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Assessing Preventive Care Utilization for Cardiovascular Disease Among U.S. Latinos

Melanie Helena Paredes
University of Central Florida, Me415756@ucf.edu

ASSESSING PREVENTIVE CARE UTILIZATION FOR CARDIOVASCULAR DISEASE AMONG U.S. LATINOS

By

MELANIE PAREDES

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ABSTRACT

Accounting for nearly 19% of the United States population in 2020, Latinos and Hispanics represent the second largest racial/ethnic group in the United States, totaling roughly 62.1 million people.[1,2] Given the growing population size and longer life expectancy estimates amongst the U.S. Latino/Hispanic community, healthcare practitioners and public health officials are increasingly emphasizing the healthcare needs and outcomes of this population. Alarmingly, current literature has highlighted significant disparities in cardiovascular disease (CVD) incidence and risk factors among U.S. Latinos/Hispanics.[1,3] As CVD continues to be one of the leading causes of death amongst all racial/ethnic groups across the United States, risk reduction through preventative care utilization remains of utmost importance for mitigating potential risk factors and eventual diagnosis of CVD. The purpose of the study was to quantify healthcare engagement through preventive care utilization for cardiovascular disease and associated risk factors among U.S. Latino/Hispanics.

This research study used a cross-sectional design with secondary data from the 2017-March 2020 National Health and Nutrition Examination Survey (NHANES). Variables related to sociodemographic characteristics, knowledge of CVD/risk factor history, and preventive service utilization for CVD were collected from a sample of N=2122 adult Latino/Hispanic participants, representing 40,412,679 U.S. Latinos/Hispanics. All 9 demographic variables were found to have significant associations with the 7 preventive service use variables ($p<.001$-$.016$). Similarly, most of the 11 variables related to knowledge of CVD history were found to have significant associations with the 7 preventive service use variables ($p<.001$). No significant associations were found between knowledge of high blood pressure history with medication use, and knowledge of diabetes history with A1C use. Findings from this study reveal various disparities

in CVD preventive care utilization amongst the study participants. Limitations for this study included lack of disaggregated ethnic data, possible bias in self-reported data, and missing responses. Results from this study can be utilized to inform clinicians and public health officials in establishing personalized preventive care interventions and increasing community engagement with cardiovascular preventive care services.

DEDICATION

To my parents

Whose sacrifices and perseverance have instilled in me the essence of hard work in all its dimensions, todo esto es para ustedes. Los quiero.

To my younger self

Who could've never imagined what was to come with this thesis, I dedicate this work to you.

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INTRODUCTION

In 2020, Latinos and Hispanics made up nearly 19% of the United States' (U.S.) population, totaling about 62.1 million people and making them the second-largest racial/ethnic group in the country.[1,2] According to the U.S. Department of Health and Human Services, the terms Hispanic/Latino encompasses people from Cuba, Mexico, Puerto Rico, South America, Central America, or other Spanish cultural origins.[1] This population is one of the fastest growing ethnic groups in the U.S., accounting for a 23% population expansion from 2010 to 2020, and contributing to 51.1% of total growth in the U.S. population in this decade.[2] Life expectancy of the U.S. Latino/Hispanic population has also increased significantly over the last few decades, with projections estimating an average of 86.5 years old by 2060.[1] Given the rising population estimates and increasing life expectancies among U.S. Latinos/Hispanics, healthcare practitioners and public health officials are intensifying their focus on the healthcare needs and outcomes of this expanding demographic.

Alarmingly, existing literature has highlighted significant disparities in chronic disease incidence, disease severity, and disease mortality among U.S. Latinos/Hispanics.[1,3] Cardiovascular disease (CVD), a group of disorders affecting the heart, heart tissue, and blood vessels, is noted of particular concern for U.S. Latinos/Hispanics, with roughly 52.3% of adult US Hispanic males and 42.7% of adult US Hispanic females reporting CVD diagnosis between 2015-2018.[3] Given that CVD has long been the leading cause of death among all racial/ethnic groups across the United States, using preventative care to reduce risk factors and prevent disease is crucial. Although research shows that sociodemographic and economic disparities negatively affect access to medical services among US Latinos/Hispanics, the link between these disparities and the use of preventive care for CVD and its risk factors requires further

investigation among this population. Therefore, this study aims to measure healthcare engagement by examining the use of preventive care for cardiovascular disease and associated risk factors among U.S. Latinos/Hispanics, while also exploring the role of various sociodemographic/economic characteristics on utilization patterns.

LITERATURE REVIEW

Cardiovascular Disease Among Latinos: Conditions, Risk Factors, and Prevalence

According to the World Health Organization, Cardiovascular Disease (CVD) refers to a group of disorders impacting the heart, heart tissue, and blood vessels.[4] Although differing in their etiology, the most common cardiovascular diseases include conditions such as coronary heart disease (impacting the blood vessels of the heart muscles), cerebrovascular disease (affecting the blood vessels supplying the brain), and deep vein thrombosis/pulmonary embolism (thrombus or blood clots of the lower extremities with risk of traveling to the heart and lungs).[4] Indication of cardiovascular disease and associated risk factors is especially worrisome due to its known contribution to a variety of fatal vascular, neurological, and renal conditions including stroke, transient ischemic attack, and renal dysfunction.[4,5] Although the term "cardiovascular disease" is traditionally used as an umbrella descriptor for a variety of cardiac-related conditions, the specific subset of diseases under this umbrella varies across data sets. Within the National Health and Nutrition Examination Survey (the data set used in this thesis), CVD refers to a known history of coronary heart disease, angina, myocardial infarction, or any other heart condition or cardiac-related disease.

Nationally, CVD is a leading chronic condition of U.S. patients, accounting for nearly 659,000 total U.S. deaths and approximately 41,794 US Latino/Hispanics deaths in 2019, making CVD one of the primary causes of mortality across all racial and ethnic groups.[6,11] Although recent literature indicated that COVID-19 has increased CVD mortality, rates of premature death from CVD have steadily risen through the last two decades. In fact, global

estimates of CVD prevalence have revealed a nearly two-fold increase in documented CVD cases from 271 million to 523 million, and reported global mortality increases from 12.1 million to 18.6 million from 1990 to 2019.[12] Total cardiovascular disease is also regarded as one of the most expensive chronic conditions, with direct costs (hospital services, medications, home health care) and indirect costs (loss of productivity from premature mortality) exceeding $363 billion dollars in the United States from 2016-2017.[3] According to the Center for Disease Control (CDC), the five U.S. states with the highest age and population-adjusted mortality from CVD include Oklahoma (264.2 per 100,000), Mississippi (255.2 per 100,000), Alabama (247.5 per 100,000), Louisiana (235.5 per 100,000), and Arkansas (231 per 100,000).[13] Among U.S. Latino/Hispanics, current literature has revealed nearly 52.3% of Hispanic males and 42.7% of Hispanic females age 20 years or older with reported cardiovascular disease from 2015-2018.[3] Additionally, in 2018 alone, CVD was noted as the primary cause of death for roughly 30,584 Hispanic males and 25,983 Hispanic females according to the American Heart Association.[3]

Individually, current literature has revealed the widespread burden and impact of cardiovascular disease and associated risk factors, along with disease management recommendations for patients nationwide. Although physical symptoms of cardiovascular disease range across specific CVD diagnoses, general symptoms of CVD commonly involved pain/discomfort in the center chest, arms, jaw, or back, as well numbness of the face, slurred speech, and fainting in cases of stroke or myocardial infarction.[4] CVD management interventions also vary by stage of disease, onset of symptoms, healthcare accessibility, etc. However, recommendations for CVD management typically involve the use of anti-arrhythmogenic, ischemic, or atherosclerotic medications such as aspirin, beta-blockers, and statins. Additionally, extreme cases of CVD may require the use of surgical interventions such as valvular repair,

coronary artery bypass, or transplantation.[4,14] Despite the use of cardiac medication and surgical procedures as secondary interventions for CVD reduction and management, ultimately CVD risk factor reduction remains one of the largest prevention efforts for reducing overall risk and eventual diagnosis of cardiovascular disease. Despite current literature revealing Latino/Hispanic's overall lower mortality from CVD when compared to non-Latino/Hispanic White adults (186-186.8 vs 254.5-254.7 per 100,000 people), a phenomenon known as the "Hispanic Paradox", incidence of common CVD risk factors are disproportionately noted among this patient population.[1,7] This elevated prevalence of CVD risk factors is especially worrisome given their known association with various neurological, renal, and vascular conditions such as stroke, renal dysfunction, and transient ischemic attack.[3,5] The sections that follow will discuss the main CVD risk factors affecting U.S. Latino/Hispanics- high blood pressure, obesity, diabetes, and high cholesterol

