UNIVERSITY OF CALIFORNIA, SAN DIEGO

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Cardiovascular Risk Factors Among Latinos: Select Behavioral and Social Determinants of Health

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy

in

Public Health (Health Behavior)

by

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2015

The dissertation of Nanette Virginia Lopez is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

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DEDICATION

I dedicate this dissertation to my children, Dylan and Madelyn, who are my sources of inspiration, curiosity, and joy; to their father, Jason, for his support and encouragement; to my parents, Robert and Sandra, who modeled an unfaltering work ethic and taught me that anything worth doing is worth doing well; and to my sister, Nicole, for her love and support throughout the years.

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LIST OF ABBREVIATIONS

AHA = American Heart Association

BMI = Body Mass Index

CI = Confidence Interval

CFA = Confirmatory Factor Analysis

CFI = Comparative Fit Index

CHD = Coronary Heart Disease

CHO = Carbohydrate

COX-2 = Cyclooxygenase-2

CRP = C-reactive protein

CVD = Cardiovascular Disease

DHA = docosahexaenoic acid

dL = Deciliter

EPA = eicosapentaenoic acid

g = gram

GED = General Education Development

HbA1c = Glycosylated Hemoglobin

HCHS/SOL = Hispanic Community Health Study/Study of Latinos

HS = High School

IL-6 = Interleukin-6

kcal = kilocalories

LTPA = Leisure Time Physical Activity

MESA = Multi Ethnic Study of Atherosclerosis

mg = Milligram

MVPA = Moderate to Vigorous Physical Activity

NCI = National Cancer Institute

NDSR = Nutrition Data System for Research

NHANES = National Health and Nutrition Examination Survey

NHIS = National Health Interview Survey

NIAAA = National Institute on Alcohol Abuse and Alcoholism

NSAID = Nonsteroidal Anti-Inflammatory drug

OR = Odds Ratio

PA = Physical Activity

RMSEA = Root Mean Square Error of Approximation

SAS = Statistical Analysis System

SE = Standard Error

SEM = Socioecological Model

SPSS = Statistical Package for the Social Sciences

SRMR = Standardized Root Mean Square Residual

TG/HDL = Triglyceride/High Density Lipoprotein

TIA = Transient Ischemic Attack

US = United States

LIST OF SYMBOLS

α = Cronbach’s alpha

ΔS-B χ^2 = Satorra-Bentler chi-square difference

df = degrees of freedom

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ACKNOWLEDGMENTS

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I am thankful for the support and guidance I received from my committee members, Drs. Ruth Patterson, Linda Gallo, Greg Talavera, and Anthony Gamst. I thank Ruth for her commitment to excellence, passion, and willingness to push me to perform my best. I thank Linda for her guidance, mentorship, and the opportunity to pursue two manuscripts using data from the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study. I thank Greg for the many opportunities he gave me, including permission to use data from the Hispanic Community Health Study/Study of Latinos. I thank Anthony for his willingness to replace a former committee member and providing me with statistical guidance. I am thankful to all my committee members for their time and commitment to my doctoral training.

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The following three chapters have co-authors: (1) Hypertriglyceridemia in the Hispanic Community Health Study/Study of Latinos: Roles of Carbohydrate Intake and Sedentary Time, (2) Measurement Properties of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale: Findings from the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study, and (3) Associations of Social Capital Indicators with Cardiovascular Disease Prevalence and Cardiovascular Disease Risk Factors in Hispanic Americans from the Hispanic Community Health Study/Study of Latinos.

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1. McKenzie TL, Moody JS, Carlson JA, **Lopez NV,** & Elder JP. (2013). Neighborhood income matters: Disparities in recreation facilities, amenities, and programs. *Journal of Park and Recreation Administration, 31*(4).
2. Elder JP, Holub CK, Crespo NC, & **Lopez NV.** (2013). Health disparities in Hispanic populations. *Oxford Bibliographies Online.*

3. Elder JP, Crespo NC, Corder K, Ayala GX, Slymen DJ, **Lopez NV,** Moody JS, & McKenzie TL. (2014). Childhood obesity prevention and control in city recreation centers and family homes: the MOVE/me Muevo Project. *Pediatric Obesity, 9*(3), 218-231.
4. Corder K, Crespo NC, Sluijs EMF, **Lopez NV,** & Elder JP. (2012). Parent awareness of young children's physical activity. *Preventive Medicine, 55*(3), 201-205.
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6. Eisenberg CM, Ayala GX, Crespo NC, **Lopez NV,** Corder K, Zive MM, Wood C, & Elder JP. (2012). Parental correlates of children's fat consumption. *Journal of Nutrition Education and Behavior, 44*(4), 302-309.
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1. Haughton J, **Lopez N,** McKenzie T, Peterson M, & Arredondo EM. Objective assessment of group physical activity classes for inactive Latina women in San Diego. Accepted as poster presentation at the American College of Sports Medicine 62nd Annual Meeting 2015 (May 27-30, San Diego, CA.)
2. Serrano N, Perez LG, **Lopez NV,** Haughton J, & Arredondo, EM. Effects of employment on the relationship between acculturation and sedentary time among church-going Latinas. Accepted as poster presentation Student Research Forum Eighth Annual Conference on Health Disparities 2014 (November 5-8, Long Beach, CA.)
3. McKenzie TL, Moody JS, **Lopez NV,** & Carlson JA. Neighborhood income matters: Disparities in recreation facilities, amenities, and programs. Accepted as oral presentation National Recreation and Parks Association Congress and Exposition 2012 (October 16-18, Anaheim CA.)
4. Corder K, Crespo NC, **Lopez NV,** & Elder JP. Parental overestimation of young children's physical activity. Accepted as oral presentation International Society for Behavioral Nutrition and Physical Activity 2012 (May 23-26, Austin TX.)

5. Elder JP, Crespo NC, **Lopez NV,** Corder K, Ayala GX, Slymen DJ, Moody JM, McKenzie TL, & Sallis JF. Effects of a recreation center- and family-based intervention on child BMI: the MOVE/Me Muevo Project. Accepted as poster presentation Society of Behavioral Medicine 2012 (April 11-14, New Orleans LA.)
6. **Lopez NV,** Crespo NC, Norman GJ, Ayala GX, & Elder JP. Longitudinal assessment of parenting behaviors as predictors of children's sugary beverage consumption. Accepted as poster presentation Society of Behavioral Medicine 2012 (April 11-14, New Orleans LA.)
7. Carlson JA, McKenzie TL, **Lopez NV,** Corder K, Sallis JF, & Elder JP. Are schools providing sufficient opportunities for physical activity? Objectively measured physical activity and sedentary time in- and out-of-school in children aged 7-10. Accepted as poster presentation Active Living Research 2012 (March 12-14, San Diego CA.)
8. Elder JP, Ayala GX, McKenzie TL, Sallis JF, Slymen DJ, Sasidharan V, Corder K, Crespo NC, Moody JS, Shadron LM, **Lopez NV,** Zive MM, & Wood C. Family health coaching, tip sheets, and parks & recreation: Unique strategies for obesity prevention. Accepted as poster presentation Childhood Obesity Conference 2011 (June 27-July 1, San Diego, CA.)
9. **(Lopez) Lee NVL,** Ayala GX, Corder K, Eisenberg CM, Zive MM, Wood C, & Elder JP. Parent-mediated behaviors are associated with children's sugar-sweetened beverage consumption. Accepted as oral presentation Student Research Symposium 2011 (March 4-5, San Diego CA.)
10. Eisenberg CM, Ayala GX, Crespo NC, **(Lopez) Lee NVL,** Corder K, Zive MM, Wood C, & Elder JP. Parental Correlates of Children's Fat Consumption. Accepted as poster presentation Obesity 2010 (Oct 8-12, San Diego CA.)

