et al., 2017;

Larsson et al., 2016). Alcohol consumption, obesity, and diabetes have a direct

association that increases the risk for stroke, while smoking doubles the risk for stroke

(Arboix, 2015; Boehme et al., 2017; Mitchell et al., 2015; Pan et al., 2019).

Education and employment determine drinking outcomes and drinking patterns.

Among Hispanic and Latino men, education is associated with current drinking status,

while income and employment put these men at risk of drinking (Castaneda et al., 2019).

In contrast, education, age, and employment are associated with current and at-risk

drinking among Hispanic and Latinx women (Castaneda et al., 2019). Acculturation is

another factor that influences drinking behavior among Hispanic women. Hispanic and Latinx women with a greater influence of acculturation to U.S. society have an increased risk of current drinking and alcohol use disorders (Castaneda et al., 2019).

In 2019, stroke was the fifth leading cause of death in the United States (Benjamin et al., 2017). In comparison to non-Hispanic Whites, Hispanics have a higher prevalence of stroke and risk factors (Aldayel et al., 2017; Balfour et al., 2016; Patel et al., 2017). According to data from the 2015 Behavioral Risk Factor Surveillance System (BRFSS), Hispanics are 1.6 times more likely to develop a stroke than non-Hispanic Whites (Aldayel et al., 2017). Despite evidence that Hispanics have nearly twice the risk of developing a stroke, there is a lack of evidence to examine the association between alcohol consumption, obesity, smoking, diabetes, education, and stroke among this population (Aldayel et al., 2017; Bailey et al., 2019; & Patel et al., 2017). The current study examined the association between five risk factors (i.e., alcohol consumption, obesity, smoking, education, and diabetes) and stroke.

Purpose of the Study

The purpose of this study was to examine the association between alcohol consumption, obesity, smoking, diabetes, education, and stroke among Hispanics. To address the research gap, I used a quantitative approach in this study to examine the association between modifiable risk factors (i.e., alcohol consumption, obesity, smoking, diabetes, and education) and the diagnosis of stroke among Hispanic adults.

Research Questions and Hypotheses

<u>Research Question 1</u>: Is there an association between obesity and the diagnosis of stroke among Hispanics?

$H_0 1$: There is no association between obesity and the diagnosis of stroke among Hispanics.

$H_A 1$: There is an association between obesity and the diagnosis of stroke among Hispanics.

<u>Research Question 2</u>: Is there an association between diabetes and the diagnosis of stroke among Hispanics?

$H_0 2$: There is no association between diabetes and the diagnosis of stroke among Hispanics.

$H_A 2$: There is an association between diabetes and the diagnosis of stroke among Hispanics.

<u>Research Question 3</u>: Is there an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education?

$H_0 3$: There is no association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

$H_A 3$: There is an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

Conceptual Framework

The conceptual framework for this study was the public health prevention framework. Prevention involves the use of strategies to prevent diseases, reduce the number of people affected by the disease, and decrease disease severity within a population or group of people (National Academies of Sciences, Engineering, and Medicine [NASEM], 2017). The public health prevention framework consists of three concepts: primary prevention, secondary prevention, and tertiary prevention. Primary prevention is focused on targeting risk factors, changing unhealthy behaviors that can lead to the disease, and increasing resistance to the disease in the event of exposure (NASEM, 2017). For example, the targeted risk factors in this study are smoking, alcohol consumption, and obesity, which can lead to a stroke. Secondary prevention is used to reduce the effect of diseases through treatment and early detection, while tertiary prevention is focused on reducing the impact of a disease or illness through long-term management and rehabilitation (NASEM, 2017).

Nature of the Study

In this study, I used a quantitative approach to analyze secondary data. Quantitative studies are used to determine the associations between an independent variable (in the case of this study, risk factors) and a dependent variable (in the case of this study, stroke; Guetterman, 2019). This research includes a cross-sectional study design using 2017, 2018, and 2019 BRFSS surveys to examine the association between stroke, a specific set of independent variables (i.e., obesity and diabetes), and the confounding variables (i.e., alcohol consumption, smoking, and education). A cross-

sectional study design is appropriate for population-based surveys and comparing different variables (Setia, 2016). A chi-square test and multiple logistic regression analysis were used to examine the association between each independent variable and the dependent variable.

Definitions of Terms

Diabetes: A disease in which the body cannot produce or use the hormone insulin, resulting in high levels of blood glucose or blood sugar, which is used as the primary source of energy in the body (National Institute of Diabetes and Digestive and Kidney Diseases, 2016).

Excessive alcohol consumption (or heavy drinking): Women drinking eight or more alcoholic beverages each week, and men drinking 15 or more alcoholic beverages each week (CDC, 2020a).

Hispanic: A person of Mexican, Cuban, Puerto Rican, Latin American descent, or Spanish origin who lives in the United States (Merriam-Webster, 2020).

Moderate alcohol consumption: Women drinking up to one alcoholic beverage per day, and men drinking up to two alcoholic beverages per day (CDC, 2020a).

Obesity: An abnormal accumulation of adipose tissue. Obesity is classified as having a body mass index (BMI) that is equal to 30 or above (World Health Organization, 2020).

Stroke: When blood flow to the brain is interrupted and reduces oxygen in the brain tissue (ASA, 2020).

Assumptions

I made several assumptions concerning this study. Using the BRFSS data set for secondary data analysis, the first assumption was that participants were chosen based on random selection. Another assumption was that there was no selection bias. I also assumed that the participants understood each survey question and provided accurate answers about their experiences or events in the past. Furthermore, I assumed that the Spanish version of the questionnaire was administered to Hispanics that were not fluent in English.

Scope and Delimitations

In this study, I examined the association between modifiable risk factors and stroke among Hispanics. Due to the availability of BRFSS data, the risk factors were diabetes, obesity, alcohol consumption, smoking, and education. All participants were assumed to be 18 years and older. The inclusion and exclusion criteria for this study were age and race/ethnicity. The inclusion criteria included adults of Hispanic, Latinx, or Spanish origin. The exclusion criteria included children and non-Hispanic adults, such as non-Hispanic Whites, African Americans, non-Hispanic American Indian or Alaskan Natives, non-Hispanic Asians, and non-Hispanic Native Hawaiian or other Pacific Islanders. The exclusion of different groups based on race/ethnicity may have limited the generalization of results on risk factors and stroke to all populations.

Limitations

The potential limitations for this study include the following: the results cannot explain the impact of each risk factor among the Hispanic population, and observational

studies using secondary data may consist of recall bias and missing data. Although the BRFSS is a large data set, one initial challenge of this study was obtaining an adequate sample size of Hispanics who experienced a stroke to determine the association between modifiable risk factors (i.e., obesity, alcohol consumption, smoking, diabetes, and education) and the diagnosis of stroke. Another limitation of this study was the inability to establish causation due to the cross-sectional study design.

Significance of the Study

Hispanics have higher stroke prevalence and risk factors compared to their White counterparts (Aldayel et al., 2017; Balfour et al., 2016; Patel et al., 2017). Hispanics have nearly twice the risk of developing a stroke, but there is a lack of evidence on the association between risk factors and stroke among this population (Aldayel et al., 2017; Bailey et al., 2019; Patel et al., 2017). With this study, I was able to fill this gap in the literature by determining the association between modifiable risk factors and the diagnosis of stroke among Hispanics. In addition, the results of this study may lead to positive social change by providing insight into the association between alcohol consumption, obesity, smoking, diabetes, education, and stroke among Hispanic adults. The study outcomes may influence public health professionals to develop stroke prevention interventions among Hispanics to reduce the risk of stroke and increase awareness of stroke risk factors.