High blood pressure

High blood pressure, otherwise known as hypertension, is defined as a condition where the force (pressure) of blood along the walls of arteries is abnormally high.[15] High blood pressure is typically categorized into either normal, stage one hypertension, or stage two hypertension. According to 2017 guidelines from the American College of Cardiology, normal blood pressure is typically defined as a systolic pressure of <120 mmHg and a diastolic pressure of <80 mmHg. While high blood pressure (also known as hypertension or HTN) is typically indicated as stage 1 (general systolic pressure of >130mmHg and a diastolic pressure of >80 mmHg) or stage 2 (general systolic pressures of >140 mmHg and diastolic pressures > 90mmHg).[16] Prevalence of hypertension increases with age, with nearly 65% of hypertension being found in adults ≥ 60

years old.[17] Nationally, prevalence of hypertension among U.S. Latinos/Hispanics is generally comparable or lower than the average U.S. population, accounting for a prevalence of 43.7% among U.S. Latinos/Hispanics vs 43.6% in non-Hispanic White and 57.1% of non-Hispanic Black.[1,18] Given the broad and heterogeneous nature of the Latino/Hispanic population with respect to background, genetic composition, and cultural traditions, notable variations in hypertension rates are also seen based on country of origin. In fact, according to a 2008-2017 study of hypertension prevalence among U.S. Latino/Hispanic subgroups, Cuban and Dominican men had the highest prevalence at 27.1% and 28.1% respectively in comparison to just 17.6% in the reported Mexican subjects.[19] Despite available literature revealing prevalence of hypertension to be reported at lower rates in the general Latino/Hispanic population when compared to other ethnic groups, hypertension awareness and blood pressure management/control notably poor among U.S. Latino/Hispanic patients. In fact, a 2013-2018 study on racial/ethnic disparities in hypertension prevalence, awareness, treatment, and control revealed that only 60.5% of Latinos/Hispanics with hypertension report receiving active treatment, with only 40.0% of these patients reporting having their hypertension under control.[20] This disparity in blood pressure treatment and management raises concerns for CVD risk as uncontrolled/mismanaged HTN has been known to contribute to various hypertensive heart diseases such as left ventricular hypertrophy, stroke, and coronary heart disease.[21] Being that hypertension is regarded as one of the important indicators for CVD development, trends in HTN awareness and disparities in blood pressure control highlight a greater need for HTN control efforts such as consistent blood pressure checks and regular visits with a healthcare provider.

Obesity

Obesity is one of the fastest growing chronic conditions both in the United States and globally, with rates of obesity climbing to nearly 1.46 billion adults globally in 2008 and increasing nearly 7.2% among U.S. adults between the years of 1999-2014.[3] Obesity is defined as excess body mass and adipose tissue due to a variety of modifiable and genetic factors, typically measured through use of the BMI system. Body Mass Index (BMI) utilizes the mass of an individual in kilograms (kg) divided by ones given height in inches squared, measuring BMI in kg/m^2. This calculated number is then categorized into either underweight, normal, or overweight categories. According to obesity management guidelines from the National Heart, Lung, and Blood Institute, class 1 obesity typically ranges from 20-34.9 kg/m^2, class 2 obesity from 35-39.9 kg/m^2, and class 3 (extreme obesity) from $\geq$40 kg/m^2.[22] Despite recent scientific debate on the use and accuracy of BMI due to bias with respect to muscle mass and weight differentiation, BMI continues to be the most commonly used assessment of obesity by national health assessments and medical personnel. Available literature has revealed the staggering disparity in obesity prevalence among Latino/Hispanic patients, who are reported as having the highest prevalence of obesity across any racial/ethnic group. In fact, from 2015-2018 alone, U.S. Latino/Hispanic men aged 20+ reported obesity rates of roughly 44.0% compared to just 40.7%, 38.2%, and 13.5% of White, Black, and Asian US men respectively.[3] Nationally, there is also growing concern of obesity among Latino/Hispanic youth populations, with nearly 25.3% of Latino/Hispanic children between the ages of 6-11 years old reporting obesity, compared to just 14.0% of non-Hispanic White children between 2013-2016 alone.[1] Given the apparent initial health advantages of foreign-born Latino/Hispanic immigrants, research into the effects of acculturation on rates of obesity have been proliferated to further explain this prevalence

disparity in obesity. In fact, a 2007 cross sectional study examining obesity among Mexican participants found the following significant increases in male obesity with increased duration of time in the U.S.: 28% obesity at <5y residency, 29% obesity at 5-9y residency, 32% obesity at 10-14y residency, to 35% obesity at ≥15y residency. Among Mexican women, similar increases were found from 35% obesity at <5y residency, 39% obesity at 5-9y residency, 44% obesity at 10-14y residency, to 51% obesity at ≥15y residency.[23]

This incidence of obesity in the Latino/Hispanic community has been attributed to a variety of factors, namely a combination of various sociodemographic/cultural factors. These often include from geographical location, inadequate access to nutrient dense foods (food deserts), income disparities contributing to inadequate access to weight management services, and cultural cooking norms utilizing excess energy dense foods such as lard, high sodium seasonings, and excessive oils. Although obesity can be minimized through lifestyle modifications such as dietary habits and exercise, the growing rate of obesity in the Latino/Hispanic community has pointed to a larger need for education and prevention interventions among this patient population. More importantly, due to the physiology of obesity and its association with other prominent CVD risk factors (including diabetes mellitus), increased use of obesity preventative services such as regular healthcare provider visits and BMI monitoring remains of utmost need for general obesity risk reduction.

Diabetes Mellitus

Diabetes Mellitus (also known as DM or diabetes) reigns as one of the largest CVD risk factors for Latino/Hispanic patients, leading as the 5th highest cause of U.S. Latino/Hispanic death and contributing to nearly 10,166 Latino/Hispanic deaths in 2019 alone.[6] Diabetes is a

metabolic chronic condition involving uncontrolled blood glucose levels that is classified into 2 main subtypes resulting from insufficient insulin production, including type 1 diabetes (T1DM) and type 2 diabetes (T2DM). T1DM is defined as an autoimmune response in which the insulin-producing pancreatic cells of the body are destroyed, often being diagnosed in young children or early adults and requiring ongoing insulin treatment.[24] T2DM, however, is defined as an imbalance between insulin levels and insulin sensitivity caused by excess fatty acids and released pro-inflammatory cytokines by excess adipose tissue. T2DM is often diagnosed in adults and is heavily associated with obesity and elevated BMI.[24,25] Diabetes is primarily diagnosed and monitored utilizing a Fasting Plasma Glucose test (FPG) or a Glycated Hemoglobin (Hb) A1C measurement test. HBA1C exams are preferred for initial diagnosis given that blood glucose levels are averaged over 2-3 months, with an A1C reading of 48 mmol/mol or >6.5% indicating DM. FPG exams are typically preferred for glucose monitoring and prevention, with FPG levels of >126 mg/dL indicating DM.[25] While research has shown significant increases in youth T1DM since 2002, given the predisposed genetic influence of T1DM, T2DM prevalence remains of particular concern for U.S. Latinos/Hispanics due to higher BMI and rates of obesity previously noted in this patient population.[26] Available literature has emphasized the significant risk of diabetes to eventual cardiovascular morbidity and mortality, more specifically to damage of restricted blood vessels and arterial walls as a result of prolonged elevated blood glucose levels (hyperglycemia). In fact, in a study comparing seven-year incidence rates of myocardial infarction (MI) among nondiabetic and diabetic patients, diabetic subjects without initial history of MI had incidence rates of roughly 20.2% in comparison to 3.5% incidence in nondiabetic subjects.[27] This risk of CVD is increasingly more worrisome for Latino/Hispanic patients, with prevalence of diagnosed DM outranking all other ethnic groups at 15.1% and 14.1% in

Latino/Hispanic men and women respectively from 2013-2016.[3] Literature has also revealed variations in diabetes morbidity among U.S. Latino/Hispanic subgroups, with Mexicans having the largest prevalence at 18.3%, followed closely by Dominicans and Puerto Ricans at 18.1% each, and Cubans with the lowest prevalence rate at just 13.4%.[28] While prevalence of DM continues to be on the rise among U.S. Latinos/Hispanics, diabetes control is continuously reported at significantly lower rates among this patient group. In fact, in the 2008-2011 Hispanic Cultural Health Survey, only 58.7% of diabetic Latino/Hispanic subjects noted awareness of their condition, with only 48% reporting having controlled diabetes (defined as A1C of roughly <7%).[28] Despite national prevention efforts such as the National Diabetes Prevention Program aimed at increasing funding and resources for diabetes reduction, prevalence of controlled and uncontrolled diabetes still remains disproportionately high among Latinos/Hispanics nationwide, pointing to the increased need for patient-directed preventative service utilization. More specifically, the utilization of frequent blood glucose/A1C monitoring remains of utmost importance for early detection, treatment, and risk reduction of diabetes mellitus.