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ABSTRACT OF THE DISSERTATION

Cardiovascular Risk Factors Among Latinos: Select Behavioral and Social Determinants of Health

by

Nanette Virginia Lopez

Doctor of Philosophy in Public Health (Health Behavior)

University of California, San Diego, 2015
San Diego State University, 2015

Professor John P. Elder, Chair

Background: This dissertation addressed the following aims: (1) examined the prevalence of hypertriglyceridemia and associations among carbohydrate intake and sedentary time with triglyceride concentration; (2) examined the internal consistency and construct validity of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale; and (3) examined associations of the use of four social capital indicators (Intrapersonal Support Evaluation List-12 (ISEL-12), Social Network Index (SNI), Neighborhood Social Cohesion Scale, and Neighborhood Problems Scale) within cardiovascular disease (CVD) risk factors and prevalence.

Methods: For Aim 1, a secondary data analysis from the Hispanic Community Health Survey/Study of Latinos (HCHS/SOL) was performed (N = 10,946). For Aims 2 and 3, a secondary data analysis from the HCHS/SOL Sociocultural Ancillary Study (SCAS) was performed (N = 5,172).

Results: Hypertriglyceridemia prevalence ranged from 2.04%-14.81% in men and 1.24% to 11.65% in women. Predicted carbohydrate consumption and Body Mass Index (BMI) were positively associated with triglyceride concentrations. The odds of having hypertriglyceridemia were greater for participants who were obese (odds ratio [OR; 95% confidence interval], [4.25; 3.44-5.24]) or overweight [2.79; 2.27-3.43]. The Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale had acceptable internal consistency for the entire sample, language groups, and Latino heritage groups ($\alpha \geq 0.60$), and satisfactory fit of the one-factor model. After adjusting for sociodemographic factors and perceived and chronic stress, SNI scores were related to a lower prevalence of CHD [0.87; 0.78-0.98], ISEL-12 scores were related to a higher prevalence of CHD [1.03; 1.00-1.05], all four social capital indicators were related to diabetes (ISEL-12: [0.98;0.96-1.00]; SNI: [0.92; 0.86-0.99]; Neighborhood Social Cohesion: [1.06; 1.02-1.10]; Neighborhood Problems: [1.04; 1.01-1.07]), SNI scores were related to a lower odds of hypertension [0.92; 0.87-0.98] and smoking [0.87; 0.80-0.93], and Neighborhood Problems was related to a higher odds of smoking [1.04; 1.01-1.07].

Conclusions: Based upon the current analyses, reduction of hypertriglyceridemia in Latinos is necessary to help decrease the risk of poor

cardiovascular health, the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale are acceptable to use within a Latino sample, and future research to confirm the effects of social capital on cardiovascular health may help reduce health disparities among Latinos.

INTRODUCTION

The *Healthy People 2020* objectives provide a systematic approach to achieving national health goals for the United States (US). Objectives related to heart disease and stroke include improving overall cardiovascular health, reducing deaths from stroke and coronary heart disease, and reducing the number of people with hypertension (1). Similar to the objectives set forth by *Healthy People 2020*, the American Heart Association's (AHA) *Impact Goals for 2020* include improving the cardiovascular health of all Americans by 20% and reducing death from stroke and cardiovascular disease (CVD) by 20% (2). These are worthwhile goals, as diseases of the heart are not only the leading cause of death in the US, but CVD accounts for the most days spent in the hospital. Cerebrovascular disease falls close behind as the fourth leading cause of death in the US (3). Not only is CVD the leading cause of mortality and hospitalization, but the economic impact of CVD is devastating. Nearly $298 billion in health care expenditures is due to CVD (3).

The AHA classified cardiovascular health into poor, intermediate, and ideal categories. Seven components of cardiovascular health were defined, including the health behaviors of smoking, weight, physical activity, and a healthy dietary pattern. Three biomarkers that contributed to the description of cardiovascular health were total cholesterol, blood pressure, and fasting plasma glucose. According to National Health and Nutritional Examination Survey (NHANES), data collected in 2007-2008, across all age groups, the prevalence of an ideal cardiovascular health profile for all seven components, was 0% (2). Upon isolating only the three biomarker components along with smoking, 27.7% of 20- to 39-year-olds had ideal cardiovascular health (2). This percentage dropped considerably with increasing age as only 9.7% of 40- to 59-year-olds and 1.0% of those aged 60 and older had ideal cardiovascular health (2). Based upon these data, it is evident that the majority of Americans are at risk for poor cardiovascular health outcomes.

Minorities are disproportionately affected by CVD risk and the burden of disease (4). For example, national data indicate Mexican-American men have the highest levels of total serum cholesterol and percent overweight of all ethnic/racial and gender groups (3). Nearly 76% of Mexican-American women are overweight, compared to 59% of non-Hispanic White women (3). Compared to non-Hispanic Whites, there is higher incidence of stroke among Latinos (5) and lower control of hypertension (6). Only 16.7% of Latino Americans met the 2008 Guidelines for Physical Activity for both aerobic and strength training, whereas 21% of non-Hispanics met both recommendations (7).

Latinos are the largest ethnic minority in the US, with increases in the Latino population contributing the most to population growth between 2000-2010 (8). From a public health perspective, it is necessary to understand the behavioral and social determinants of cardiovascular health in this fast-growing and vulnerable population.

Hypertriglyceridemia

Hypertriglyceridemia is an independent risk factor for CVD (9) with Latinos affected by disparities in hypertriglyceridemia prevalence. Compared to non-Hispanic Whites, Mexican-Americans have higher rates of hypertriglyceridemia (10) and lower awareness and treatment rates for dyslipidemia (11), putting them at increased risk for development of atherosclerosis and other CVD. Lifestyle modification is the first line of treatment for hypertriglyceridemia (12). Studies report reductions of triglyceride concentration following moderate physical activity (12, 13) and consumption of foods high in unsaturated fatty acids and fiber (12).

Because dietary and activity behaviors contribute to triglyceride metabolism and subsequent CVD risk (12), it is important to identify these individual factors in Latinos. Data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) indicate that dietary intakes of Latinos vary depending on ethnic background, with 24-hour recalls indicating that Cubans have the highest overall fat intake, Puerto Ricans have the highest saturated fat intakes, and Dominicans have the highest carbohydrate intakes (14). Physical activity levels of Latinos vary depending upon ethnic background. Data from the National Health Interview Survey (NHIS) indicate that 62.2% of Cubans, 59.8% of Dominicans, 47.7% of Central or South Americans, 45.9% of Puerto Ricans, and 42.4% of Mexican Americans report no leisure time physical activity (LTPA) (15). Independent of activity levels, sedentary time is associated with higher levels of triglyceride concentrations (16). Although data for separate Latino ethnic groups are lacking, 2003-2006 NHANES data indicate that accelerometer-derived sedentary time in Mexican Americans was 7.54 hours/day (17). Lack of physical activity and excess sedentary time is detrimental to cardiovascular health. Because of these discrepancies in diet and physical activity behaviors, evaluation among separate Latino ethnic groups is needed to adequately address their contributions to disparities in CVD risk.