Summary and Transition

In this study, I examined five factors that may contribute to stroke among Hispanics. Using a quantitative approach and secondary analysis, I examined the

association between the dependent variable (i.e., stroke), independent variables (i.e.,

obesity and diabetes), and the confounding variables (i.e., alcohol consumption, smoking,

and education). The findings from this study may add to the existing literature and help

identify ways to incorporate education of risk factor prevention in the management of

stroke among the Hispanic population. In Chapter 2, I will provide a review of the current

literature related to the variables and concepts described in this study to demonstrate the

limited evidence on this public health issue.

Chapter 2: Literature Review

The purpose of this study was to examine the association between multiple risk factors and stroke among Hispanics. Stroke risks can differ by race and ethnicity, and Hispanics have a high prevalence of stroke and stroke risk factors (Aldayel et al., 2017). Several risk factors can lead to a stroke by causing a blockage of arteries that lead to the brain or changes in blood vessels (ASA, 2020). Alcohol consumption, obesity, and diabetes have a direct relationship that increases the risk for stroke, while smoking doubles the risk (Arboix, 2015; Boehme et al., 2017; Mitchell et al., 2015; Pan et al., 2019). In this chapter, I discuss the literature search strategy, conceptual framework, smoking and stroke, alcohol consumption and stroke, obesity and stroke, diabetes and stroke, and education and stroke.

Literature Search Strategy

The Walden University library system was used to search the literature and find relevant articles and databases. The databases used in the literature search included Academic Search Complete, MEDLINE, PsycINFO, Public Health, PubMed, Science Citation Index, and ScienceDirect. Each database was used to find literature that related to stroke, alcohol consumption, obesity, smoking, diabetes, and education. The keywords used to search the literature were *alcohol consumption, education level, alcohol use, alcohol intake, drinking alcohol, Hispanics, risk factors, smoking, cigarette smoking, diabetes, acculturation, obesity, obese, overweight, stroke,* and *ischemic stroke*. Duplicate articles and unrelated topics were eliminated in all literature searches. I collected additional information from the ASA and CDC websites.

Conceptual Framework

I used the public health prevention framework as the conceptual framework for this study. The public health prevention framework was created by Robert Gordon (1983) and consists of the following concepts: primary prevention, secondary prevention, and tertiary prevention. Previous research has shown how the conceptual framework is applied using primary, secondary, and tertiary prevention to analyze the risk factors associated with cardiovascular diseases and decrease the impact of the disease in high-risk adults (Karunathilake & Ganegoda, 2018). Each level of prevention is relevant to the risk factors of stroke in this study. Primary prevention involves an intervention that occurs before there is evidence of a disease (NASEM, 2017). Primary prevention can be used to reduce or eliminate risk factors (i.e., obesity, education, smoking, diabetes, and alcohol consumption) of stroke among Hispanics. One example of primary prevention is to educate Hispanics on healthy lifestyle behaviors, such as exercising, limiting alcohol consumption, quitting smoking, and eating healthy foods. Secondary prevention involves early detection of a disease before there are symptoms or signs of the disease (NASEM, 2017). Examples of secondary prevention include screening tests (i.e., fasting plasma glucose test) and regular exams for Hispanics to detect stroke and stroke risk factors (i.e., Type 2 diabetes). Tertiary prevention is the management of diseases, after a diagnosis, to prevent the disease from progressing (NASEM, 2017). An example of tertiary prevention is to manage stroke among Hispanics by developing a chronic disease management program or a stroke rehabilitation program.

Literature Review on Modifiable Risk Factors and Stroke

Obesity and Stroke

Obesity is a risk factor for stroke, regardless of sex or race (CDC, 2018b). In the United States, the prevalence of obesity from 2017 to 2018 was 42.4% among adults (Hales et al., 2020). In addition, the prevalence of obesity was 44.8% for Hispanics, 49.6% for non-Hispanic Blacks, 42.2% for non-Hispanic Whites, and 17.4% for non-Hispanic Asians. Obesity can lead to decreased quality of life and cause other health conditions, such as diabetes, heart disease, and hypertension. Individuals with a high BMI (i.e., 30 or greater) have an increased risk of having a stroke compared to those with a healthy or normal BMI (Mitchell et al., 2015). Obesity is the lead cause of mortality that can be prevented in the United States. Due to excess adipose tissue, obesity increases the risk of stroke by causing an increased risk of blockage and restricting blood flow to the brain. Skolarus et al. (2014) examined the association between BMI and all-cause mortality among Mexican Americans and non-Hispanic Whites with acute ischemic stroke. In this study, the researchers, who categorized obesity as Class 1 obesity (30 to 34.9 kg/m^2), Class 2 obesity (35 to 39.9 kg/m^2), and severe obesity (greater than or equal to 40 kg/m^2) found that severely obese patients with acute ischemic stroke have the highest mortality, and stroke patients with a BMI of 35 kg/m^2 was associated with the lowest risk of mortality (Skolarus et al., 2014).

The Hispanic community is affected by poor dietary behaviors in the United States (Villegas et al., 2018). Engaging in regular physical activity and eating a healthy diet can help decrease obesity, prevent excess weight gain, and reduce the risk of stroke

(CDC, 2018b). Villegas et al. (2018) researched factors that influence changes in dietary patterns, food preferences, and health behaviors of Hispanic immigrants. In their study, Hispanics reported an increase in eating outside of their homes and eating foods high in saturated fats (Villegas et al., 2018). The authors concluded that acculturation, location, and immigration were all barriers to healthy dietary habits among Hispanic immigrants. Hispanics living in rural areas often have limited access to healthy foods and places to engage in physical activity compared to those living in urban areas. Kwon et al. (2015) examined the relationship between the consumption of fruits and vegetables, being physically active, and health-related quality of life among older racial/ethnic minorities in New York City. The highest prevalence of adequate physical activity was found among Hispanics (Kwon et al., 2015). The authors noted that Hispanics reported 14 or more unhealthy days of poor mental health, physical health, and activity limitation. Due to the self-reported data, the authors could not establish a cause-and-effect relationship; however, significant associations were found between physical health days and fruit and vegetable intake among older Hispanics.

Diabetes and Stroke

Diabetes is one of the leading causes of stroke. Tun et al. (2017) reported that individuals who have diabetes are 4 times more likely to have a stroke than individuals without diabetes. Hispanics have a greater risk of Type 2 diabetes and prediabetes (Nokes et al., 2015). Physical inactivity, obesity, hypertension, dietary patterns, and genetics are all factors that contribute to the greater risk of Type 2 diabetes among Hispanics (Tun et al., 2017). There are multiple ways to prevent the development of Type 2 diabetes, such

as exercising 30 minutes a day for 5 days a week, drinking water, eating healthy foods, consuming fewer calories each day, and losing weight.