Hyperlipidemia

High blood lipid levels (also known as Hyperlipidemia, HLD, or Dyslipidemia) is known as a condition involving both genetic or acquired disorders leading to elevated total cholesterol (TC) and low-density lipoproteins (LDL), as well as decreased levels of high-density lipoproteins (HDL). Total cholesterol is regarded as the total amount of cholesterol including both HDL and LDL. High density lipoproteins are categorized as cholesterol rich proteins that are responsible for transporting excess cholesterol to the liver for proper disposal in the body. Low-density lipoproteins, however, are typically categorized as cholesterol rich particles derived

from lipolysis of triglycerides that are primarily responsible for the buildup and blockage of cholesterol in the arteries, leading to valvular conditions such as atherosclerosis.[29,30] Utilizing lipid screening criteria and national guidelines, hyperlipidemia or dyslipidemia is typically diagnosed utilizing blood laboratory tests to gather a fasting lipid profile of total cholesterol, low-density lipoproteins, and high-density lipoproteins.[29] Among US Latino/Hispanic adults, prevalence of hyperlipidemia remains worrisome as both Latino/Hispanic men and women continue to have some of the highest rates of hyperlipidemia of any racial/ethnic group. In fact, from 2017-2020, adult Hispanic men were found to have the second highest mean levels of LDL at 110.5 mg/dL (secondary to non-Hispanic adult Asian men at 114.8 mg/dL), while Hispanic women were found to have the highest mean LDL levels of any ethnic group at 115.5 mg/dL from.[11] Prevalence of low HDL levels were also seen highest in both Hispanic male and female youth with mean HDL levels of 45.4 mg/dL and 55.4 mg/DL respectively.[11] Although disaggregated literature on hyperlipidemia among US Latinos/Hispanics remains understudied in current research, limited studies have revealed variations of hyperlipidemia prevalence among studied US Latino/Hispanic subgroups. In fact, a 2015 study assessing prevalence of high cholesterol among Hispanics found participants of Cuban, Central American, and Mexican descent to have the highest prevalence of noted hyperlipidemia at 48%, 46%, and 45% respectively.[31] This disproportion prevalence is especially worrisome as HLD continues to be one of the most significant risk factors for cardiovascular disease. More specifically, hyperlipidemia has been attributed to the evolution of atherosclerosis, coronary heart disease, stroke, and other associated vascular diseases as a result of built-up cholesterol within the walls of the arteries, causing the constriction and narrowing of the blood vessels.[3,29] This CVD risk factor is further complicated by associated conditions such as T2DM and high blood pressure

due to their studied effects on decreasing HDL levels and the further constriction of blood vessels and arteries.[29] While increased prevalence and complications of hyperlipidemia continue to be studied in this population, U.S. Latino and Hispanics continue to have some of the lowest documented rates of HLD control and awareness.[3,11] This can be further seen in the 2011-2012 NHANES study where, in a group of adults with a history of myocardial infarction, only 66% of Hispanic adults reported having a controlled cholesterol (TC <200 mg/dL) in comparison to 82% of non-Hispanic White adults.[11] Given the impact of diet, physical activity, and comorbidities on the progression and severity of hyperlipidemia, primary treatment and management of HLD are generally focused on preventative service utilization and prevention behaviors. More specifically, regular moderate to high-intensity physical activity along with a low-fat (low saturated/trans-fat) diet is typically recommended for patients with mild hyperlipidemia.[11,29,30] For patients with significant hyperlipidemia and moderate to high risk of atherosclerotic CVD, a variety of lipid-lowering medications may be utilized including the use of statins and Omega-3 fatty acids.[30]

Latino/Hispanic Health Care and Preventive Service Engagement

Given the noted prevalence of various cardiovascular disease risk factors faced by the U.S. Latino/Hispanic population, engagement with preventive care services is of utmost importance for reducing CVD morbidity/mortality, and the development of associated chronic conditions such as T2DM, obesity, and HDL. However, Latino/Hispanics often have a complex and nuanced relationship with the U.S. healthcare system, plagued by a variety of barriers and restrictions to care access and utilization. Obstacles often include language barriers, cultural nuance/disconnect, acculturation, and the lack of healthcare insurance.

Language and cultural disconnect is often noted as the first major barrier to healthcare access and service utilization among U.S. Latinos/Hispanics. For new immigrants, limited English proficiency (LEP) has been largely studied to investigate patient perception of care and trust in healthcare professionals. For example, a 2017 study exploring the management of language barriers in healthcare explored the use of the word "*batalla" [battle]* that mothers of the study used to describe the lack of access to consistent Spanish interpreters or reliance on medical staff/family members for translation in non-primary care settings.[32] As the study later revealed, the effects of similar negative encounters and frustration with a lack of linguistic accommodations creates damaging effects to Latino patient/provider relationships and the utilization of preventative services. Not only do these encounters further contribute to mistrust and miscommunication regarding medical treatments, but they have also been revealed to cause reluctancy in preventive service engagement within this population.[33] Although policy interventions such as Title VI of the Civil Rights Act and national compliance guidelines have been issued and upheld by various federal health agencies, meeting the linguistic needs of LEP patients has remained difficult with increasingly limited bilingual healthcare providers and financial burdens on healthcare systems and clinics of rural communities.[32] Additionally, further literature has highlighted the cultural barriers impacting the utilization of preventive services, with increasing emphasis on the impact of traditional gender roles in Latino/Hispanic families. For example, a 2006 study investigating *Health Seeking among Mexican American Men* examined the relationship of traditional Latino gender identities like *machismo* (hypermasculinity), and the influence of these cultural/gender roles on the interpretation of medical symptoms and reluctancy to seek care for health concerns.[34] Other cultural norms and beliefs such as the identity of *Caballerismo* (Chivalry) and *Fatalismo* (Fatalism) have also been

examined for their influence on health promoting behaviors and prevention utilization, with specific regards to the barriers these beliefs create to prevention service use and early detection efforts such as cancer screenings.[32,34,35]Acculturation is also noted as a unique indicator of preventive care utilization amongst U.S. Latinos/Hispanics, often heavily impacted by both intrinsic and extrinsic factors (cultural identity and connection versus surrounding cultural community). Acculturation in U.S. Latinos/Hispanics is defined as a uni or bi-dimensional construct measured by the changes in cultural engagement with regards to music, diet, use or preference for the Spanish language, sense of cultural identity, and/or the adoption of U.S. cultural values and behaviors.[36] While the impact of acculturation has been reviewed with regards to cultural behaviors and language, the association of this factor to preventive service use is often complex and typically differs between U.S. born versus immigrated Latinos/Hispanics. Existing literature often debates the negative or positive impact of acculturation on medical engagement or prevention utilization within this community. For example, one study *Comparing Factors Related to Low Birth Weight in Rural Mexico-Born and US-Born Hispanic Women* found that U.S.-born Hispanic mothers were 1.8 times more likely to deliver low-birthweight (LBW) infants in comparison to Mexico-Born mothers.[37] This difference in LBW was likely attributed to the collected hospital records indicating that U.S.-born Hispanic women reported smoking, drinking alcohol, or using illicit drugs significantly more than Mexico-born mothers.[37] However, an additional study noting *Health care usage by Hispanic outpatients as a function of primary language* found that even after accounting for age and income distribution, use of health services increased with the use of English across groups of only Spanish-speaking, primarily Spanish speaking, and primarily English-speaking participants.[38] Measurement of acculturation's impact on prevention service utilization is also further complicated by the lack of disaggregated

data on Latino/Hispanic healthcare and service utilization, making it difficult to investigate this relationship across varying Latino/Hispanic subgroups.

An additional barrier to Latino/Hispanic healthcare engagement and preventive service utilization includes financial limitations due to income and lack of healthcare insurance. Historically, lack of healthcare insurance coverage has been one of the biggest limitations to proper healthcare access and prevention utilization, with an estimated 18.3% of Hispanics/Latinos reporting being uninsured in 2020, in comparison to just 16.7% and 17.8% in 2019 and 2018 respectfully.[1] Insurance coverage also varies among Latino/Hispanic subgroups based on country of origin, with 57.4% of Cubans, 56.3% of Puerto Ricans, 47.9% of Mexicans, and 41.7% of Central Americans reporting having some degree of healthcare insurance.[1] Being that Latino/Hispanics have some of the highest rates of uninsured patients out of any other racial/ethnic group, this lack of insurance coverage often translates to higher out-of-pocket costs for healthcare visits, preventive testing, and medications. These increased out-of-pocket costs are particularly concerning for Latinos/Hispanics who, according to 2019 US Census Bureau data, were 1.5 times more likely to be in poverty than the general U.S. population, comprising 28.1% of the total impoverished population.[39] The high prevalence of poverty among this population decreases the likelihood of being able to afford out-of-pocket medications, healthcare appointments, or preventative treatments. However, despite a slight increase in uninsured rates among U.S. Latino/Hispanics from 2018-2020, health insurance coverage has significantly risen since the pass of the 2010 Affordable Care Act (ACA), which expanded access to health coverage for low-income adults through the ACA Marketplace and Medicaid.[40] In fact, according to the US Census Bureau, U.S. Latinos/Hispanics had the largest decline in uninsurance rates compared to other racial/ethnic groups after the ACA, with rates of

uninsurance dropping from 30% in 2013 to 19% in 2017.[40] While public policy and federal outreach programs like the ACA have significantly reduced the uninsured rate of U.S. Latinos/Hispanics, these programs have yet to sufficiently close the gap in insurance status, healthcare access, and prevention utilization amongst this population. Given this evident gap in insurance status, further examination of preventive care utilization and engagement with medical services remains of utmost need for better gauging access to care and the reduction of chronic conditions such as CVD within this population.