Neighborhoods

Although the Latino population comprises the majority of population growth in the US (8), and makes up the largest immigrant group (18), there is a lack of research identifying neighborhood features that are relevant to cardiovascular health among Latinos. Compared to more ethnically-diverse neighborhoods, Latino enclaves often have lower socioeconomic status (19) and fare worse on measures of physical activity environments and social environments, including walkability, safety, social cohesion, and civic participation (20). Regardless of these deleterious factors, compared to US-born Whites, Latino immigrants have lower mortality risks (21). This unexpected outcome, termed the Hispanic paradox (22), suggests that either individual-level characteristics, like health behaviors, or beneficial neighborhood characteristics mitigate the role of negative environmental effects on Latinos' health. Evaluating these neighborhood characteristics is important to help address social and environmental factors that contribute to CVD risk among Latinos.

Social Capital

Social capital is conceptualized as the social networks of people living in a community that allow for society to function effectively (23). In addition to the structural dimension of social capital that includes the social network, there is a cognitive dimension that includes trust and social norms (23). Research suggests that social capital is a determinant of health. For example, among non-Hispanic whites, higher levels of neighborhood social capital are associated with lower all-cause mortality of residents (24). This could be due to the establishment of healthy social norms among residents or from the social support provided by members of neighbors' social networks. Social network and social support are associated with health outcomes. For example, compared to those with more extensive social networks, individuals who are socially isolated have higher mortality rates (25, 26). Similarly, a review of studies examining the role of social support and health found that social support is a cardiovascular health protective factor (27).

There is little research regarding the health effects of social capital among Latino groups. In addition to the existing health disparities among Latinos, various operationalizations of social capital have contributed to the lack of research. Examining social capital indicators among Latinos will help inform research regarding social determinants of cardiovascular health in this underserved group.

The Hispanic Community Health Study/Study of Latinos (HCHS/SOL) is the most inclusive study of Latinos ever conducted. Data from this study will inform researchers of risk and protective factors associated with varied health conditions and measures needed to promote health in the Latino community. Limited studies have evaluated triglyceride levels among Latinos of diverse ancestries (28-30). No studies have assessed the internal consistency and construct validity of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale in an exclusively Latino sample. Similarly, no studies have examined the relationship between social capital indicators and clinically assessed CVD risk factors and CVD prevalence in an exclusively Latino sample.

Chapters of the Dissertation

The goals of this dissertation are to better understand the relationships between select behavioral and social determinants of cardiovascular health among Latinos.

A Socioecological Model (SEM) of cardiovascular health, the Meikrich Model of Health, served as a theoretical guide for the dissertation (Figure 0.1) (31). Chapter 1 examines individual-level factors of dietary behaviors and sedentary time on cardiovascular health. Chapter 2 examines social and physical environmental factors contributing to cardiovascular health. Chapter 3 examines social environmental factors of cardiovascular health.

Chapter 1 examined the prevalence of hypertriglyceridemia and associations of carbohydrate intake and sedentary time with triglyceride concentration. Participants included 10,946 Latinos (aged 18-74) from four study sites: Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA. Chapter 1 was a secondary data analysis of HCHS/SOL. The main objective of this ongoing, multi-center epidemiologic study was to determine the prevalence of, and the risk and protective factors for, cardiovascular disease and other health conditions in diverse US Latino populations. At this time, Chapter 1 is the first study to assess the relationship between carbohydrate intake and accelerometer-measured sedentary time with triglyceride concentrations among the diverse heritage groups that compose the US Latino population.

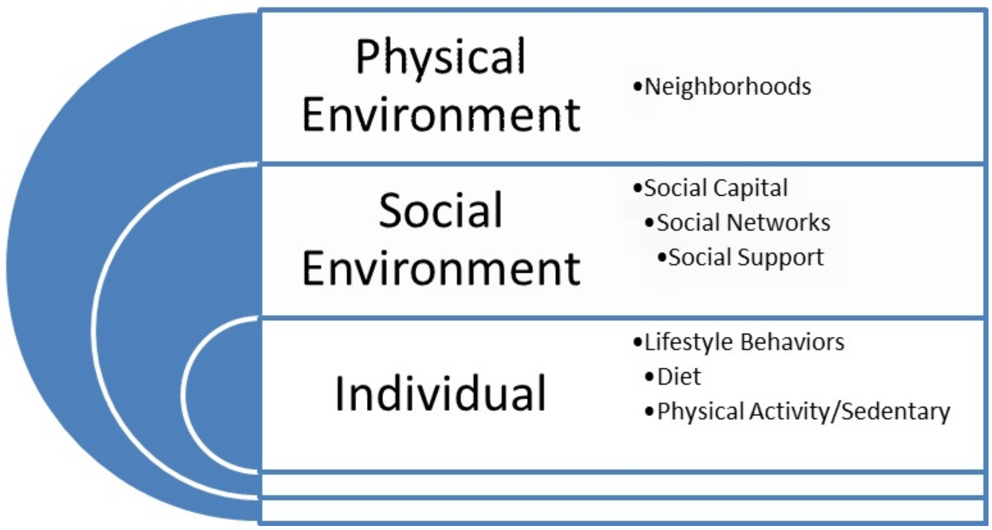

Figure 0.1: Socioecological Model.

Chapter 2 examined the internal consistency and construct validity of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale in an exclusively Latino sample. Participants included 5,172 Latinos (aged 18-74 years) from four study sites: Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA. Chapter 2 was a secondary data analysis of the HCHS/SOL Sociocultural Ancillary Study (SCAS). The main objective of HCHS/SOL SCAS was to evaluate the relationships among sociocultural, socioeconomic, and psychological risk and protective factors with metabolic syndrome and cardiovascular disease prevalence. At this time, Chapter 2 is the first study to examine the internal consistency and construct validity of a Neighborhood Social Cohesion Scale and a Neighborhood Problems Scale administered in two languages (English and Spanish) among several Latino groups.

Chapter 3 examined the use of four social capital indicators (Intrapersonal Support Evaluation List-12, Social Network Index (SNI), Neighborhood Social Cohesion Scale, and Neighborhood Problems Scale) in relation to CVD risk factors and CVD prevalence. Chapter 3 was a secondary data analysis of the HCHS/SOL SCAS, and included the same participants as those in Chapter 2. At this time, Chapter 3 is the first study to examine the relationship between social capital correlates and clinically assessed CVD risk factors and CVD prevalence in an exclusively Latino population.

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CHAPTER 1

Hypertriglyceridemia in the Hispanic Community Health Study/Study of Latinos: Roles of Carbohydrate Intake and Sedentary Time

Abstract

Triglyceride concentration is a risk factor for cardiovascular disease (CVD). However, data are sparse regarding triglyceride concentrations among Latinos. The present study examined estimated mean triglyceride concentration among six Latino heritage groups, and investigated the relationship of carbohydrate intake and sedentary time with triglyceride concentration, and with elevated triglycerides. Data were from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL). Participants included 10,946 Latinos (aged 18-74 years) from four study sites: Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA. They completed anthropometric, dietary, activity, and clinical measures. The estimated mean triglyceride concentration for men was higher than optimal (i.e., ≥150 mg/dL) for Central Americans, Mexican Americans, and South Americans. Estimated mean triglyceride concentrations for women were in the normal range for all heritage groups. Among the sample, the percentage of men with elevated triglyceride concentration ranged from 2.04% to 14.81% across the different heritage groups. For women, the range was 1.24% to 11.65%. Predicted carbohydrate consumption and Body Mass Index (BMI) were positively associated with triglyceride concentration. The odds of having elevated triglyceride concentration were greater for participants who were obese (OR = 4.25, 95% CI = 3.44-5.24) or overweight (OR = 2.79, 95% CI = 2.27-3.43). To reduce the risk of future CVD incidence, it is necessary to evaluate the prevalence of hypertriglyceridemia and examine dietary and activity correlates of triglyceride concentration.