In comparison to non-Hispanic Whites, Hispanics are more susceptible to have a stroke at an early age due to diabetes and worse health outcomes (i.e., hypertension, high cholesterol, and obesity; Nokes et al., 2015). Kim et al. (2017) investigated differences in undiagnosed diabetes and prediabetes among various race/ethnic groups of stroke survivors in the United States. In their study, the National Health and Nutrition Examination Survey was used to assess the history of stroke from 1999–2010 (Kim et al., 2017). The highest prevalence of undiagnosed diabetes and prediabetes was found among non-Hispanic Blacks; however, the results also showed a higher prevalence of diabetes among Mexican Americans more than non-Hispanic Whites.

Smoking and Stroke

Cigarette smoking is a modifiable risk factor of stroke (Chen et al., 2019). Smoking cigarettes can worsen mental health, decrease physical functioning, and increase the severity of chronic diseases (CDC, 2018a). Every year, 1 in 5 deaths is caused by smoking cigarettes in the United States (Hu et al., 2019). Individuals who smoke have a greater risk of cardiovascular diseases, such as coronary heart disease and stroke. Smoking can damage blood vessels by making them thicken or grow narrower, which causes an increase in heart rate and blood pressure.

Researchers have provided several benefits to quitting smoking. Once an individual quits smoking, the body starts to repair any smoking-related damages, and the risk of diseases caused by smoking is reduced (CDC, 2018a). Within a 2- to 5-year

timeframe, stopping cigarette smoking can decrease the chances of having a stroke to the risk of a nonsmoker (CDC, 2018a). Chen et al. (2019) investigated the relationship between smoking and the risk of recurrent stroke, and the results showed 2 times the risk of stroke recurrence for persistent smokers more than nonsmokers after stroke.

According to Kaplan et al. (2014), smoking-related diseases are a leading cause of death among Hispanics. Hispanics have an intermittent smoking pattern, which is a pattern of smoking that does not occur daily. Smoking cigarettes is more common among Hispanic and Latinx men compared to women. Researchers have found an increase in intermittent smoking among Puerto Rican and Mexican men and a decrease in heavy daily smoking among men and women of Hispanic and Latinx ethnic groups (Blanco et al., 2014). Due to sticky blood and clot formations, smoking can lead to a stroke by causing blockages that disrupt the flow of blood to the brain and heart (ASA, 2020). In the United States, smoking behaviors differ across the Hispanic and Latinx population. Kaplan et al. examined the smoking prevalence and smoking behaviors among 16,322 Hispanic and Latinx adults in urban areas of the United States. The authors recruited participants from the Hispanic Community Health Study/Study of Latinos to assess cigarette smoking behaviors based on factors, such as national background and socioeconomic status. Their results showed that Dominicans had a lower prevalence of smoking, and Cubans and Puerto Ricans had a higher prevalence of smoking (Kaplan et al., 2014). Hispanic and Latinx adults with a lower income and lower education levels were more likely to be a current smoker and less likely to quit smoking.

Tobacco smoking is a risk factor for several chronic diseases. Quinones et al. (2017) examined whether the diagnosis of chronic diseases (i.e., stroke) can cause changes in smoking behaviors between different racial/ethnic groups. The authors used data from the 1992–2010 Health and Retirement Study to conduct a secondary data analysis. The results revealed that the highest percentage of smokers who quit after a new stroke diagnosis were Latinx older adults (38%; Quinones et al., 2017). Despite these results, the authors concluded that Latinx adults were less likely to reduce smoking behaviors compared to their White counterparts. In a similar study, Tran et al. (2020) found an increase in smoking continuation after stroke among the following socio-demographic factors: male gender, health care coverage, higher education, older age, higher income levels, and Hispanic or Asian ethnicity.

Alcohol Consumption and Stroke

Alcohol consumption is a risk factor of chronic diseases that can cause a stroke and negatively impact the Hispanic community in the United States. Light, moderate, heavy, and binge drinking are the different levels of alcohol consumption (CDC, 2020a). Heavy drinking, also known as excessive alcohol consumption, results in more than 80,000 deaths per year in the United States (CDC, 2020a). In the Hispanic community, Puerto Ricans and Mexicans have the highest rate of alcohol consumption (Velasco-Mondragon et al., 2016). The use of alcohol is introduced in early adolescence. Nino et al. (2017) examined the development of heavy drinking and drunkenness among four Latina and Latino ethnic groups from childhood to adulthood. The authors used data from the National Longitudinal Study of Adolescent to Adult Health to assess alcohol use

among Mexican Americans, Puerto Ricans, Cubans, and Central/South Americans (Nino et al., 2017). Their results showed that heavy drinking and drunkenness among Latina and Latino ethnic groups increases in childhood, reaches the highest point in early adulthood, and declines in adulthood.

In a similar study, Caetano et al. (2014) assessed alcohol consumption (i.e., binge drinking and alcohol use disorder) and age at first drink among Hispanics (i.e., Mexican Americans, Puerto Ricans, Cubans, and Central/South Americans) in the United States. Participants in their study came from two independent studies that conducted interviews using the Hispanic Americans Baseline Alcohol Survey and the border survey. The researchers found that drinking at a younger age is associated with higher probabilities of binge drinking and alcohol use disorder (Caetano et al., 2014). Furthermore, the Hispanics born in the United States are more likely to consume alcohol at a younger age compared to those who are foreign born. Researchers have found that light to moderate alcohol consumption is protective against ischemic stroke but increases the risk of hemorrhagic stroke; however, excessive alcohol consumption increases the risk of both ischemic and hemorrhagic stroke (Larsson et al., 2016).

Education and Stroke

Education is an indicator of socioeconomic status and a consistent predictor of cardiovascular disease (Rodriguez et al., 2014). Socioeconomic status is a reliable predictor of health outcomes and overall quality of life; a low socioeconomic status is associated with higher rates of cardiovascular morbidity and mortality (Rodriguez et al., 2014). The socioeconomic status of Hispanics is lower than non-Hispanic Whites in the

United States (Moon et al., 2012; Rodriguez et al., 2014). Educational attainment has increased among Hispanics (Velasco-Mondragon et al., 2016). Despite the increase in education, foreign-born Hispanics have the lowest educational attainment in the United States (Rodriguez et al., 2014). Education is linked to stroke risk factors. For example, researchers have found that among Hispanic and Latinx men and women, education is associated with current drinking status (Castaneda et al., 2019).

Health education related to stroke is another important component of education. The U.S. Latinx immigrant population continues to suffer from a lack of stroke knowledge and stroke risks (Silberberg et al., 2018). Silberberg et al. (2018) examined a community-based intervention that focused on stroke education in classes and workshops among Latinx immigrants. The authors placed the participants into two separate groups: Participants with high stroke risk factors or a prior history of stroke were placed in the care management group, and participants with low stroke risks were assigned to the programming group. Both groups received stroke education related to stroke risk factors, knowledge, symptoms, and prevention. Surveys were administered to test the stroke knowledge of each participant before, during, and after the stroke education. The results showed an increase in stroke knowledge for both groups and a significant increase in knowledge for Latinx immigrants with low education levels. Olaiya et al. (2017) also examined an intervention led by nurses to educate and improve the knowledge of stroke risk factors among patients with a stroke or transient ischemic attack. The researchers found that the intervention group showed an improvement in the knowledge of stroke risk

factors but concluded that more effective strategies are needed to educate stroke patients (Olaiya et al., 2017).