RESEARCH QUESTIONS

The impact of various sociodemographic/sociocultural barriers has been studied in relation to healthcare engagement and service utilization among U.S. Latino/Hispanics. However, given the distinct prevalence of cardiovascular disease risk factors within the U.S. Latino/Hispanic community, a significant gap in the literature remains concerning how these disparities affect the utilization of preventive services for CVD and associated risk factors. Given the emphasis that physicians, healthcare providers, and US health policies makers place on reducing chronic disease and healthcare disparities, it is crucial to assess the use of CVD preventive services and their relationship to sociodemographic factors, to further reduce CVD risks through tailed prevention efforts. To that end, this study uses nationally representative data from the Center for Disease Control's National Health and Nutritional Examination Survey (NHANES) to address the following research questions:

1. What is the prevalence of preventive care utilization for cardiovascular disease and associated risk factors amongst U.S. Latinos and Hispanics?
2. What is the association between awareness of current/history of cardiovascular disease (CVD) risk factors and the utilization of prevention services?
3. What is the association between utilization of CVD prevention services and various sociodemographic and sociocultural factors within this population?

METHODS

This research study used a cross-sectional design with secondary data from the National Health and Nutrition Examination Survey (NHANES) provided by the National Center for Health Statistics (NCHS) and the Center for Disease Control (CDC). Established in the early 1960s, the NHANES program examines a nationally representative sample of 5,000 people each year through interviews and physical examinations to assess prevalence of major diseases, risk factors, and nutritional status.[41] This study utilized the NHANES dataset spanning from 2017 to March 2020, which combined data from 2019 to March 2020 with the 2017-2018 NHANES dataset in response to the Coronavirus pandemic (COVID-19).

Study variables

To answer the aforementioned research questions, this study analyzed and investigated key variables related to sociodemographic characteristics, awareness of current/history of CVD and associated risk factors, and CVD preventive service use among the indicated Latino/Hispanic participants. A risk factor index (RFI) was created by calculating total responses to CVD/CVD risk factor history questions including history of congestive heart failure, coronary heart disease, heart attack, stroke, and high BMI. RFI scores were then used to assess risk of CVD based on previous risk factor history. Figure 1 summarizes RFI scores without BMI ranging from 0-2 (low), 3-5 (moderate), and 6+ (high). Figure 2 summarizes RFI scores including BMI ranging from 0-3 (low risk), 4-6 (moderate risk), 7-9 (high risk), and 10+ (very high risk). Recoded BMI ranges were added to the risk factor totals to obtain the RFI scores pictured in Figure 2.

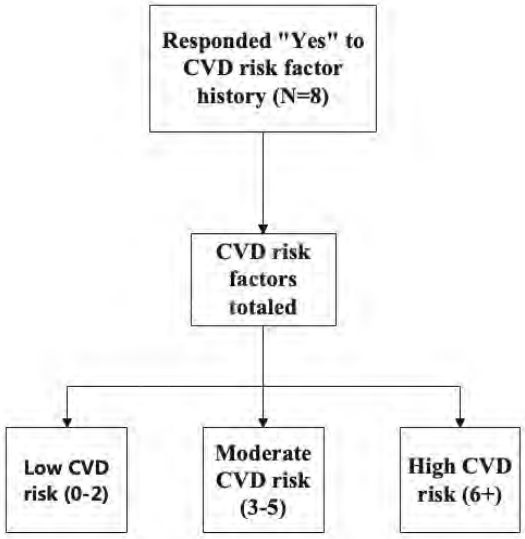

Figure 1: CVD Risk Factor Index (Without BMI)

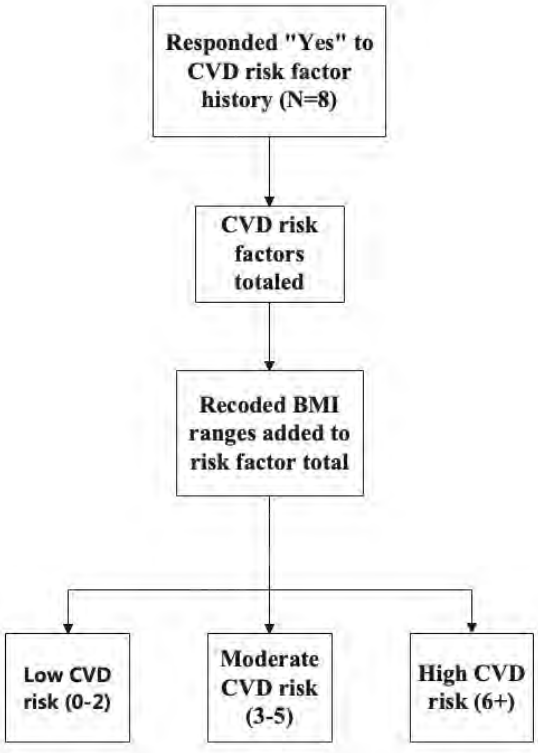

Figure 2: CVD Risk Factor Index (With BMI)

Table 1 summarizes the various demographic information gathered from the study population. These characteristics include age, gender, education level, race, insurance status, country of origin, language spoken at home, time spent in the USA, and income to poverty ratio. Data responses outside of the inclusionary criteria or categorized as refused, don't know, or missing were excluded prior to data analysis.

Table 1. Demographic Variables

Variable Name	**Variable description**	**Survey questions**	**Codes**	**Description of code**	**Level of Measurement**
RIDAGEYR	Age of participant	Age in years of participant at time of screening?	1 2 3 4	Ages 18-30 31-45 46-65 66+	Discrete
RIAGENDR	Gender of participant	Gender of participant?	1 2	Male Female	Dichotomous
DMDEDUC2	Education of participant	What is the highest grade or level of school completed or highest degree?	1 2 3 4	<HS Some HS HS graduate/GED Some college or college Grad	Ordinal
RIDRETH3 SAS	Race/Hispanic Origin	Recode of reported race and Hispanic origin information.	1 2	Mexican American Other Hispanic	Nominal
HIQ011	Health insurance coverage	Are you covered by health insurance or some other kind of health plan?	1 0	Yes No	Dichotomous

DMDBORN4	Naturalization	In what country (were you/was SP) born?	1 2	Born in 50 states or DC Other	Nominal
ACD040	Language at home	What language(s) do you usually speak at home? Do you speak only Spanish, more Spanish than English, both equally, more English than Spanish, or only English?	1 2 3	Mostly Spanish or Only Spanish Both equally Mostly English or only English	Nominal
DMDYRUSZ	Length of time in US	Length of time participant has been in the US?	1 2 3	<5y 5y-14y 15y+	Ordinal
INDFMPIR	Ratio of family income to poverty	SP family income	1 2 3 4	<.5 .5-1 1-2 2+	Ordinal

Table 2 describes the various CVD knowledge/history information gathered from the study population. These variables include knowledge of high blood pressure history, elevated cholesterol history, diabetes history, history of being overweight, BMI, CHF history, CHD history, history of heart attack, stroke history. Additional variables for Risk Factor Index scores with and without BMI were also created to assess risk of CVD.

Table 2. Cardiovascular Disease and Risk Factor History Variables

Variable Name	Variable description	Survey questions	Codes	Description of code	Level of measurement
BPQ020	Elevated blood pressure	Have you ever been told by a doctor or healthcare professional that you had hypertension?	1 0	Yes No	Dichotomous
BPQ080	Elevated cholesterol	Have you ever been told by a doctor or other health professional that your blood cholesterol was high?	1 0	Yes No	Dichotomous
DIQ010	Indication of Diabetes	Other than during pregnancy, have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?	1 0 2	Yes No Borderline	Dichotomous

MCQ080	Overweight	Has a doctor or other health professional ever told you that you were overweight?	1 0	Yes No	Dichotomous
BMXBMI	Body mass index	Recorded body mass index.	1 2 3 4	<18.5 (underweight) 18.5-25 (Normal) 25-29.00 (Overweight) 30+ (obese)	Ordinal
MCQ160b	Congestive Heart Failure	Has a doctor or other health professional ever told you that you had congestive heart failure?	1 0	Yes No	Dichotomous
MCQ160c	Coronary Heart Disease	Has a doctor or other health professional ever told you that you had coronary heart disease?	1 0	Yes No	Dichotomous
MCQ160e	Heart attack	Has a doctor or other health professional ever told you that you had a heart attack?	1 0	Yes No	Dichotomous
MCQ160f	Ever told stroke	Has a doctor or other health professional ever told you that you had a stroke?	1 0	Yes No	Dichotomous
Risk Factor index (wobmi)	Risk Factor index (w/o BMI)	0-8 (total number of "Yes" or "borderline" responses to any of the 8	1 2 3	0-2 (Low risk) 3-5 (moderate risk) 6+ (High risk)	Ordinal

		CVD/CVD risk factor questions).			
Risk factor index (wbmi)	Risk Factor Index (with BMI)	0-13 (total number of "Yes" or "Borderline" responses to any of the 8 CVD/CVD risk factor questions plus BMI category).	1 2 3 4	0-3 (Low risk) 4-6 (Moderate risk) 7-9 (High Risk) 9+ (Very high risk)	Ordinal

Table 3 describes the various preventive care utilization variables gathered from the study samples. These variables include currently taking aspirin for blood pressure control, high blood pressure medication, time since last blood cholesterol check, blood sugar testing within the past three years, A1C checked in the past year, time since last healthcare visit, and moderate intensity recreational activities within the past year.