Introduction

Cardiovascular disease (CVD) accounts for one out of three deaths in the US, resulting in over 786,000 deaths annually (1). Independent of other risk factors, hypertriglyceridemia is a known risk factor for CVD in adults (2). In 2011, The National Cholesterol Education Program revised guidelines for the classification of serum triglyceride concentration into categories; a concentration ≥150 mg/dL is considered above normal (see Table 1.1) (3). According to 1999-2008 NHANES data, 48.3% of all adult Americans aged 20 years and older had triglyceride concentrations ≥150 mg/dL (4).

Table 1.1. Adult Treatment Panel III (ATP-III) Classification of Serum Triglycerides (mg/dL)

Triglycerides	Concentrations
Normal	<150
Borderline high	150-199
High	200-499
Very high (severe)	≥500

Energy balance plays a role in triglyceride metabolism. National data indicate that individuals with hypertriglyceridemia are more likely to be overweight or obese, compared with people who have normal triglyceride concentrations (5). Controlled feeding studies with diets high in carbohydrate result in higher concentrations of fasting triglycerides (6). This increase in triglyceride concentrations is theorized to occur from an impaired ability by insulin to reduce the rate of lipolysis in adipose tissue, resulting in increased production of Very Low-Density-Lipoproteins (VLDLs) which are endogenous sources of triglycerides (6). Prolonged sedentary behavior is also associated with higher triglyceride concentrations in adults (7), even in those who meet physical activity guidelines (8). Initial treatment of elevated triglycerides involves lifestyle changes, including increasing physical activity while avoiding high-carbohydrate diets (3). Moderate intensity physical activity is associated with a reduction of triglyceride concentration (3, 9). Results from clinical trials report reductions in triglyceride concentration with consumption of a Mediterranean-style diet, which promotes foods high in unsaturated fatty acids and fiber (3).

Dietary correlates of triglyceride concentration have been examined, including alcohol consumption, fiber intake, and eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) from fish oil consumption. Excessive alcohol consumption has a deleterious effect on triglyceride concentration. In a study conducted among 5,769 Swiss adults, compared to non-drinkers, significant positive associations in triglyceride concentration were seen in both high alcohol drinkers (14-34 drinks/week) and very high drinkers (≥35 drinks/week) (10). In another study conducted among 482 Chinese adults, those with hypertriglyceridemia reported significantly higher consumption of alcohol compared to those who had normal triglyceride concentrations (11). A meta-analysis of 42 experimental studies showed that triglyceride concentration increased by 5.69 mg/dL per 30 grams of alcohol consumed daily, a 5-10% increase over non-drinkers (12). Conversely, fiber intake has beneficial effects on triglyceride concentration. Among a group of 1,592 middle-aged Spaniards, triglyceride concentration was significantly inversely associated with consumption of both insoluble and soluble fiber, with consumption of an additional 1g of insoluble fiber daily associated with a reduction of 0.037mg/dL in the Triglyceride/High Density Lipoprotein (TG/HDL) ratio (13). In a meta-analysis of 341 participants in eight randomized controlled trials lasting between 4 and 12 weeks long, consumption of 3-10g/day of barley resulted in an 11.83 mg/dL decrease in triglyceride concentration (14). Consumption of EPA/DHA also has beneficial effects on triglyceride concentration. In a controlled trial of over 18,000 hypercholesterolemic middle-aged Japanese adults randomized to either statin only or a statin with a daily 1,800 mg EPA supplement, those who consumed the EPA had a 9% decrease in triglyceride concentrations 4 to 6 years after baseline (15). In a double-blind trial with 332 Swedes, those who consumed specified amounts of EPA/DHA had a 9.3-16.2% lower triglyceride concentration compared to those in a placebo-controlled group (16).

Disparities in dyslipidemia prevalence, which includes hypercholesterolemia and hypertriglyceridemia, exist among Latinos. According to 1999-2008 NHANES data, Mexican Americans appear to suffer more from elevated triglycerides compared to non-Hispanic Whites (4). Additionally, Mexican Americans have significantly lower awareness and treatment rates for dyslipidemia compared to non-Hispanic Whites (17). The combination of greater prevalence and lower rates of awareness and treatment puts Mexican Americans at increased risk for development of atherosclerosis and other CVD (3). Hispanic NHANES data from 1982-1984 and 1999-2006 indicate the percentage of Mexican-American adults who are obese has increased from 21.2% to 34.7% over the past 25 years (18). This rise in obesity parallels an increase in calorie consumption that appears to be from an increase in carbohydrate consumption, and decreases in total fat intake, saturated fat intake, and protein intake(18). In addition to this, Mexican Americans are not meeting physical activity guidelines (19). With increases in obesity from a combination of greater carbohydrate consumption and low rates of physical activity, increases in triglyceride concentrations would likely result.

Limited studies have characterized the prevalence of hypertriglyceridemia among Latinos. Furthermore, there is limited research assessing triglyceride concentrations among various Latino heritage groups, which limits a thorough understanding of the disparities associated with this CVD risk factor. One previous study examined triglyceride concentrations among Hispanic Americans (20) and two among persons of diverse Latino heritages, including Mexican, Puerto Rican, and Cuban (21, 22). No studies have assessed the relationship between carbohydrate intake and accelerometer-measured sedentary time with triglyceride concentrations among the diverse heritage groups that compose the US Latino population. The current study is innovative because it not only uses data from a large epidemiologic study whose participants are exclusively Latino, but Latinos of different backgrounds are well represented. The purpose of the present study is to (1) evaluate the prevalence of hypertriglyceridemia in Latinos who participated in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), (2) assess estimates of mean triglyceride concentration for six Latino heritage groups, (3) to investigate the independent association of dietary carbohydrate intake, sedentary time, and Body Mass Index (BMI) with overall triglyceride concentration, and (4) to investigate the independent association of dietary carbohydrate intake, sedentary time, and BMI with elevated triglyceride concentration versus normal values of triglyceride concentration.

Methods

Participants and Procedures

This cross-sectional study involved secondary data analyses from participants of HCHS/SOL. Specifics regarding the design and implementation of the HCHS/SOL study were previously published (23). Briefly, the main objective of this ongoing, multi-center epidemiologic study was to determine the prevalence of, and the risk and protective factors for, cardiovascular disease and other health conditions in diverse US Latino populations. Coronary Heart Disease prevalence, stroke prevalence, and percentages of individuals with related risk factors of hypercholesterolemia, hypertension, obesity, diabetes mellitus, and smoking have been previously reported (24). Study centers from where targeted populations were recruited include (1) Bronx, New York, (2) Chicago, Illinois, (3) Miami, Florida, and (4) San Diego, California.

Specifics regarding the sampling design and cohort selection were previously published (25). Briefly, to minimize bias and increase the diversity of the study sample, a two-stage probability sampling design was used. Random selection of census block groups, stratified by Latino concentration and socioeconomic status with oversampling from highly populated Latino areas, was the first stage. Random selection of households, with oversampling from those with Latino surnames, was the second stage. Participants were 16,415 adults, aged 18-74. The present analyses were limited to participants who wore an accelerometer for 3 or more days at baseline assessment and who completed two 24-hour food recalls (*N* = 10,946).

Measures

Demographic Variables. A questionnaire assessed sex, age, annual income (less than $10,000, $10,001-$20,000, $20,001-$40,000, $40,001-75,000, and $75,001 or greater), duration of residence in the US (less than 10 years or 10 or more years), nativity (US born or foreign born), education (less than high school, high school graduate or equivalent, more than high school), language used during the interview (Spanish or English), and Latino background (Dominican, Central American, Cuban, Mexican American, Puerto Rican, South American).