Summary and Transition

In this chapter, I provided evidence showing that there are several risk factors for stroke. Obesity, diabetes, alcohol consumption, smoking, and education are all risk factors that may influence the prevalence of stroke among Hispanics. There is little to no evidence in the literature to demonstrate an association between all five variables and stroke in the Hispanic population. The findings of this study will add to the existing literature by providing data and results to help develop future stroke interventions targeted towards stroke prevention and reducing stroke outcomes among Hispanics. In Chapter 3, I explain the research design, approach, and methodology.

Chapter 3: Methods

The purpose of this quantitative study was to examine the association between multiple risk factors and stroke among Hispanics. Hispanics have a high prevalence of stroke and stroke risk factors, such as obesity, diabetes, smoking, alcohol use, and education. In this chapter, I discuss the research design and approach, methodology, target population, sampling and sampling procedures, sample size and power calculations, instrumentation and operationalization of constructs, statistical analysis, research questions, and threats to validity.

Research Design and Approach

In this study, I used a quantitative approach to analyze secondary data. A quantitative method was appropriate for this study because it allowed me to determine the association between the independent variables (i.e., risk factors) and the dependent variable (i.e., stroke). This research includes a cross-sectional study design using the 2017, 2018, and 2019 BRFSS data sets. A cross-sectional study design is appropriate to use for population-based surveys and comparing different variables. I chose a quantitative, cross-sectional research design to explore the association between the categorical independent and dependent variables using statistical analyses.

Methodology

Target Population

The population of the BRFSS represents U.S. adult residents in all 50 states, the District of Columbia, and three U.S. territories (CDC, 2019). The sample for this study was limited to Hispanic adults (i.e., individuals of Hispanic, Latinx, or Spanish origin)

aged 18 years and older. The Hispanic population is 1.6 times more likely to develop a

stroke than non-Hispanic Whites (Aldayel et al., 2017). I selected Hispanics as the target

population for this study to examine the association between modifiable risk factors for

stroke (i.e., alcohol consumption, obesity, smoking, diabetes, and education) and the

diagnosis of stroke among this population.

Sampling and Sampling Procedures

Random digit dialing techniques on the cell phone and landline were used to

capture BRFSS data from all survey respondents (CDC, 2019). The BRFSS data were

collected at the state level. Each state used the same sampling methodology known as

iterative proportional fitting or the raking method. This particular sampling and weighting

method assigns a weight to each survey participant, and the weighted distribution of the

sample is close to the control variables (i.e., demographic variables; Iachan et al., 2016).

An advantage of using the raking method is to increase the representation of the sample

and decrease selection bias. Due to the variation in samples at the state level, national

weights and variance estimates were used to represent the total population. For this study,

I analyzed the BRFSS data using sample weights to generalize the sample to the

population.

Sample Size and Power Calculations

I conducted a power analysis to determine the sample size for this study. A power

analysis determines the sample size using the effect size and significance level (Bujang et

al., 2018). When the statistical power is higher, the sample size is larger. An adequate test

power is typically 80% or greater (Bujang et al., 2018). Understanding this process was

important to determining the minimum sample size that would yield a statistically significant result. This study included multiple comparisons of the dependent variable, which resulted in an alpha level of .01. I used G*Power 3.1 software to perform the statistical power analysis for the chi-square test and multiple binary logistic regression as well as calculate the sample size. Due to the different variables in each research question, a separate power analysis was calculated.

To calculate the sample size for power analysis for the first research question and examine the association between obesity and the diagnosis of stroke among Hispanics, the odds ratio was 1.5, the alpha error probability was 0.01, the probability $(Y = 1|X = 1)$ H_o was 0.2, the power $(1 -$ beta error probability$)$ was 0.80, the R^2 other X was zero, the X distribution was binomial, and the X parm π was 0.5. The calculation resulted in a minimum sample size of 1,599 and an 80% chance of correctly rejecting the null hypothesis that obesity is not associated with stroke among Hispanics.

To calculate the sample size for power analysis for the second research question and examine the association between diabetes and the diagnosis of stroke among Hispanics, the odds ratio was 1.5, the alpha error probability was 0.01, the power $(1 -$ beta error probability$)$ was 0.80, the R^2 other X was zero, the X distribution is binomial, and the X parm π was 0.5. The calculation resulted in a minimum sample size of 1,599 and an 80% chance of correctly rejecting the null hypothesis that diabetes is not associated with stroke among Hispanics.

To calculate the power analysis of the association between obesity, diabetes, alcohol consumption, smoking, education, and the diagnosis of stroke among Hispanics,

the odds ratio was 1.5, the alpha error probability was 0.01, the power (1 − beta error probability) was 0.80, the R^2 other X was 0.25, the X distribution was binomial, and the X parm π was 0.5. The calculation resulted in a minimum sample size of 2,131 and an 80% chance of correctly rejecting the null hypothesis that there is no association between obesity, diabetes, alcohol consumption, smoking, education, and the diagnosis of stroke among Hispanics.

Data Collection of Secondary Source

The BRFSS is a telephone health survey system that collects data from each state in the United States related to health risk behaviors and chronic diseases (CDC, 2019). This is the most extensive adult health survey system, with numerous interviews completed every year. The BRFSS data are used to monitor disease rates, detect populations at a higher risk for chronic diseases, and develop local and state-level prevention strategies. The BRFSS data are available to the public, and there are no permissions needed to access the data. The data set is free to download and can be retrieved through the Annual Survey Data section of the CDC website. In this study, I analyzed secondary data from the BRFSS. The data related to smoking, alcohol consumption, obesity, diabetes, and stroke were available in the BRFSS 2017, 2018, and 2019 data sets, which were the most recent BRFSS data accessible on the CDC website. The use of secondary data for this study was beneficial because it allowed for the use of a large population-based survey to conduct research and was economical (see Cheng & Phillips, 2014). An advantage of using secondary data for this study was that it saved time on data collection, and the data were easily accessible to the public (see Cheng &

Phillips, 2014). This study included variables on demographics, health risks, and chronic disease.

Instrumentation and Operationalization of Constructs

The data collection method for this study was a population-based survey used for secondary data analysis. I used 2017, 2018, and 2019 BRFSS data to conduct this research. The BRFSS survey includes a set of core questions with an optional module set of questions on specific health issues. The annual questionnaire is available in English and Spanish. State health departments use interviewers, call centers, and universities to administer these surveys to participants through cell phones and landlines (CDC, 2019).

The operationalization of constructs for this study included alcohol consumption, obesity, smoking, diabetes, education, and stroke. The dependent variable was the diagnosis of stroke; the key independent variables were obesity and diabetes; and the confounding variables were alcohol consumption, smoking, and education. All variables were categorical variables in this study. Each variable consisted of different levels of measurement. The dependent variable had a binary measurement. Smoking and education had ordinal levels of measurement, and obesity and diabetes had a nominal scale. In the data set, alcohol consumption was a continuous variable, but I recoded the variable to include the following ordinal measurements: light, moderate, heavy, and binge drinking.