Table 3. Preventative Service Utilization Variables

Variable Name	Variable description	Survey questions	Codes	Description of code	Level of Measurement
RXQ515	Told to take low-dose aspirin for CVD, followed advice	Doctors and other health care providers sometimes recommend that you take a low-dose aspirin each day to prevent heart attacks, strokes, or cancer. Have you ever been told to do this? Are you now following this advice	1 0 2	Yes No Sometimes & stopped aspirin use due to side effects	Nominal
BPQ050A	Med to reduce hypertension	Because of your (high blood pressure/hypertension), have you ever been told to . . . take prescribed medicine? Are you now taking prescribed medicine?	1 0	Yes No	Dichotomous

BPQ070	Cholesterol checked	How long has it been since you last had your blood cholesterol checked? Has it been...	1 2 3	>1y 1 year but <2 2+ years	Ordinal
DIQ180	Glucose checked for diabetes	Have you had a blood test for high blood sugar or diabetes within the past three years?	1 0	Yes No	Dichot omous
DIQ275	A1C checked in past year	During the past 12 months, has a doctor or other health professional checked your glycosylated hemoglobin or "A one C"?	1 0	Yes No	Dichot omous
HUD06 2	Time since last doctor/healthc are visit	About how long has it been since you last saw a doctor or other health care professional about your health for any reason?	0 1 2 3	Never <1 year 1-2 years 2+ years	Ordinal

PAQ665	Moderate-intensity recreational activities	In a typical week do you do any moderate-intensity sports, fitness, or recreational activities that cause a small increase in breathing or heart rate such as brisk walking, bicycling, swimming, or volleyball for at least 10 minutes continuously?	1 0	Yes No	Dichotomous

Statistical Analysis

To account for missing data in variable responses, this study applied the MEC (Mobile Examination Clinic) sample weights (as provided by the NHANES data set) prior to data analysis. Descriptive statistics were utilized to assess prevalence of CVD preventive service utilization among the U.S. Latino/Hispanic participants. Moreover, to identify potential associations between CVD preventive service use, sociodemographic characteristics, and awareness of CVD/CVD history, Pearson Chi Square (χ^2) analysis was employed. To ensure the reliability of the study's findings, significance weas established at a p-value of $<.05$. Data analysis was conducted utilizing the Statistical Package for the Social Science application (SPSS), version 29.0.0.0 (241). This study was reviewed and approved by the University of Central Florida Institutional Review Board and was determined to not involve human subjects (STUDY00005741).

RESULTS

An original sample population of 2122 adult Hispanic/Latino participants (aged 18+) were included within the study. Sociodemographic information, awareness of CVD/CVD risk factor history, and CVD preventive service use information was collected from the sample. After applying sample weights to account for missing data responses, an effective sample size of N=40,412,679 was subsequently used for data analysis.

Research Question 1: Sample Demographics, Knowledge of CVD History, and Preventive Service Use

Table 4 summarizes the collected sociodemographic information of the study sample. The study sample was predominantly aged 31-45 years old (33.2%), female (50.2%), with some college education or was a college graduate (43.3%) and is Mexican American (52.5%). Additional, participants primarily had some insurance coverage (71.2%), were not US-born (57.3%), spoke mostly Spanish or only Spanish at home (48.3%), had spent 15+ years in the USA (70.4%), and had an income to poverty ratio (IPR) of 2+ (46.6%).

Table 4: Demographic Descriptive Statistics

Demographic Variables		Frequency	Percent	Valid Percent
Age Groups	18-30 y.o.	11955031	29.6	
	31-45 y.o.	13432875	33.2	
	46-65 y.o.	11175655	27.7	
	66+ y.o.	3849119	9.5	
	Valid Total	40412679	100	
Gender	Male	20138618	49.8	
	Female	20274062	50.2	
	Valid Total	40412679	100	
Education	<High School	5788505	14.3	15.1
	Some High School	4852297	12	12.7
	High School Graduate/GED	11104389	27.5	29
	Some College or College Graduate	16576729	41	43.3
	Valid Total	38321920	94.8	100
	Missing	2090760	5.2	
Race	Mexican American	21224129	52.5	
	Other Hispanic	19188551	47.5	
	Valid Total	40412679	100	
Insurance	No	11566661	28.6	28.8
	Yes	28579817	70.7	71.2
	Valid Total	40146478	99.3	100
	Missing	266202	0.7	
Origin of Birth	Born in 50 States or DC	17206749	42.6	42.7
	Other	23120787	57.2	57.3
	Valid Total	40327536	99.8	100
	Missing	85144	0.2	
Language	Mostly Spanish or Only Spanish	19307295	47.8	48.3
	Spanish and English Equally	6213936	15.4	15.5
	Mostly English or Only English	14489884	35.9	36.2
	Valid Total	40011116	99	100
	Missing	401564	1	
Time Spent in the USA	<5 Years	2464681	6.1	11.5
	5-14 Years	3888059	9.6	18.1
	15+	15098735	37.4	70.4
	Valid Total	21451475	53.1	100
	Missing	18961205	46.9	
Income to Poverty Ratio	<.5	3562443	8.8	10.6
	.5-1	4849492	12	14.5
	1-2	9472560	23.4	28.3
	2+	15595679	38.6	46.6
	Valid Total	33480173	82.8	100
	Missing	6932506	17.2	

Table 5 summarizes the collected CVD/CVD risk factor history information. Study participants typically had no knowledge of high blood pressure history (76.9%), elevated cholesterol (71.3%), diabetes (86.8%), being overweight (57.9%), congestive heart failure (98.6%), coronary heart disease (98.2%), a heart attack (98.1%), or a stroke (97.9%). BMI distribution among study participants were as follows: 47.5% had BMI of 30+ (obese), 31.8% had BMI of 25.0-29.0 (overweight), 19.5% had BMI of 18.5-25.0 (normal), 1.2% had BMI of <18.5 (underweight). Utilizing the Risk Factor Index without BMI, participant scores ranged 84.8% low risk (0-2 score), 14.4% moderate risk (3-5 score), and 0.8% high risk (6+ score). RFI scores including BMI were as follows: 39.1% low risk (0-3 score), 50.7% moderate risk (4-6 score), 9.5% high risk (7-9 score), and 0.6% very high risk (10+ score).

Table 5: CVD History Descriptive Statistics

CVD History Variables		Frequency	Percent	Valid Percent
Knowledge of High Blood Pressure	No	31038284	76.8	76.9
	Yes	9313564	23	23.1
	Valid Total	40351848	99.8	100
	Missing	60831	0.2	
Knowledge of Elevated Cholesterol	No	28650335	70.9	71.3
	Yes	11537731	28.5	28.7
	Valid Total	40188066	99.4	100
	Missing	224614	0.6	
Knowledge of Diabetes	No	34956546	86.5	86.8
	Yes	4383213	10.8	10.9
	Borderline	953228	2.4	2.4
	Valid Total	40292986	99.7	100
	Missing	119693	0.3	
Knowledge of Being Overweight	No	23344939	57.8	57.9
	Yes	17008262	42.1	42.1
	Valid Total	40353201	99.9	100
	Missing	59479	0.1	
Body Mass Index	<18.5 (Underweight)	440910	1.1	1.2
	18.5-<25.0 (Normal)	7245902	17.9	19.5
	25-29.0 (Overweight)	11819129	29.2	31.8
	30+ (Obese)	17625000	43.6	47.5
	Valid Total	37130941	91.9	100
	Missing	3281738	8.1	
Knowledge of Congestive Heart Failure	No	37807196	93.6	98.6
	Yes	519379	1.3	1.4
	Valid Total	38326575	94.8	100
	Missing	2086104	5.2	
Knowledge of Coronary Heart Disease	No	37626027	93.1	98.2
	Yes	692393	1.7	1.8
	Valid Total	38318420	94.8	100
	Missing	2094260	5.2	
Knowledge of a Heart Attack	No	37534988	92.9	98.1
	Yes	737393	1.8	1.9
	Valid Total	38272381	94.7	100
	Missing	2140298	5.3	
Knowledge of a Stroke	No	37496689	92.8	97.9
	Yes	799991	2	2.1
	Valid Total	38296680	94.8	100
	Missing	2116000	5.2	
Risk Factor Index (Without BMI)	0-2 (Low Risk)	34270818	84.8	
	3-5 (Moderate Risk)	5799513	14.4	
	6+ (High Risk)	342349	0.8	
	Valid Total	40412679	100	
Risk Factor Index (With BMI)	0-3 (Low Risk)	15803374	39.1	
	4-6 (Moderate Risk)	20501564	50.7	
	7-9 (High Risk)	3853225	9.5	
	10+ (Very High Risk)	254516	0.6	
	Valid Total	40412679	100	

Table 6 summarizes the collected CVD preventive service use information. When assessing preventive care for CCVD among the study participants, a majority reported aspirin use for BP control (59.8%), high BP medication (83.6%). Additionally, 50.7% had blood sugar tested in the past 3 years, while 54.7% and 80.9% had their blood cholesterol and A1C checked in the last year respectively. Furthermore, 50.1% of study participants reported 2+ years since last healthcare visit, and 59.2% had no regular moderate-intensity physical activity.