Anthropometrics. Height in meters and weight in kilograms were measured using a standardized protocol. BMI was calculated using the Quetelet index (kg/m^2).

Alcohol Use. Participants reported alcohol consumption in total drinks per week. Following the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guidelines (26), a derived variable was created to differentiate non-users from low level users and high level users. Former users were grouped with participants who indicated they never drank alcohol. Low level users were defined as consuming fewer than 7 drinks per week for women, and fewer than 14 drinks per week for men. High level users were defined as consuming 7 or more drinks per week for women, and 14 or more drinks per week for men.

Medications. Participants were asked to bring in all current prescription medications to the clinical exam. Medications were classified into the following groups: Hormone Replacement Therapies (HRT), antiarrhythmics, anticoagulants, antidiabetics, antihypertensives, antiplatelets, Beta blockers, Calcium channel blockers, cardiac glycosides, antineoplastics, COX-2 inhibitors, diuretics, fibric/ nicotinic acids, insulins, lipid lowering drugs, NSAIDs, and statins. Participants who took any drug listed were considered a user, while those who did report taking medications were considered non-users.

Triglyceride Concentration. Participants underwent a blood draw using standardized procedures, to determine triglyceride concentration. Serum triglycerides were measured using a glycerol blanking enzymatic method (Roche Diagnostics, Indianapolis, IN) on a Roche Modular P chemistry analyzer (Roche Diagnostics, Indianapolis, IN). The clinically reportable range for triglyceride concentrations is 10-4000 mg/dL (27).

24-hour Dietary Recalls. Two 24-hour food recalls, conducted using the Nutrition Data System for Research (NDSR), were administered to participants between 5 and 45 days apart. The first dietary recall was conducted in person at the baseline visit by trained interviewers, with the second recall occurring over the phone. Assessment of dietary intake used a one-part non-linear mixed statistical model to estimate usual intake of nutrients (28, 29). Derived variables were then calculated using the National Cancer Institute (NCI) method for total energy (kcal), total carbohydrate (g), total fiber (g), and EPA/DHA intake (http://appliedresearch.cancer.gov/diet/usualintakes/method.html).

Physical Activity (PA) and Sedentary Time by Accelerometry. Participants were instructed to wear an Actical™ (MiniMiter Respironics®, Bend, OR) accelerometer (model 198-0200-03) for 7 consecutive days. Initial analysis of accelerometry data was standardized by specifying the first day of wear time as the day following the baseline visit, and keeping at most, 6 days of data. Periods of 90 minutes or more that had continuous zero activity counts (30) and any days with fewer than 10 hours of recording were excluded. At least 3 adherent days of accelerometer data were required for summarization at the participant level. The accelerometers measured counts in 60-second epochs. Less than 100 counts per 60 second epoch (<100 counts/min) was used as the threshold for calculating minutes of sedentary time. Moderate physical activity (PA) was defined as 1535-3961 counts per 60 second epoch (1535-3961 counts/min) (31). Vigorous physical activity (PA) was defined as greater than or equal to 3,962 counts per 60 second epoch (≥3,962 counts/minute) (31). Average minutes per day of sedentary time, moderate PA, and vigorous PA were calculated across all valid days (number of valid days ranged from 3 to 6). Participants with fewer than 3 valid days were excluded from the present analyses because 2 days may not have been representative of their usual physical activity and sedentary patterns (32).

Procedure and Statistical Analyses

Descriptive statistics included means and standard errors for continuous variables and numbers and percentages for categorical variables. Sex-specific age adjusted means were estimated for triglyceride concentrations for the separate Latino heritage groups. The percentage of the sample with elevated triglycerides was calculated for each Latino heritage group. Linear regression analyses were used to examine associations of predicted carbohydrate intake and sedentary time with log transformed triglyceride concentrations. Models were adjusted for age, sex, annual income, education, language preference, years in the US, nativity, Latino heritage, BMI, moderate PA, vigorous PA, predicted fiber intake, predicted EPA/DHA intake and predicted total caloric intake. Specific continuous variables were modeled so that interpretation of results was more meaningful. For example, age was modeled in 10-year increments. Moderate PA, vigorous PA, and sedentary time were modeled in 10-minute bouts. Predicted total caloric intake was modeled in 100-calorie increments. Annual income, education, language preference, years in the US, nativity, and Latino heritage were categorical variables. Logistic regression analyses were used to examine associations of predicted carbohydrate intake and sedentary time with hypertriglyceridemia (elevated triglyceride concentration versus normal). Logistic models were adjusted using the same covariates listed for linear models. Triglyceride concentration was dichotomized so that concentrations greater than or equal to 150 mg/dL were considered elevated and concentrations less than 150 mg/dL were normal. BMI was categorized into three groups, underweight/normal weight, overweight, and obese. Odds ratios with 95% CIs were reported. All statistical tests were two-sided with significance set at 0.05 with no adjustments made for multiple comparisons. All statistical analyses were performed using Statistical Analysis System (SAS) Version 9.3 (Cary, NC) (33) to account for study design and sample weighting, with adjustments for sampling probability and non-response (34).

Results

Participant demographic characteristics are reported in Table 1.2. Of the 10,946 participants who completed baseline measures, nearly 51% of the weighted sample was women, with 53% indicating that they were married or living with a partner. Nearly 60% of the weighted sample had at most a high school education. Only 20% of the weighted sample was born in the continental US, with 73.4% residing in the US for 10 or more years and 77.5% completing the interview in Spanish. Almost half (46.3%) of the weighted sample reported annual earnings of $20,000 or less.

Estimated Mean Triglyceride Concentrations

Estimated triglyceride means are presented in Table 1.3. The average age of male participants was 41.8 years, while the average age of female participants was 43.3 years. Among the six Latino heritage groups, estimated mean triglyceride concentrations for men were greater than normal for three of the groups, including Central Americans, Mexican Americans, and South Americans. None of the estimated mean triglyceride concentrations for women were greater than normal. Of those estimated, Central American men had the highest mean triglyceride concentration and Dominican women had the lowest mean triglyceride concentration. Among the six Latino heritage groups, the greatest percentage of participants with elevated triglycerides was Mexican American men (14.8%) and women (11.7%).

Regression Analyses

Results from the linear regression analysis examining correlates of back transformed triglyceride concentrations are in Table 1.4. Significant positive associations were found between triglyceride concentration and predicted total carbohydrate ($p < 0.05$), such that for every gram increase in carbohydrate, triglyceride concentration increased by 1mg/dL. BMI was positively associated with triglyceride concentration, such that for every unit increase in BMI, triglyceride concentrations increased by 1 mg/dL.

Results from logistic regression models regressing elevated triglycerides (yes/no) on covariates and predictors are presented in Table 1.5. Obese participants and overweight participants had increased odds of elevated triglycerides compared to underweight/normal weight participants. Neither carbohydrate intake, nor sedentary time were significantly associated with elevated triglycerides.

Discussion

This study assessed the relationship of carbohydrate intake and sedentary time with triglyceride concentration and with hypertriglyceridemia in a diverse group of six Latino heritage groups. There were differences in the estimated mean values of triglycerides among the six Latino heritage groups, with the highest estimated concentrations seen in Central American men. In women, none of the six Latino heritage groups had elevated estimated mean values. In linear regression models with correlates of triglyceride concentration, predicted carbohydrate intake and BMI were significantly positively associated with triglyceride concentration. In logistic regression models with correlates of elevated triglyceride concentration, BMI was significantly associated with elevated triglyceride concentration.