Table 1

Description of Operational Measures

Variables	Description	Response Categories	Variable Type
		Dependent Variable	
Stroke	Ever diagnosed with a stroke?	1 = Yes 0 = No	Binomial
		Independent Variables	
Obesity	BMI ≥ 30	1 = Obese 0 = Not obese	Binomial
Diabetes	Ever told you have diabetes?	1 = Yes 0 = No	Binomial
		Confounding Variables	
Smoking	Do you now smoke cigarettes every day, some days, or not at all?	1 = Not at all 2 = Some days 3 = Every day	Ordinal
Alcohol consumption	Average alcoholic drinks per day in the past 30 days	1 = Light drinking 2 = Moderate drinking 3 = Heavy drinking 4 = Binge drinking	Ordinal
Education	Education level completed	1 = Did not graduate high school 2 = Graduated high school 3 = Attended college or technical school 4 = Graduated from college or technical school	Ordinal
Race	Hispanic, Latinx, or Spanish origin	1 = Hispanic, Latinx, or Spanish origin 0 = Not of Hispanic, Latinx, or Spanish origin	Nominal

Note. Variables used in the study from the 2017, 2018, and 2019 BRFSS questionnaires.

Statistical Analysis

I used descriptive statistics to characterize the study sample and inferential statistics for the hypotheses testing analyses. The descriptive statistics included frequencies and percentages. The inferential statistics included the chi-square test and multiple logistic regression analysis. A chi-square test of independence is performed to examine the statistical significance between categorical variables (Rana & Singhal, 2015). Logistic regression is a type of predictive analysis used when the dependent variable is binary or dichotomous (Sperandei, 2014). Logistic regression describes the relationship between one or more independent variables and one dichotomous dependent variable.

There are five assumptions for the logistic regression analysis (Kalil et al., 2010). The first assumption for a binary logistic regression is that the dependent variable is binary. The second assumption requires linearity between the independent variables and the log odds. The third assumption of logistic regression assumes the independence of each observation. The fourth assumption requires the independent variables to have minimal or no multicollinearity, which means that the predictor variables should not have a high correlation. The fifth assumption generally requires a large sample size for the logistic regression analysis. I used the Statistical Package for the Social Sciences (SPSS), Version 27 in this study for data analysis.

Research Questions and Hypotheses

Research Question 1: Is there an association between obesity and the diagnosis of stroke among Hispanics?

$H_0$1: There is no association between obesity and the diagnosis of stroke among Hispanics.

H_A1: There is an association between obesity and the diagnosis of stroke among Hispanics.

The key independent variable for this research question was obesity (i.e., BMI $\geq$ 30), the dependent variable was the diagnosis of stroke (i.e., Yes, No), and the statistical analysis test was a bivariate model with the Pearson chi-square. The null hypothesis was rejected if $p < .01$.

Research Question 2: Is there an association between diabetes and the diagnosis of stroke among Hispanics?

$H_0$2: There is no association between diabetes and the diagnosis of stroke among Hispanics.

H_A2: There is an association between diabetes and the diagnosis of stroke among Hispanics.

The key independent variable for this research question was diabetes (i.e., Yes, No), the dependent variable was the diagnosis of stroke (i.e., Yes, No), and statistical analysis test was a bivariate model with the Pearson chi-square. The null hypothesis was rejected if $p < .01$.

Research Question 3: Is there an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education?

$H_0 3$: There is no association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

$H_A 3$: There is an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

The key independent variables for this research question were obesity and diabetes; the confounding variables were alcohol consumption (i.e., amount of drinking in past 30 days), smoking (i.e., current frequency of smoking), and education (i.e., level of education completed), and the dependent variable was the diagnosis of stroke. The statistical analysis test was multiple logistic regression. The null hypothesis was rejected if $p < .01$.

Threats to Validity

Validity in research is essential to determine that the survey questions accurately measure the social problem. Internal validity refers to the true representation of the observed results in the study population (Patino & Ferreira, 2018). The possible threats to internal validity in this study include instrumentation and selection bias. Selection bias occurs when the selection of participants in a study are unrepresentative of the population of interest. Selection bias was minimized in this study because the BRFSS is a cross-sectional survey that consists of adults in the United States, and this study involved Hispanic adults aged 18 years and older. The BRFSS conducts telephone interviews in each state, using the random digit dialing method to reduce selection bias.

Instrumentation relates to how an instrument is designed, assessed, and administered which can lead to bias. The BRFSS coordinators and staff members from each state health department receive training from the CDC on the correct approach to administer the survey questions and analyze the data. The CDC is responsible for processing the data, providing monthly and yearly reports on data quality, and conducting annual training on survey design, research methods, and collecting data using computer-assisted telephone interviewing (CDC, 2019). Another threat is external validity.

External validity occurs when the study results among the participants are generalizable to other populations (Patino & Ferreira, 2018). The threat to external validity is based on the specific time, place, or people involved in the study. Every year, the BRFSS is used to collect health data from adult residents in the United States located in all 50 states, three U.S. territories, and the District of Columbia. I minimized the threat to external validity by weighting the sample of Hispanic adults to represent the Hispanic adult population in the United States. Using a large data set, such as the BRFSS helped eliminate threats to internal and external validity in this study.

Ethical Procedures

Participation in the BRFSS is voluntary. The BRFSS does not provide personally-identifiable information which protects the confidentiality of the participant's answers. All answers to the survey questions are combined to ensure that the data cannot be traced back to a specific individual. The telephone numbers used to contact each person is not included in the public data sets. The data for this study was obtained from the CDC website: https://www.cdc.gov/brfss/annual_data/annual_data.htm. For the secondary

analysis of this study, I obtained the Institutional Review Board approval (#11-12-20-0690082) at Walden University.

Summary and Transition

The purpose of this study was to examine the association between multiple risk factors and stroke among Hispanics. In Chapter 3, I explained the research design and approach, study methodology, threats to validity, and ethical procedures. This doctoral study includes a cross-sectional study design using secondary data from the BRFSS 2017, 2018, and 2019 data sets. The exposure variables are obesity and diabetes; the confounding variables are alcohol consumption, smoking, and education, and the dependent variable is the diagnosis of stroke. For the statistical analysis of the research questions and hypotheses, I merged the 2017, 2018, and 2019 BRFSS datasets and completed a chi-square test and multiple logistic regression analysis to determine the association between the modifiable risk factors and stroke. In Chapter 4, I explain data collection, data management, and the descriptive and inferential results of the study.

Chapter 4: Results

The purpose of this quantitative study was to examine the association between multiple risk factors and stroke among Hispanics. This study was used to answer three research questions to determine the association between obesity, diabetes, alcohol consumption, smoking, education, and stroke. In this chapter, I describe the process of secondary data collection and management, as well as the descriptive analysis used to explain the demographic characteristics of the sample population. The statistical assumptions are explained, and the Pearson chi-square and multiple logistic regression analyses performed are discussed.

Data Collection and Data Management

The data for this study were initially collected by the BRFSS 2017, 2018, and 2019 telephone health surveys among U.S. adult residents in all 50 states, the District of Columbia, and three U.S. territories (see CDC, 2019). The sampling method for the BRFSS was the iterative proportional fitting or raking method, which increases the representation of the sample (CDC, 2019). For each year, the overall mean response rates for the 2017, 2018, and 2019 BRFSS landline and cell phone surveys were 44.9%, 49.8%, and 50%, respectively. The original intent of this study was to collect data from the 2017 and 2018 BRFSS data sets; however, after collecting and analyzing the data, the sample size was inadequate for the number of Hispanics diagnosed with a stroke. Consequently, I downloaded and merged the 2017, 2018, and 2019 data sets to obtain an adequate sample size ($n = 2,828$) of Hispanics who were diagnosed with a stroke. The BRFSS 2017, 2018, and 2019 data sets were downloaded and merged in SPSS to create

one data set. The merged data set resulted in a sample population of 111,429 Hispanic

adults aged 18 years and older. I cleaned the data by removing incomplete, missing, and

irrelevant data. The final data set was securely saved as an SPSS statistics data (.sav) file

on my computer.