Table 6: Preventive Service Use Descriptive Statistics

Preventive Care Use Variables		Frequency	Percent	Valid Percent
Currently Taking Asprin for Blood Pressure	No	2113546	5.2	33.9
	Yes	3724465	9.2	59.8
	Sometimes or Stopped Due To Side Effects	392362	1	6.3
	Valid Total	6230374	15.4	100
	Missing	34182306	84.6	
Currently Taking High Blood Pressure Medication	No	1314539	3.3	16.4
	Yes	6715372	16.6	83.6
	Valid Total	8029910	19.9	100
	Missing	32382769	80.1	
Time Since Last Blood Cholesterol Check	<1 Year	14919231	36.9	54.7
	1-<2 Years	5600393	13.9	20.5
	2+ Years	6772384	16.8	24.8
	Valid Total	27292008	67.5	100
	Missing	13120672	32.5	
Blood Sugar Test Within The Past Three Years	No	17740359	43.9	50.7
	Yes	17242414	42.7	49.3
	Valid Total	34982773	86.6	100
	Missing	5429907	13.4	
Had A1C Checked In The Past Year	No	812908	2	19.1
	Yes	3442033	8.5	80.9
	Valid Total	4254941	10.5	100
	Missing	36157738	89.5	
Time Since Last Healthcare Visit	Never	369913	0.9	3.8
	<1 Year	1249598	3.1	12.7
	1-<2 Years	3268393	8.1	33.3
	2+ Years	4913964	12.2	50.1
	Valid Total	9801867	24.3	100
	Missing	30610812	75.7	
Moderate-Intesity Recreational Activities	No	23907884	59.2	
	Yes	16504796	40.8	
	Valid Total	40412679	100	

Research Question 2 and 3: Correlation Analysis

To explore the relationship between sociodemographic characteristics, knowledge of CVD/risk factor history, and preventive care use, Chi square analysis was used to compare categorical and ordinal variables at a significance level of $p<0.05$.

Table 7 presents the chi square associations between demographic characteristics and preventive service use for CVD. Age, education level, race, insurance status, country of origin, language spoken at home, time spent in the USA, and income to poverty ratio were found to have significant associations with all 7 preventive service use variables at a significance level of $p<.001$. Gender was found to have significant associations with 6/7 preventive service variables at $p<.001$ with exception to A1C check in the past year, which was found to have a weaker association at $p<.016$.

Table 8 presents the chi square associations between knowledge of CVD/CVD risk factor history and preventive service use. Knowledge of elevated cholesterol, being overweight, BMI, congestive heart failure, coronary heart disease, heart attack, and stroke was found to be significantly associated with all 7 preventive care utilization variables at a significance of $p<.001$. Risk factor index scores (with and without BMI) were also found to be significantly associated with the 7 preventive care utilizations variables at a significance of $p<.001$. Knowledge of high blood pressure was found to be significantly associated with 6/7 preventive service variables at $p<.001$, with exception to high BP medication use (no association). Similarly, knowledge of diabetes history was significantly associated with 6/7 preventive care utilization variables at a significance of $p<.001$, with exception to A1C use (no association).

Table 7: Pearson Chi-Square: Sociodemographic vs Preventive Service Utilization

		Age	Gender	Education Level	Race	Insurance	Country of Origin	Language Spoken At Home	Time Spent in USA	Income To Poverty Ratio
Currently Taking Aspirin for Blood Pressure	Chi-square	245921.614	20476.483	111177.382	8474.125	32219.417	134844.659	13034.467	37329.644	47242.305
	df	4	2	6	2	2	2	4	4	6
	Sig.	<.001*,b,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Currently Taking High Blood Pressure Medication	Chi-square	496892.29	3068.543	19904.195	161.135	693177.373	30424.917	55201.271	105418.354	210389.379
	df	3	1	3	1	1	1	2	2	3
	Sig.	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Time Since Last Blood Cholesterol Check	Chi-square	1621751.638	237934.381	362618.808	935.261	2564451.881	35998.978	187238.747	207473.998	197341.761
	df	6	2	6	2	2	2	4	4	6
	Sig.	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Blood Sugar Test Within The Past Three Years	Chi-square	3067012.743	614650.093	257670.23	391384.631	1217251.034	108748.281	134391.661	231203.178	402897.597
	df	3	1	3	1	1	1	2	2	3
	Sig.	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Had A1C Checked In The Past Year	Chi-square	308874.07	5.838	134333.108	15575.771	134405.222	118913.326	89102.425	38850.894	316678.896
	df	3	1	3	1	1	1	2	2	3
	Sig.	<.001*,c	.016*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Time Since Last Healthcare Visit	Chi-square	402245.589	154372.094	791486.359	121782.106	421579.122	156836.27	165104.523	313110.855	390242.467
	df	9	3	9	3	3	3	6	6	9
	Sig.	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c
Moderate-Intensity Recreational Activities	Chi-square	333074.082	49578.956	1276506.845	1588.098	358995.277	488412.804	858242.306	60195.258	1219994.341
	df	3	1	3	1	1	1	2	2	3
	Sig.	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c	<.001*,c

Results are based on nonempty rows and columns in each innermost subtable.

*. The Chi-square statistic is significant at the .05 level.

b. More than 20% of cells in this subtable have expected cell counts less than 5. Chi-square results may be invalid.

c. Some cell counts in this subtable are not integers. They were rounded to the nearest integer before the computation of Chi-square test.

Table 8: Pearson Chi-Square: CVD History vs Preventive Service Utilization

		Currently Taking Asprin for Blood Pressure	Currently Taking High Blood Pressure Medication	Time Since Last Blood Cholesterol Check	Blood Sugar Test Within The Past Three Years	Had A1C Checked In The Past Year	Time Since Last Healthcare Visit	Moderate-Intensity Recreational Activities
Knowledge of High Blood Pressure	Chi-square	333828.037		1117671.425	1833267.634	124698.885	129445.109	20049.411
	df	2		2	1	1	3	e
	Sig.	<.001*,b	b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Knowldege of Elevated Cholesterol	Chi-square	23836.919	38683.526	350490.696	2300542.229	139924.221	294332.27	31348.881
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Knowledge of Diabetes	Chi-square	38234.207	283045.481	1314132.354	514931.279		317599.05	76529.203
	df	4	2	4	1		6	2
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b,c	.b	<.001*,b	<.001*,b
Knowledge of Being Overweight	Chi-square	2024.552	2364.39	200688.871	1440808.622	5415.886	277226.139	37793.641
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Body Mass Index	Chi-square	156071.819	64606.474	97867.359	628310.315	16595.453	69109.092	170284.382
	df	6	2	6	3	2	9	3
	Sig.	<.001*,b	<.001*,b,c	<.001*,b	<.001*,b	<.001*,b,c	<.001*,b	<.001*,b
Knowldege of Congestive Heart Failure	Chi-square	121421.001	59829.265	180155.124	27982.141	42944.926	7876.171	108891.572
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Knowledge of Coronary Heart Disease	Chi-square	167804.612	57419.022	93003.875	35887.924	36921.854	50376.492	36481.492
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Knowlege of a Heart Attack	Chi-square	134965.396	26775.474	87516.201	19169.702	55656.533	19622.54	794.352
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Knowlege of a Stroke	Chi-square	7010.535	14743.944	86158.34	101.586	41447.191	21956.716	100378.147
	df	2	1	2	1	1	3	1
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Risk Factor Index (Without BMI)	Chi-square	392229.681	204885.229	1303729.597	1067574.723	280870.472	149968.807	131463.672
	df	4	2	4	2	2	6	2
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b
Risk Factor Index (With BMI)	Chi-square	440041.147	132208.05	1014272.95	1793126.997	207012	114917.033	80435.703
	df	6	3	6	3	3	9	3
	Sig.	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b	<.001*,b

Results are based on nonempty rows and columns in each innermost subtable.

*. The Chi-square statistic is significant at the .05 level.

b. Some cell counts in this subtable are not integers. They were rounded to the nearest integer before the computation of Chi-square test.

c. More than 20% of cells in this subtable have expected cell counts less than 5. Chi-square results may be invalid.

DISCUSSION

This study aimed to quantify healthcare engagement and preventive service utilizing among U.S. Latino/Hispanics, while further identifying associations with sociodemographic characteristic and knowledge of CVD/risk factor history. Results from this study found nearly all the sociodemographic characteristics to be significantly associated with the 7 preventive use variables at a significance level of $p<.001$, with exception to gender ($p<.016$). The majority of variables related to knowledge of CVD/risk factor history were also found to be significantly associated with the 7 preventive service use variables at a significance of $p<.001$.