Previously reported mean triglyceride concentrations for Latinos indicated that Mexican American men had elevated triglycerides, but did not report elevated concentrations among Puerto Rican, Dominican, or a fourth category of Latinos categorized as "Other" (21). One study that differentiated among Latino heritage groups reported a mean for Mexican-American men that is identical to the estimated mean reported in the present study, while estimated means for Cubans and Puerto Ricans are higher than those previously reported (22).

Predicted carbohydrate intake and BMI were found to be significantly associated with triglyceride concentration. Predicted dietary carbohydrate was positively associated with triglyceride concentration, which is supported by previous findings from clinical studies (6, 35). Previous research indicates that diets high in fats result in lower concentrations of fasting triglyceride concentrations compared to diets that are high in carbohydrates (35). BMI was positively associated with elevated triglyceride concentration, with obese participants having 4.25 greater odds of having elevated triglycerides compared to underweight/normal weight participants. These data confirm previous results reporting higher concentrations of triglycerides among people with greater adiposity (36, 37).

Detrimental associations between sedentary time and triglyceride concentration in adults have been previously reported (7, 8, 38). Unlike previous studies, there was no significant association between sedentary time and triglyceride concentration seen in this study. However, a lack of a relationship between sedentary time and triglyceride concentration has been seen in other cross-sectional studies. For example, among 4,935 Canadian adults participating in the Canadian Health Measures Survey, there was no significant association between accelerometer measured total sedentary time and triglyceride concentration (39). In another study with 135 inactive, obese Canadian adults, there was no significant association between accelerometer-measured sedentary time and triglyceride concentration (40). In a study that examined NHANES data from 2003-2006, increasing quartiles of accelerometer-measured sedentary time was significantly associated with triglyceride concentration in non-Hispanic adults, but not among Mexican Americans (41). These data may help to explain the conflicting reports of associations with sedentary time and triglyceride concentration.

Study strengths include the use of a large, ethnically diverse Latino sample, representing six Latino heritage groups, including Central Americans, Cuban

Americans, Dominicans, Mexican Americans, Puerto Ricans, and South Americans. Study participants were randomly selected from four populated cities, including the Bronx, Chicago, Miami, and San Diego, ensuring good representation of diverse Latino heritage groups. This study also used accelerometers to objectively measure physical activity and sedentary time. The study, however, does have limitations. Participants were not recruited nationally, and thus, there is a limit to the ability to generalize to other US Latino populations, such as those residing in rural areas. Also, Central and South American participants were not grouped by individual country or territory, as was done for the other participants. There is also the potential of measurement error, including participant recall bias and interviewer bias when conducting 24-hour food recalls. There was no objective observation of diet. Future research could address these limitations by either assessing nutritional biomarkers to obtain objective estimates of dietary exposure or incorporating technological advances by using ecological momentary assessment of eating.

Conclusions

These are the first findings to show an association between predicted carbohydrate intake and triglyceride concentration in a diverse Latino sample. Although no relationship was found between sedentary time and triglyceride concentration, further research, including experimental studies in diverse Latino heritage groups, is needed to better understand the roles of sedentary time on cardio-metabolic risk factors.

Acknowledgment: This chapter is currently under review. The reference information will be as follows: Nanette V. Lopez, John P. Elder, et al., Hypertriglyceridemia in the Hispanic Community Health Study/Study of Latinos: Roles of Carbohydrate Intake and Sedentary Time. A full listing of co-authors is unable to be determined at this time.

Table 1.2: Weighted Sample Characteristics for the Total Sample and by Hispanic/Latino Background Group (N = 10,946)

	Overall (n = 10,946)		Dominican (n = 1,046)		Central American (n = 1,109)		Cuban (n = 1,421)		Mexican American (n = 4,754)		Puerto Rican (n = 1,840)		South American (n = 776)	
Characteristic	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Age (*M*, *SE*)	42.54	0.27	40.66	0.75	41.20	0.61	48.27	0.54	39.95	0.38	44.13	0.53	43.66	0.76
Women	50.81	0.68	57.29	2.17	49.25	2.11	43.78	1.38	52.77	1.22	49.70	1.64	52.57	2.34
Married or cohabitating	53.18	0.90	40.09	2.10	49.63	2.21	54.97	1.65	62.50	1.46	36.65	1.70	55.29	2.44
Income														
$<10,000	14.54	0.57	16.65	1.65	14.87	1.43	18.49	1.41	10.20	0.76	21.20	1.49	9.68	1.45
$10,001-20,000	31.76	0.85	35.68	2.08	37.84	2.16	36.45	1.57	28.94	1.49	27.82	1.46	33.28	2.47
$20,001-40,000	33.33	0.73	34.26	2.22	33.47	2.12	29.37	1.47	36.74	1.28	26.82	1.56	38.27	2.50
$40,001-75,000	14.31	0.61	10.49	1.30	11.09	1.39	10.71	0.97	16.49	1.05	16.79	1.29	14.48	1.59
$>75,001	6.05	0.68	2.93	0.95	2.72	0.69	4.98	0.97	7.63	1.36	7.36	0.92	4.29	1.11
Education														
<High School/ GED	31.96	0.82	36.02	2.01	36.77	1.94	20.10	1.24	36.20	1.51	33.35	1.58	21.16	2.05
High School	27.88	0.65	23.58	1.91	27.17	1.75	28.39	1.66	28.86	1.10	28.21	1.46	27.06	2.15
>High School GED	40.16	0.92	40.39	1.93	36.06	1.98	51.51	1.69	34.94	1.77	38.44	1.67	51.79	2.38
Years in US														
<10	26.62	0.95	23.74	2.25	34.49	2.58	44.98	1.97	24.20	1.27	6.01	1.00	39.07	2.77
≥10	73.38	0.95	76.26	2.25	65.51	2.58	55.02	1.97	75.80	1.27	93.99	1.00	60.93	2.77
US born	19.97	0.82	13.31	1.94	6.21	1.24	5.27	0.98	21.45	1.11	48.49	1.84	5.31	1.07
Spanish language	77.53	0.92	78.81	2.09	88.14	1.68	94.37	0.83	79.94	1.09	41.89	2.00	90.87	1.46

Table 1.3: Estimated Triglyceride Means Adjusted Using Gender-Specific Mean Age (N = 10,946)

Gender-specific mean age	Ethnicity	Estimate (*SE*)	Percent (*SE*) with ElevatTGs (≥150mg/dL)
Male age mean (41.80 yrs)	Dominican	120 (5.40)	2.04 (0.29)
	Central American	170 (8.44)	3.12 (0.34)
	Cuban	147 (3.77)	8.35 (0.84)
	Mexican American	156 (4.29)	14.81 (0.92)
	Puerto Rican	148 (13.0)	5.02 (0.47)
	South American	153 (6.43)	2.28 (0.28
Female age mean (43.25 yrs)	Dominican	102 (3.41)	1.52 (0.23)
	Central American	120 (2.75)	1.74 (0.21)
	Cuban	116 (2.58)	4.63 (0.54)
	Mexican American	129 (2.14)	11.65 (0.67)
	Puerto Rican	122 (4.78)	3.93 (0.45)
	South American	110 (3.56)	1.24 (0.17)

Table 1.4: Linear Regression of Associations among BMI, Carbohydrate Intake, Accelerometry-measured Sedentary Time, and Back Transformed Natural Log Triglyceride Concentrations among HCHS/SOL Participants (*N* = 10,946)