I recoded the dependent variable, stroke, from (1 = yes and 2 = no) to the

binomial distribution (0 = no and 1 = yes). The exposure variables (i.e., obesity, diabetes,

smoking, and alcohol consumption) were also recoded for this study. The BRFSS data

sets code obesity into the following BMI groups: underweight (BMI < 18.5), normal

weight (18.5 ≤ BMI < 25), overweight (25 ≤ BMI < 30), and obese (BMI ≥ 30). For the

current study, the obesity variable was recoded into a binomial variable and labeled as 0

= not obese (BMI < 30) and 1 = obese (BMI ≥ 30). Diabetes was categorized as yes, yes

(female informed during pregnancy), no, and no (prediabetes). The variable diabetes was

recoded as 0 = no and 1 = yes. Smoking was categorized as the frequency of days now

smoking, and the categories were recoded as 1 = not at all, 2 = some days, and 3 = every

day. Alcohol consumption was classified as a continuous variable to represent the

average number of alcoholic beverages consumed per day in the past 30 days. The

variable was converted into the following categories: 1 = light drinking, 2 = moderate

drinking, 3 = heavy drinking, and 4 = binge drinking. All changes are presented in Table

1. Missing data include stroke (0.3%), obesity (14%), diabetes (0.3%), smoking (71%),

education (0.5%), and alcohol consumption (61%). Data reported as missing, incomplete,

do not know, or refused were recoded as system missing and excluded from this study.

Descriptive and Inferential Results

Characteristics of the Study Sample

The demographic characteristics of this study included a sample of 111,429 Hispanic adults who responded to the 2017, 2018, and 2019 BRFSS surveys. The study sample was weighted to represent the national sample of Hispanics aged 18 years and older using the final weight variable of _LLCPWT. The weighted and unweighted frequencies and percentages for the categorical variables of age, gender, marital status, health care coverage, education, and income level are presented in Table 2. The majority of the sample (39.9%) and (32.1%) were between the ages of 25 to 44 years old and 45 to 64 years old, respectively. There were slightly more females (54%) than males (46%). Over half of the respondents (55.6%) were not married, and more than half (75.6%) had health care coverage. In addition, over a third (40.1%) had an income level of $15,000 to less than $35,000.

Table 2

Unweighted and Weighted Demographic Characteristics of Study Sample

Characteristic	Unweighted Frequency N	Unweighted Percentage %	Weighted Percentage %
Age group			
Age 18 to 24	13,496	12.1	16.6
Age 25 to 44	44,460	39.9	45.0
Age 45 to 64	35,755	32.1	27.8
Age 65 or older	17,718	15.9	10.6
Gender			
Male	34,131	46.0	49.7
Female	40,128	54.0	50.3
Marital status			
Married	49,191	44.4	44.3
Not married	61,540	55.6	55.7
Health care coverage	83,801	75.6	71.3
Yes	26,993	24.4	28.7
No			
Income level			
Less than $15,000	18,699	20.6	20.3
$15,000 to < $35,000	36,300	40.1	39.7
$35,000 to < $50,000	11,079	12.2	12.5
$50,000 or more	24,496	27.0	27.5

Note. $N = 111,429$. Pooled BRFSS data of the Hispanic population, 2017–2019.

Demographic Characteristics by Stroke

The weighted demographic characteristics by stroke are presented in Table 3. Based on the weighted data, among Hispanics who were diagnosed with a stroke, 6.8% were age 65 and older, 2.4% were males, 2.5% had health care coverage, and 3.3% had an income level of less than $15,000. In addition, among Hispanics diagnosed with a stroke, 2.1% were married and 2.2% were not married. The results showed a significant association between demographic variables (i.e., age, gender, marital status, health care coverage, and income level) and the diagnosis of stroke among Hispanics ($p < .01$).

Table 3

Weighted Demographic Characteristics by Stroke

Variables	Stroke Diagnosis		*P*–value
	Yes	No	
Age group			< .001*
Age 18 to 24	0.4%	99.6%	
Age 25 to 44	0.9%	99.1%	
Age 45 to 64	3.3%	96.7%	
Age 65 or older	6.8%	93.2%	
Gender			< .001*
Male	2.4%	97.6%	
Female	2.1%	97.9%	
Marital status			< .003*
Married	2.1%	97.9%	
Not married	2.2%	97.9%	
Health care coverage			< .001*
Yes	2.5%	97.5%	
No	1.3%	98.7%	
Income level			< .001*
Less than $15,000	3.3%	96.7%	
$15,000 to < $35,000	2.2%	97.8%	
$35,000 to < $50,000	1.7%	98.3%	
$50,000 or more	1.2%	98.8%	

Note. Weighted BRFSS data of the Hispanics (2017–2019); $p < .01$ indicates statistical significance.

Descriptive Analyses of Key Study Variables

The descriptive analyses of the study variables consisted of the weighted and unweighted frequency distribution for stroke, obesity, diabetes, smoking, and alcohol consumption (see Table 4). Based on the weighted data, most of the respondents (97.9%) did not report a stroke diagnosis, and over half (66.3%) did not report being obese. The majority of the respondents (86.7%) did not have diabetes, and more than half (57%) reported that they do not smoke at all. In addition, most of the sample (40.7%) is moderate drinkers compared to light drinkers (31.2%), heavy drinkers (14.3%), and binge drinkers (13.8%). Education level shows that more of the sample (35%) did not graduate high school compared to those that graduated from high school (27.6%), attended college or technical school (23.1%), and graduated from college or technical school (14.3%).

Table 4

Unweighted and Weighted Frequency Distribution of the Study Variables

Variable	Unweighted Frequencies	Unweighted Percentages	Weighted Percentages
Stroke			
Yes	2,828	2.5	2.1
No	108,254	97.5	97.9
Obesity			
Obese	32,468	34.0	33.7
Not obese	63,036	66.0	66.3
Diabetes			
Yes	17,060	15.4	13.3
No	94,034	84.6	86.7
Smoking			
Not at all	19,364	59.5	57.0
Some days	5,556	17.1	19.9
Every day	7,633	23.4	23.1
Alcohol consumption			
Light drinking	14,114	32.7	31.2
Moderate drinking	17,859	41.3	40.7
Heavy drinking	5,700	13.2	14.3
Binge drinking	5,543	12.8	13.8
Education			
Did not graduate high school	28,836	26.0	35.0
Graduated high school	31,520	28.4	27.6
Attended college or technical school	25,436	22.9	23.1
Graduated college or technical school	25,072	22.6	14.3

Note. $N = 111,429$. BRFSS data of the Hispanic population, 2017–2019.