Examination of the demographic characteristics of the study population provided nuanced insights on the complex interplay of socioeconomic factors, acculturation patterns, and healthcare disparities among U.S. Latinos/Hispanics. Participants in this study were revealed to have educational levels higher than national averages, with the majority reported to have some college experience or be a college graduate at 38.2% (n=761). This figure stands in contrast to national education averages for U.S. Latinos/Hispanics, which report 25% of U.S. Latinos having some college education and nearly 20% having a bachelor's degree or higher in 2021.[42] This educational discrepancy highlights the impact of education in shaping preventive care utilization and knowledge of CVD history amongst U.S. Latinos. Existing literature has previously noted the impact of formal education on increasing preventive service utilization and access to medical care, with service use increasing as high as 10% for those with a college education.[43,44] Knowing the role of increased education on healthcare access and preventive service utilization, our findings suggest that higher educational attainment may correlate with increased use healthcare resources, preventive services, and enhanced awareness of CVD/risk factor history.

Equally striking was our analysis of insurance status, revealing a high coverage rate of 72.3% among study participants. This finding contrasts the previously studied rates of uninsurance among U.S. Hispanics/Latinos, with only 49.9% of U.S. Latinos having coverage by private insurance, and 35.9% relying on Medicaid or public insurance (the highest amongst any other ethnic group in the US).[45] The stark contrast between our study population and national averages underscores the need for further investigation into factors contributing to coverage disparities and their effects on preventive service utilization, including access to employer-sponsored insurance, eligibility for public assistance programs, and variations in state-level healthcare policies. Moreover, our study revealed intriguing trends in the immigration patterns of Latino/Hispanic participants, with approximately 75.2% having resided in the USA for over 15 years. This trend points to a notable shift in Hispanic/Latino retention rates following immigration, with previous literature revealing 78% of immigrated Latinos/Hispanics have lived in the U.S. for more than a decade, a significant increase of 14% from 2010.[46] Time spent in the U.S. was the sole measurement of acculturation used in the 2017-March 2020 NHANES dataset. Acculturation, as previously noted, is the complex change in music, diet, language, and cultural identity as a result of assimilation to U.S. culture following immigration. Although existing literature has examined the negative impacts of acculturation on elevated substance use and dietary practice amongst US Latinos/Hispanics,[47] recent literature has also highlighted positive associations of high acculturation levels on general preventive service use in this population.[48,49] Further literature is needed to examine the role of acculturation factors (such as length of time in the U.S., language preference following immigration, dietary changes, etc.) and its impact on preventive care utilization for cardiovascular disease within this group.

In addition to the demographic findings of our study, our analysis also uncovered apparent gaps in knowledge of CVD/risk factor history among the study participants. Previous literature has revealed the disproportionate prevalence of CVD risk factors within the Latino/Hispanic population including obesity, diabetes, and hypertension.[19,23,28] Results from this study revealed low levels of reported knowledge of CVD history & associated risk factors (see table 5). Knowledge of being overweight was the most cited risk factor, reported by 42.1% of study participants, followed by awareness of elevated cholesterol levels at 28.5%. These variables related to CVD knowledge/history remains consistent with previous literature, which notes similar rates of high cholesterol and obesity knowledge at 56% and 30% respectively in monolingual Hispanics.[50] An unexpected finding was revealed in relation to knowledge of diabetes, with only 10.8 % of participants reporting prior knowledge of diabetes history and only 2.4% reporting knowledge of borderline diabetes. This gap in knowledge of diabetes history is of particular concern for U.S. Latinos/Hispanics, as previous literature has revealed diabetes to be one of the largest risk factors for CVD, and has been shown to be of highest prevalence within this population.[3,6] This concern is further heightened by additional literature, which has noted prevalence of diabetes to be as high as 18.3% in US Latinos/Hispanics.[51] Knowledge of CHD and CHF were noted at lowest prevalence in this study at 1.7% and 1.3% respectively. Variations in CHD history among U.S. Latinos are noted in current literature, with studies estimating prevalence of CHD to be 6.7% in this population and varying amongst Latino subgroups (7% in Mexican men vs 5% in Dominican men).[52-54] Literature on CHF history in U.S. Latinos is limited, with some studies noting prevalence of CHF to be 3.5 (per 1,000 persons-years) in U.S. Latinos when compared to non-Hispanic Black (4.6) and non-Hispanic White (2.4).[55] Similar national studies have revealed rates of CHF to be 2.4% in Hispanic males and 1.7% in Hispanic

females.[56] With regards to the risk factor index, table 5 reveals differences in risk of CVD among the study participants. When including BMI, the majority of participants had a moderate risk of CVD at 50.7% (4-6 totaled CVD risk factors). When excluding BMI, 84.8% of study participants were considered low risk (0-2 totaled CVD risk factors). This discrepancy in risk factor classification due to BMI highlights the impact of BMI on increasing risk for cardiovascular disease within this population. Existing literature has long noted BMI's influence on increasing CVD risk, with previous studies finding increased cardiometabolic and inflammation risk factors in patients with elevated BMI (>25 kg/m^2) and lower cardiovascular mortality in patients with lower BMI (25-35 kg/m^2).[57] This influence is further supported by additional literature, which found that patients with elevated BMI had an increased risk of developing CVD at an earlier age, increasing the proportion of years lived with CVD morbidity.[11]

With regards to preventive service utilization, this study found large disparities in the use of CVD preventative services, with highest use of blood cholesterol test within 1 year (36.9%), moderate-intensity recreational activities (40.8%), and blood glucose testing within 3 years (42.7%). While blood cholesterol and blood glucose testing are the most utilized services in this study, these results remain consistent with the overall low rates of blood glucose/cholesterol testing amongst U.S. Latinos when compared to other ethnic groups. In a study comparing self-monitored blood glucose (SMBG) testing in low-income patients, Latinos/Hispanics were found to have the lowest rates of SMBG testing when compared to non-Hispanic Black and non-Hispanic White participants (65%, 79%, and 85% respectively).[58] This disparity is also noted among Latinos/Hispanics with varying documentation status, with a similar study finding utilization of cholesterol testing to be lower in undocumented Latinos/Hispanics when compared to U.S. born Latinos/Hispanics (56% and 83% respectively).[59] These diminished rates of

preventive service utilization are particularly worrisome as Latinos/Hispanics are noted to have the highest prevalence of hyperlipidemia and T2DM.[30] Given current clinical recommendations of moderate-intensity physical activity for controlling hyperlipidemia, the rates of physical activity in conjunction with blood cholesterol testing as seen in this study remain consistent with existing literature.[29,30]

Table 7 summarizes the Pearson Chi-Square results between sociodemographic characteristics and preventive service utilization for CVD. Age and gender were found to be significantly associated with all 7 preventive services variables at a significance level of $p<.001$-.016. These results remain consistent with existing literature investigating age and gender related correlations with CVD risk factors, particularly related to increased incidence of angina pectoris, elevated total cholesterol, HF, stroke, and MI associated with participant age.[60,61] Significant associations between the 7 preventive service use variables, country of origin, time in the U.S., and insurance status was of particular interest given the difference in naturalization and insurance status of the study group (57.2% foreign born, 37.4% in USA for 15+ years, and 28.6% without insurance). These associations are similarly seen in literature examining CVD in U.S. Latinos, with one study finding naturalization to be correlated with an increasingly worse cardiovascular risk profile for U.S. born Hispanic/Latinos, explained primarily by decreased physical activity, worsening diet, and sedentary behaviors.[62] Furthermore, the associations of insurance status with preventive service use in this study are particularly interesting as previous literature has highlighted the impact on uninsured status on decreased medical screenings, engagement in risk reduction behaviors, and likelihood of a usual source of medical care.[63]

Table 8 summarizes the Pearson Chi-Square results between knowledge of CVD/risk factor history and preventive care utilization variables. Despite low participant responses, aspirin

use for blood pressure control was found to be significantly correlated with all 11 CVD history variables, including both risk factor indices. This association can be noted inferred in existing literature, as significant differences in aspirin use has been found in those with and without history of CVD.[64] Use of high blood pressure medication was significantly associated with 9/11 of the CVD history variables, with no association being found with knowledge of high blood pressure history and body mass index. This lack of association, in part due to missing variable data (80.1% missing for blood pressure medication use), is particularly interesting given that BMI is often used as a primary indicator for high blood pressure and subsequent BP medication use. This indication is noted in existing literature, with antihypertensive medication and BMI having significant associations with diastolic blood pressure.[65] Additional literature has noted this relationship by revealing variable BP outcomes with use of antihypertensive medications in respect to BMI, highlighting BMI's significance when prescribing antihypertensives and managing CVD risk factors.[66] Time since blood cholesterol testing, blood sugar testing within the past 3 years, time since last health care visit, and moderate-intensity recreational activities were statistically associated with all 11 CVD history variables. These associations align with current clinical recommendations for reducing the onset of CVD and CVD risk factors. In fact, 2019 guidelines for CVD prevention provided by the American College of Cardiology recommends risk estimation and clinical testing with a clinician, antihypertensive use for primary prevention of Atherosclerotic Cardiovascular Disease (ASCVD), and 150 minutes per week of moderate intensity physical activity.[67] A1C testing was found to have significant associations with 9/11 of the CVD history variables, with unreliable associations found with knowledge of diabetes and BMI. The undetectability of this analysis is likely due to significant missing data in responses to A1C testing, as only 10.5% of responded data was collected in the

data set. Previous literature has well examined the relationship between A1C levels, diabetes, and BMI.[68,69] However, the impact of diabetes and elevated BMI history has not been further explored in relation to A1C use in existing literature. Further analysis with complete A1C response data is needed to determine further associations between A1C, knowledge of diabetes, and BMI.