Demographics		Percent estimate	β coefficient	*SE* (lower)	*SE* (upper)	*p* value
Gender	Male vs. female	25.06	1.251	1.223	1.279	<0.0001
Age	10-yr increments	9.20	1.092	1.083	1.101	<0.0001
Medications[a]	Any vs. none	5.77	1.058	1.035	1.081	0.010
Alcohol use[b]	High vs. none	16.00	1.160	1.106	1.122	0.002
	Low vs. none	2.00	1.020	1.004	1.036	0.202
Education	Less than HS vs. More than HS	-0.23	0.998	-1.022	1.018	0.909
	HS/GED vs. More than HS	-3.35	0.966	-1.057	-1.013	0.103
Income	<$10,000 vs. >$75,001	14.33	1.14	1.097	1.191	0.001
	$10,001-$20,000 vs. >$75,001	11.81	1.12	1.078	1.160	0.002
	$20,001-$40,000 vs. >$75,001	9.53	1.10	1.055	1.137	0.015
	$40,001-$75,000 vs. >$75,001	6.82	1.07	1.026	1.113	0.105
Acculturation	US Born vs. Foreign Born	-4.64	0.954	-1.079	-1.019	0.098
	Yrs in US (≥10 vs. <10)	-1.42	0.986	-1.034	1.005	0.447
Predicted EPA/DHA (g)		-0.042	1.00	-1.001	-1.000	0.135
Predicted total CHO (g)		0.105	1.00	1.001	1.001	0.014
Predicted fiber (g)		-0.027	1.00	-1.003	1.002	0.909
Moderate activity	10-min increments	-1.20	0.988	-1.017	1.008	0.006
Vigorous activity	10-min increments	-0.735	0.993	-1.015	-1.000	0.302
Sedentary time	10-min increments	0.010	1.00	-1.000	1.001	0.856

(*table continues*)

Table 1.4: Continued

Demographics		Percent estimate	β coefficient	*SE* (lower)	*SE* (upper)	*p* value
Predicted energy intake	100-kcal increments	-1.14	0.989	-1.017	-1.006	0.029
BMI		2.21	1.02	1.021	1.023	<0.001

[a]Medications = Included medications are anti-arrythmics, anti-anginals, anti-coagulants, anti-hypertensives, Beta blockers, diuretics, contraceptives and hormone treatment, anti-glucosides, aspirin, NSAIDs, statins.

[b]Alcohol use = Low is 1 drink weekly for women and 1-2 drinks weekly for men; High is more than 7 drinks weekly for women and more than 14 drinks weekly for men.

Table 1.5: Logistic Regression among BMI, Carbohydrate Intake, Accelerometry-measured Sedentary Time, and Triglyceride Levels (Outcome = Elevated Triglycerides) among HCHS/SOL Participants (*N* = 10,946)

Demographics		OR	(95% CI)	*p* value
Gender	Male vs. Female	2.20	1.83-2.64	<0.001
Age	10-yr increments	1.24	1.16-1.34	<0.001
Medications[a]	Any vs. None	1.40	1.18-1.66	0.001
Alcohol use[b]	High vs. None	1.31	0.95-1.81	0.123
	Low vs. None	1.05	0.90-1.22	0.356
Education	Less than HS vs. More than HS	0.89	0.74-1.06	0.643
	HS/GED vs. More than HS	0.84	0.71-1.00	0.130
Income	<$10,000 vs. >$75,001	2.36	1.63-3.41	0.001
	$10,001-$20,000 vs. >$75,001	2.22	1.58-3.10	0.001
	$20,001-$40,000 vs. >$75,001	1.89	1.35-2.64	0.242
	$40,001-$75,000 vs. >$75,001	1.66	1.19-2.31	0.506
Acculturation	US Born vs. Foreign Born	0.85	0.66-1.09	0.188
	Yrs. in US (≥10 vs. <10)	9.93	0.78-1.10	0.367
Predicted EPA/DHA(g)		0.997	0.995-1.00	0.023
Predicted total CHO (g)		1.00	1.00-1.01	0.134
Predicted fiber (g)		1.00	0.98-1.02	0.690
Moderate activity	10-min increments	0.97	0.93-1.00	0.081
Vigorous activity	10-min increments	0.97	0.88-1.07	0.561

(*table continues*)

Table 1.5: Continued

Demographics		OR	(95% CI)	*p* value
Predicted energy intake	100-kcal increments	0.98	0.93-1.02	0.301
BMI	Obese vs. underweight/normal weight	4.25	3.44-5.24	<0.0001
	Obese vs. overweight	2.79	2.27-3.43	<0.0001

[a]Medications = Included medications are anti-arrythmics, anti-anginals, anti-coagulants, anti-hypertensives, Beta blockers, diuretics, contraceptives and hormone treatment, anti-glucosides, aspirin, NSAIDs, statins.

[b]Alcohol use = Low is 1 drink weekly for women and 1-2 drinks weekly for men; High is more than 7 drinks weekly for women and more than 14 drinks weekly for men.

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CHAPTER 2

Measurement Properties of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale: Findings from the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study

Abstract

Measures of Neighborhood Social Cohesion and Neighborhood Problems are used to evaluate the relationship between neighborhood characteristics and individual health outcomes. Although researchers have used several versions of these scales, few have reported on their psychometric properties. The present study examined the internal consistency of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale in an exclusively Latino sample. Both were tested for factorial validity. To determine the equivalence of scale parameters for all groups, factorial invariance of the one-factor model for each scale was tested, across English and Spanish language versions and across six Latino heritage groups. Data were from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) Sociocultural Ancillary Study (SCAS). Participants included 5,172 Latinos (aged 18-74 years) from four study sites: Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA. Participants completed an interview in either Spanish or English, providing information on the level of social cohesion and problems within their individual neighborhoods. Neighborhood Social Cohesion was assessed with five items, while Neighborhood Problems was assessed with seven items. Both the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale had acceptable internal consistency for the entire sample, language groups, and Latino heritage groups ($\alpha \geq 0.70$). The Neighborhood Social Cohesion Scale was invariant across language groups and Latino heritage groups (CFI$\geq$0.90, RMSEA$\leq$0.08, and SRMR$\leq$0.08). Although the Neighborhood Problems Scale did not meet all recommended cutoffs

(CFI0.≥90, RMSEA≤0.08, and SRMR≤0.08), taken as a whole, the results indicate satisfactory fit of the one factor model to the data. Evaluating measurement equivalence of scales within Latino heritage groups helps reduce bias in results and informs future studies conducting research in this fast-growing and diverse population.

Introduction

Neighborhood characteristics, including social cohesion and problems, have been assessed in studies examining the relationship between group-level effects and individual health outcomes (1-8). "Neighborhood social cohesion" is the sense of trust and solidarity among neighbors through the formation of social ties. "Neighborhood problems" indicates the types of environmental conditions that affect an entire community, including air pollution, safety concerns, access to resources, and neighborhood aesthetics. Group-level effects are the contributions of neighborhood physical and social environments on health status, independent of one's individual-level characteristics such as gender, age, ethnicity, acculturation, and socioeconomic status. These group-level effects consist of a neighborhood's aesthetic quality, walking environment, availability of healthy foods, places to be active, safety, violent crime rates, and camaraderie among neighbors. Neighborhood group-level effects are frequently measured using an ecometric approach in which researchers evaluate census tract-level data to aggregate individual perceptions to the neighborhood level. For example, using this approach, greater neighborhood social cohesion is associated with less hypertension (6) and a reduced risk of death from both stroke (2) and myocardial infarction (1) among neighborhood residents. Neighborhood problems are positively associated with higher rates of depression (7), greater prevalence of smoking and alcohol consumption (7) and poorer self-rated health (8). While the ecometric approach allows for these estimations of health outcomes, it lacks the ability to evaluate specific health-relevant features across which neighborhoods may differ.