Statistical Assumptions

The first assumption for a binary logistic regression is that the dependent variable is binary or dichotomous, consisting of two values (Kalil et al., 2010). The binary assumption was met for this study because the dependent variable (i.e., stroke) had two values (i.e., yes and no). The second assumption relates to the linearity of the independent variables (Kalil et al., 2010). The second assumption was met due to linearity between the independent variables and the log odds. The third assumption of logistic regression assumes the independence of each observation (Kalil et al., 2010). The assumption of independence was met because the observations did not consist of matched or repeated data. The fourth assumption requires the independent variables to have minimal or no multicollinearity, which means that the independent variables (i.e., obesity and diabetes) and the confounding variables (i.e., alcohol consumption, smoking, and education) should not have a high correlation; however, multicollinearity does not decrease the reliability of the model. The fifth assumption generally requires a large sample size for the logistic regression analysis (Kalil et al., 2010). Due to the large population in the BRFSS data, this study met this assumption with 111,429 Hispanic adults.

Research Questions and Hypotheses

I addressed three research questions in this study. The results of the chi-square and multiple logistic regression analyses are presented in this section. The statistical analyses were performed to test the following research questions and hypotheses:

Research Question 1: Is there an association between obesity and the diagnosis of stroke among Hispanics?

$H_0$1: There is no association between obesity and the diagnosis of stroke among Hispanics.

H_A1: There is an association between obesity and the diagnosis of stroke among Hispanics.

To investigate the first research question, a bivariate model with the Pearson chi-square test was conducted. The exposure variable is obesity (BMI < 30) = 0 and (BMI ≥ 30) = 1, and the outcome variable is the diagnosis of stroke (yes = 1 and no = 0). Table 5 showed that among Hispanics diagnosed with a stroke, 2.7% were obese, and 2.0% were not obese. The analysis ($X^2 = 62192.1$, $df = 1$, and $p < .001$) showed a significant association between obesity and stroke. Due to the statistically significant results, the null hypothesis was rejected. Therefore, the results indicate that there is an association between obesity and stroke among Hispanics.

Research Question 2: Is there an association between diabetes and the diagnosis of stroke among Hispanics?

$H_0$2: There is no association between diabetes and the diagnosis of stroke among Hispanics.

H_A2: There is an association between diabetes and the diagnosis of stroke among Hispanics.

To investigate the second research question, a bivariate model with the Pearson chi-square test was conducted. The exposure variable was diabetes (no = 0 and yes = 1), and the outcome variable was diagnosis of stroke (yes = 1 and no = 0). Table 5 shows that among Hispanics diagnosed with a stroke, 1.4% had no diabetes and 6.7% had

diabetes. The analysis ($X^2 = 1950856$, $df = 1$, and $p < .001$) showed a significant association between diabetes and stroke. Due to the statistically significant results, the null hypothesis was rejected. Therefore, the results indicate that there is an association between diabetes and stroke among Hispanics.

Table 5

Chi-Square Test Between the Exposure and Outcome Variables

Variables	Stroke Diagnosis		*P*–value
	Yes	No	
Obesity			< .001*
Obese	2.7%	97.3%	
Not obese	2.0%	98.0%	
Diabetes			< .001*
Yes	6.7%	93.3%	
No	1.4%	98.6%	
Smoking			< .001*
Not at all	4.0%	96.0%	
Some days	2.2%	97.8%	
Every day	3.8%	96.2%	
Alcohol consumption			< .001*
Light drinking	2.0%	98.0%	
Moderate drinking	1.4%	98.6%	
Heavy drinking	1.4%	98.6%	
Binge drinking	1.4%	98.6%	
Education			< .001*
Did not graduate high school	2.7%	97.3%	
Graduated high school	2.0%	98.0%	
Attended college or technical school	1.9%	98.1%	
Graduated college or technical school	1.4%	98.6%	

Note. Weighted 2017-2019 BRFSS data; *p < .01 indicates statistical significance.

Research Question 3: Is there an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education?

$H_0$3: There is no association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

H_A3: There is an association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education.

To investigate the third research question, a multiple binary logistic regression was used to examine the association between the exposure variables: obesity (BMI < 30) = 0 and (BMI ≥ 30) = 1 and diabetes (no = 0 and yes = 1); the confounding variables: alcohol consumption (light drinking = 1, moderate drinking = 2, heavy drinking = 3, and binge drinking = 4), smoking (not at all = 1, some days = 2, and every day = 3), and education (did not graduate high school = 1, graduated high school = 2, and attended college or technical school = 3, and graduated from college or technical school = 4); and the outcome variable, which is the diagnosis of stroke (yes = 1 and no = 0). The reference categories include not obese, no diabetes, no smoking, light drinking, and did not graduate high school. For this study, the omnibus test (X^2 {10, n = 111,429} = 546912.711, $p < .001$) indicates that the model had a good fit. The Nagelkerke's R^2 = .140, which suggests that the model explains roughly 14% of the variation in the outcome.

For the multiple logistic regression (Table 6), the results showed that compared to non-obese Hispanics, those who are obese were 13% less likely to be diagnosed with a stroke (OR = .869, 99% CI [.862, .876], p < .001). Compared to Hispanics with no diabetes, those with diabetes were 8 times more likely (OR = 7.939, 99% CI [7.875, 8.003], p < .001) to be diagnosed with a stroke. Hispanics who smoke on some days were 49% less likely (OR = .508, 99% CI [.502, .515], p < .001), and those that smoke every day were 29% less likely (OR = .707, 99% CI [.700, .714], p < .001) to have a stroke diagnosis compared to those who do not smoke.

The results also showed that compared to those who did not graduate high school, high school graduates were 21% less likely (OR = .789, 99% CI [.781, .796], p < .001), attended college or technical school were 42% less likely (OR = .583, 99% CI [.577, .589], p < .001), and college or technical school graduates were 57% less likely (OR = .427, 99% CI [.420, .433], p < .001) to be diagnosed with a stroke. Compared to Hispanics who reported light drinking, moderate drinkers were 39% less likely (OR = .611, 99% CI [.606, .617], p < .001), heavy drinkers were 32% less likely (OR = .678, 99% CI [.670, .687], p < .001), and binge drinkers were 40% less likely (OR = .598, 99% CI [.591, .605], p < .001) to have a stroke diagnosis. The p-values were less than .01 and statistically significant, which demonstrates that there is an association between the exposure and outcome variables. Therefore, I can reject the null hypothesis and conclude that there is an association between obesity, diabetes, alcohol consumption, smoking, education, and the diagnosis of stroke among Hispanics.

Table 6

Adjusted Multiple Logistic Regression Analysis

Variables	β	S.E.	Wald	df	Sig.	Exp(β)	99 % C.I. for EXP(β)	
							Lower	Upper
Obesity	-.140	.003	1,945	1	.000	.869	.862	.876
Diabetes	2.072	.003	437,141	1	.000	7.939	7.875	8.003
Smoking			23,586	2	.000			
Not at all*								
Some days	-.676	.005	20,181	1	.000	.508	.502	.515
Every day	-.346	.004	7,547	1	.000	.707	.700	.714
Education			31,878	3	.000			
Did not graduate HS*								
Graduated HS	-.237	.004	4,012	1	.000	.789	.781	.796
Attended college or technical school	-.539	.004	18,033	1	.000	.583	.577	.589
Graduated college or technical school	-.852	.006	22,242	1	.000	.427	.420	.433
Alcohol Use			22,222	3	.000			
Light drinking*								
Moderate drinking	-.492	.004	18,107	1	.000	.611	.606	.617
Heavy drinking	-.388	.005	6,683	1	.000	.678	.670	.687
Binge drinking	-.514	.005	11,879	1	.000	.598	.591	.605
Constant	-3.28	.004	69,898	1	.000	.038		

Note. Weighted Variables: Obesity, Diabetes, Smoking, Education, and Alcohol consumption; (*)
Reference variables; HS = High school; $p < .01$ indicates statistical significance.