Limitations

There are several limitations to be noted within this study. Firstly, the lack of disaggregated ethnic data on specific Latino subgroups (such as Dominicans, Guatemalans, Puerto Ricans, etc.) poses a significant limitation to the study. By failing to differentiate between the distinct cultural and ethnic groups within the Latino/Hispanic population, this dataset may overlook potential variations in healthcare utilization patterns among the study population. While the NHANES data set did not include disaggregated ethnic data on the Latino/Hispanic participants, similar studies have found variation in CVD risk factor prevalence amongst Latino subgroups including Dominicans, Central Americans, Mexicans, and Puerto Ricans.[52,53,70] Similarly, while the data used in this study may be nationally representative, healthcare access, culture, and local health policy can vary significantly across states with differing Latino populations, potentially impacting the use of preventive care services.[1] Future research should work to enhance participant recruitment, employ targeted sampling, and include stratified geographical data on study participants to ensure representation from each major Latino/Hispanic subgroup by region.

Moreover, the reliance of self-reported data as collected by the NHANES database introduces the possibility of recall bias, wherein participants may inaccurately recall their CVD risk factor history or preventive care utilization, leading to variations in the data. This limitation

is particularly relevant in studies involving retrospective self-reporting of health-related behaviors, as individuals' responses may be influenced by memory lapses, social desirability bias, and subjective interpretations of their health status.[71] To mitigate recall bias in future studies, researchers should incorporate objective measures such as medical records to validate self-reported data and provide a more accurate assessment of participants' health status and healthcare utilization patterns over time. Missing data provided in the NHANES dataset also produced challenges when interpreting the study findings and generalizability. Incomplete data, particularly in variables related to knowledge of CVD history and preventive service utilization, may introduce systematic biases and undermine the robustness of the statistical analyses. To address this limitation, future research should prioritize data quality assurance measures during data collection and implement strategies to improve participant engagement and retention within the study. In place of other advanced statistical techniques such as multiple imputation and nearest neighbor matching, this study opted to use the NHANES sample weights to account for this missing data as recommended by the NHANES study.[72] By addressing these methodological limitations, future studies can better inform targeted interventions at reducing cardiovascular health disparities amongst this population.

Applications

Considering the demographic shifts and increasing health challenges facing U.S. Latinos/Hispanics, the implications of this research extend to both clinical practice and public health initiatives. For clinical practice, these findings demonstrate the need for personalized preventive care interventions tailored to the unique needs of Latino/Hispanic patients. Previous literature has revealed the use of *promotores de salud* (Hispanic/Latino community health educators), bilingual education materials, and cultural diet modifications for decreasing

cardiovascular risk in this population.[73] The findings of this research study support the use of these materials by providing significant associations between patient education, SES, lifestyle behaviors, and knowledge of CVD history with preventive care utilization. Healthcare providers can leverage these findings to design culturally sensitive interventions, such as group education sessions or one-on-one counseling, focused on managing CVD risk factors and promoting healthy lifestyles. By addressing specific gaps in knowledge of CVD/risk factor history and acknowledging the unique nuances in CVD risk among U.S. Latino/Hispanics, clinicians can enhance patient engagement and improve health outcomes related to cardiovascular disease prevention.[74] Furthermore, this study highlights disparities in the utilization of preventive services for CVD such as moderate-intensity recreational activities, blood glucose testing, and blood cholesterol testing among Latino/Hispanic individuals, underscoring the importance of enhancing screening programs within this population. Healthcare facilities serving Latino/Hispanic communities can implement targeted screening initiatives that offer convenient and affordable access to these essential tests for the early detection of CVD risk factors. For example, previous literature has highlighted the use of mobile health clinics in improving health screenings by providing on-site testing for various chronic disease measures such cholesterol and glucose levels among Latino/Hispanic patients.[75] Community health centers can also offer regular health screenings as part of their services, including blood pressure checks and body mass index (BMI) measurements to gauge CVD risk in this population. By improving access to screening services, healthcare providers can detect CVD risk factors early and initiate appropriate interventions to prevent or manage cardiovascular conditions.

With regards to public health applications, this study's identification of associations between sociodemographic factors (such as education level, length of time in the U.S., and

insurance status) and preventive service use highlights the importance of patient advocacy and resource allocation in addressing cardiovascular healthcare disparities. Public health officials can use these insights to advocate for policy changes aimed at improving access to healthcare coverage and promoting health literacy initiatives targeted at underserved Latino/Hispanic communities. For instance, policymakers can support the expansion of Medicaid eligibility criteria to cover more low-income individuals, including undocumented immigrants who may face barriers to accessing preventive care services.[76] Additionally, these research findings support increased funding to community-based organizations, who can provide culturally competent health education programs and navigation services for US Latino/Hispanic patients.[77] These research findings also highlight the importance of community engagement and empowerment in addressing cardiovascular health disparities among Latino/Hispanic populations. Public health initiatives can engage community members as partners in identifying local health needs and developing culturally relevant CVD risk reduction interventions. For example, community health intervention programs composed of local residents, healthcare providers, and community leaders can be formed to assess community cardiovascular needs and implement strategies to promote cardiovascular health. Previous literature has supported the effectiveness of these initiatives for promoting positive behavioral outcomes including increased healthy eating and physical activity.[78] Additional literature has highlighted the use of media through Spanish-language television and radio as additional resources for promoting prevention within this population group.[77] By empowering communities to take ownership of their health and well-being, public health efforts can foster sustainable changes leading to improved cardiovascular outcomes and reduced risk of CVD in the Latino/Hispanic community.

CONCLUSION

In conclusion, given the expanding demographic presence and the pronounced burden of cardiovascular disease (CVD) within U.S. Latino/Hispanic community, this study aimed to discern the prevalence of CVD preventive care utilization in this population, while further examining influence of sociodemographics and CVD history on these utilization patterns. Through analysis of data from the National Health and Nutrition Examination Survey (NHANES), this study uncovered nuanced insights into healthcare engagement and demographic trends among this population. While a considerable portion of participants exhibited higher levels of education and insurance coverage than national averages for Latinos/Hispanics, there were notable gaps in knowledge regarding history CVD and associated risk factors. Moreover, this study further identified disparities in the utilization of preventive services for CVD, identifying blood glucose testing in the past three years (49.3%) and blood cholesterol testing in the past year (54.7%) to be most used preventive service variables. Age, gender, education level, race, insurance status, country of origin, language spoken at home, time spent in USA, and income to poverty were significantly associated with all 7 variables related to preventive service utilization ($p<.001$-$.016$). Similarly, most of the 11 variables related to knowledge of CVD history was found to have significant associations with the 7 preventive service use variables ($p<.001$). No associations were found between knowledge of high blood pressure history with BP medication use, and knowledge of diabetes history with A1C use. While the results of this study highlight the complex interplay of sociodemographic factors, knowledge of CVD history, and prevention utilization, there remains several limitations to this study. The lack of disaggregated ethnic data for specific Latino subgroups and the absence of state-level demographic data limits the granularity of the analysis and understanding of regional variations.

Additionally, reliance on self-reported data introduces potential recall biases for preventive service use, and missing respondent data poses challenges in interpreting findings. Despite these limitations, the implications of this research extend to both clinical practice and public health initiatives. Clinicians can leverage insights from this study to design culturally sensitive interventions and screening programs for cardiovascular disease in Latino/Hispanic patients. Public health officials can utilize these findings to advocate for policy changes aimed at improving healthcare access and promoting health literacy of cardiovascular disease within these communities. Overall, this study sheds light on the complex dynamics influencing preventive care utilization for CVD among U.S. Latinos/Hispanics. By addressing these disparities and tailoring interventions to the health needs of this population, healthcare professionals can work towards reducing cardiovascular health disparities and improving outcomes within the Latino/Hispanic community.

APPENDIX A: IRB EXEMPTION LETTER

UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

NOT HUMAN RESEARCH DETERMINATION

September 7, 2023

Dear Susanny Beltran:

On 9/7/2023, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	Assessing Preventive Care Utilization for Cardiovascular Disease Amongst US Latinos/Hispanics
Investigator:	Susanny Beltran
IRB ID:	STUDY00005741
Funding:	None
Documents Reviewed:	• Data Access - Data User Agreement.pdf, Category: Other; • IRB Beltran 5741 HRP-250 - FORM - Request for NHSR (1) (2).docx, Category: IRB Protocol; • Project variables as requested, Category: Other;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should changes outside of administrative ones (study personnel, timelines, etc.) be made. If non-administrative changes are made (design, information collected, instrumentation, funding, etc.) and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination by **clicking Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Kamille C. Birkbeck

Kamille Birkbeck
UCF IRB

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