Summary and Transition

A multiple statistical method was used to analyze the sample of 111,429 Hispanic adults in the United States. Descriptive statistics were used to describe the sample population and study variables. The three research questions and hypotheses were examined to determine if an association exists between the modifiable risk factors (obesity, diabetes, alcohol consumption, smoking, and education) and the diagnosis of stroke among Hispanics. The null hypotheses were rejected, and the results showed a statistically significant association between obesity, diabetes, alcohol consumption, smoking, education, and stroke diagnosis among Hispanics. In Chapter 5, I explain the summary and interpretation of these findings, limitations, recommendations for future research, and implications for positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative, cross-sectional study was to examine the association between five risk factors (i.e., alcohol consumption, obesity, smoking, education, and diabetes) and the diagnosis of stroke among the Hispanic population. I analyzed pooled data from the 2017–2019 BRFSS surveys. Secondary data was weighted to represent the sample of Hispanics, 18 years old and older, in the United States. SPSS Version 27 was used to provide descriptive and inferential analyses. In this chapter, I summarize and interpret the study findings and discuss the limitations, future research recommendations and action, and social change implications before concluding the study.

Interpretation of Findings

In this study, I proposed three research questions to test the association between modifiable risk factors and the diagnosis of stroke among Hispanics. In the first research question, obesity was used as the exposure variable. In the second research question, I determined whether an association exists between diabetes and stroke diagnoses. The third question included obesity and diabetes as the exposure variables and the diagnosis of stroke as the outcome; smoking, alcohol consumption, and education were entered into the logistic regression model as confounding variables to determine whether an association exists between the exposure and outcome variables.

The results of the first research question indicated that the association between obesity and the outcome was statistically significant. My findings are consistent with Mitchell et al. (2015) who found that individuals with a higher BMI have an increased risk of having a stroke. In the second research question, the association between diabetes

and the outcome was significant. Compared to those with no diabetes, Hispanics with diabetes were 8 times more likely to have a stroke. Furthermore, the study findings showed a positive association between diabetes and stroke, which indicates that as diabetes increases, stroke increases. My findings were consistent with Arboix (2015) and Boehme et al. (2017) who reported that diabetes has a direct association that increases the risk for stroke. The results of the third research question showed that there is a statistically significant association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as smoking, alcohol consumption, and education. My findings were consistent with Boehme et al., Larsson et al. (2016), and Rodriguez et al. (2014), who reported that a low socioeconomic status and alcohol consumption is associated with higher rates of cardiovascular disease and stroke.

The results of this study are aligned with the public health prevention framework, which consists of primary, secondary, and tertiary prevention to analyze the risk factors associated with cardiovascular diseases and decrease the impact of the disease in high-risk adults. The results demonstrate the need for primary prevention to target modifiable risk factors, such as diabetes, to educate Hispanics on healthy lifestyle behaviors that can reduce their risk for stroke. The study outcomes also indicate that secondary prevention related to early detection of diabetes is needed to decrease stroke among Hispanics. Furthermore, tertiary prevention is necessary to assist Hispanic adults with long-term management of stroke and stroke risk factors that will help prevent disease progression or recurrence among the Hispanic population.

Limitations

Despite a large sample size of Hispanic adults, there were several limitations to this study. One limitation was the original BRFSS data set consisted of missing data. There were a large number of missing data for the smoking and alcohol consumption variables. I removed these missing data for the purpose of analyses in this study. The BRFSS was weighted to reflect the Hispanic population more accurately in the United States. Another limitation with using secondary data is that the study sample may experience recall bias. The BRFSS questionnaire requires respondents to recall information in the past (typically the past 30 days) related to health risks and health behaviors. Although there is evidence of validity and reliability of BRFSS data, some participants may have under- or over-reported their responses. Another limitation of this study was the use of a cross-sectional research design, which was appropriate for this study but limits the ability to establish causation. Causal inferences could not be made, especially for the statistically significant associations found between alcohol consumption, obesity, smoking, education, diabetes, and the diagnosis of stroke among Hispanics.

Recommendations for Action and Future Research

This study is beneficial because it reveals the association between modifiable risk factors (i.e., alcohol consumption, obesity, smoking, education, and diabetes) and the diagnosis of stroke among Hispanics. One advantage of using the publicly available BRFSS data set was that it eliminated time and cost restraints that are associated with primary data collection (see Cheng & Phillips, 2014). Another advantage was that most

of literature included recent studies that used primary or secondary data collection to determine the association between modifiable risk factors and stroke. However, the literature on the association between alcohol consumption, obesity, smoking, education, diabetes, and stroke among Hispanic adults was scarce, so I recommend more research be conducted to understand the association between modifiable risk factors and stroke among Hispanics.

The BRFSS questionnaire includes a Spanish version that all states can use to meet the language needs of their Hispanic populations (CDC, 2019). More information is needed to determine whether the Hispanic population understands each survey question to provide an accurate response. Regarding future research among Hispanics, I recommend using a longitudinal study design to examine demographic characteristics, modifiable risk factors, and stroke over a period of time. Longitudinal studies allow researchers to examine the same sample over time to detect any changes (Caruna et al., 2015). A prospective study design is also recommended for future research to follow a sample of Hispanic adults over time and examine the development of a stroke based on the supposed risk factors. In addition, use of a qualitative research approach could help public health professionals understand the cultural and traditional norms that may impact the lifestyle behaviors of Hispanics that have been diagnosed with a stroke.

Implications for Social Change

The outcome of this research showed a statistically significant association between obesity, diabetes, and the diagnosis of stroke among Hispanics, controlling for confounding factors such as alcohol consumption, smoking, and education. The results

can provide insight into the association between modifiable risk factors and the diagnosis of stroke among Hispanic adults. The findings of this study provide evidence for public health professionals to propose interventions that educate Hispanics on diabetes and other risk factors for stroke to reduce the burden of the disease. With the findings, public health practitioners and specialists may develop new or inform existing stroke prevention programs to increase awareness of stroke risk factors, such as diabetes, and environmental, social, or economic determinants of health that influence stroke outcomes in the Hispanic community. Such stroke prevention programs should consider the demographic characteristics, socioeconomic status, and cultural norms and values that can impact the disease management for each individual. The implications for positive social change include increasing awareness of stroke risk factors, developing stroke prevention interventions, and improving stroke management among the Hispanic population.

Conclusion

To my knowledge, the present study was the first to examine the association between obesity, diabetes, and the diagnosis of stroke, controlling for confounding factors (i.e., alcohol consumption, smoking, and education) among Hispanic adults in the United States. The study outcome showed a significant association between the modifiable risk factors and the diagnosis of stroke. Furthermore, the results revealed a positive association between diabetes and the diagnosis of stroke. The significance of the findings suggests that primary, secondary, and tertiary prevention methods are needed to reduce the risk of stroke among Hispanics. To increase prevention methods in the

Hispanic community, I suggest a need to address diabetes and risk factors for diabetes, such as family history, obesity, high blood pressure, and physical inactivity. The results of this study support the need for screening and early detection for stroke among Hispanics. The study findings may help develop health education and stroke management or rehabilitation programs to improve stroke outcomes among the Hispanic population.

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