Health-relevant neighborhood features are especially important to determine among Latinos, as growth in the Latino population comprises the majority of population growth in the US (9). Among US immigrants, Latinos are the largest group (10). Immigrant enclaves of Latinos fare worse on measures of physical activity environments and social environments, including walkability, safety, social cohesion, and civic participation, compared to those neighborhoods with less Latino immigrants (11). These enclaves often have lower socioeconomic status compared to ethnically-diverse neighborhoods (12). Although these inferior social and environmental features are associated with worse health, Latino immigrants have lower mortality risks compared to their US-born White counterparts (13). This suggests that either individual-level characteristics, like health behaviors, or a beneficial neighborhood characteristic, like greater social cohesion, mitigate the role of negative neighborhood effects on Latinos' health.

Besides using census-tract measures, there are several other ways to assess neighborhood characteristics. Geographic information systems can be used to map physical locations of homes, stores, and community properties like schools, libraries, and parks. Trained observers can be used to assess neighborhoods on specific health-relevant dimensions, such as walkability and availability of healthy foods and places to be active. Concurrent validity can be addressed by asking individuals residing in the same neighborhood to provide an assessment of neighborhood conditions, independent of those providing health-related data. These individual assessments can then be aggregated to the neighborhood level and linked to the study population. While all these approaches provide meaningful data, this study focused on the use of self-reported perceptions of neighborhood social cohesion and neighborhood problems. Construct validity is assessed by evaluating the internal structure of the questionnaires using confirmatory factor analyses.

The Neighborhood Social Cohesion Scale used in the present study was initially developed as part of a larger 10-item scale for the Project on Human Development in Chicago Neighborhoods, which recruited 8,782 Chicago-area residents from 343 racially diverse neighborhoods (14). Adaptations of Sampson's Social Cohesion Scale were used in several other studies, with two using the same 5-item version used in the present study (7, 15). The Neighborhood Problems Scale used in the present study was also used in a study conducted among Multi Ethnic Study of Atherosclerosis (MESA) participants, an ethnically diverse group of 5,943 people living in six US cities (7). While various iterations of scales assessing these constructs have been used in research, with many reporting internal consistency data (5, 14-19), few studies have reported construct validity (8, 20-22).

Little is known about how to measure neighborhood social cohesion and neighborhood problems. In part, research has been hindered by varied measurement approaches across studies and a lack of valid and reliable measures of these constructs. Furthermore, little research has been performed among Latino groups, with limited representation in large studies that do not define psychometric properties for individual ethnic groups (6-7, 14-15). Instruments that lack testing of psychometric properties across groups are limited in their applicability to various populations. For example, equivalence is a measure of content validity, supported when the measure assesses the intended construct regardless of sample characteristics. Ensuring equivalence across language and ethnicities limits the systematic measurement bias from differential misclassification of assessment of these constructs among different groups (23).

The purpose of the present study is to examine the internal consistency and construct validity of a Neighborhood Social Cohesion Scale and a Neighborhood Problems Scale administered in two languages (English and Spanish) among several Latino groups. More specifically, the aims of this study are to (1) examine the internal consistency of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale, and (2) test the factorial validity and factorial invariance of the model for English and Spanish language versions and for Latino heritage groups. Evaluating measurement equivalence among Latino heritage groups will help ensure accurate reporting of data and inform future studies conducting research in this fast-growing and diverse population.

Methods

Participants and Procedures

This cross-sectional study involved secondary data analyses from a subset of participants of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), who also participated in the HCHS/SOL Sociocultural Ancillary Study (SCAS). Details of the design and implementation of the HCHS/SOL study have been published (24). Briefly, the primary goal of this ongoing epidemiologic study was to identify the prevalence of, and the risk and protective factors for, cardiovascular disease and other conditions in diverse US Latino populations. Targeted populations were communities in (1) Chicago, Illinois, (2) Bronx, New York, (3) Miami, Florida and (4) San Diego, California.

Details of the sampling design and cohort selection have been published (25). In brief, a two-stage probability sampling design was used to minimize selection bias and increase the diversity of the study sample. The first stage was random selection of census block groups, stratified by Latino concentration and socioeconomic status with oversampling from high concentration areas. The second stage was random selection of households, with oversampling from those with Latino surnames.

The primary goal of the HCHS/SOL Sociocultural Ancillary Study (SCAS) (26) was to evaluate the relationships among sociocultural, socioeconomic, and psychological risk and protective factors with metabolic syndrome and cardiovascular disease prevalence. All HCHS/SOL participants who agreed to a second appointment within 9 months following the baseline examination were eligible to participate in

SCAS. Of 7,321 individuals whom recruiters attempted to reach, 5,313 (*N* = 72.6%) participated. SCAS participants were largely representative of the HCHS/SOL cohort, with the exception of lower participation among some higher socioeconomic strata (26).

Measures

Demographic Variables. Participants responded to a questionnaire assessing age, sex, education (less than high school, high school graduate or equivalent, more than high school), annual income (less than $10,000, $10,001-$20,000, $20,001-$40,000, $40,001-75,000, and $75,001 or greater), duration of US residence (less than 10 years or 10 or more years), preferred language during the interview (Spanish or English), and Latino background (Dominican, Central American, Cuban, Mexican American, Puerto Rican, South American).

Neighborhood Social Cohesion Scale. The Neighborhood Social Cohesion Scale (7) consisted of five items assessing self-reported relationships among neighbors. Respondents indicated agreement with each statement using a 5-point Likert response format from 1 indicating “strongly disagree,” to 5 indicating “strongly agree.” Scores for the five items were summed with total scores ranging from 5 to 25. Increasing scores represented higher levels of neighborhood social cohesion. Spanish versions of scale items were available prior to use with SCAS participants, originally developed for use in the MESA study (27).

Neighborhood Problems Scale. The Neighborhood Problems Scale (7) consisted of seven self-report items assessing problematic characteristics in participants' neighborhoods (defined as "the area around where you live"). Items asked respondents to indicate the seriousness of each problem on a 4-point Likert scale ranging from 1 indicating "not really a problem," to 4 indicating "very serious problem." Scores for the seven items were summed with total scores ranging from 7-28. Increasing scores represented a greater number of problems within the neighborhood. Spanish versions of scale items were available prior to use with SCAS participants, originally developed for use in the MESA study (27).

Procedure and Statistical Analyses

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) Version 21.0 (Armonk, NY) (28), Statistical Analysis System (SAS) Version 9.2 (Cary, NC) (29), and MPlus Version 7.0 (Los Angeles, CA) (30). SAS® was used to perform descriptive statistical analyses to account for study design and sample weighting, with adjustments for sampling probability and non-response (25). Internal consistency testing was performed in SPSS. Confirmatory factor analyses (CFA) and multi-group confirmatory factor analysis models were tested using mPlus.

Internal Consistency

Internal consistency was estimated using Cronbach's alpha for the entire sample, and separately for English and Spanish language, and Latino heritage groups. Reliability coefficients greater than 0.60 were deemed satisfactory (31).

Confirmatory Factor Analysis and Multiple-Group Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) was used to examine latent constructs underlying the scale items for the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. CFA and multiple group CFA models were examined for goodness of fit using the maximum likelihood parameter estimate with standard errors and a mean-adjusted chi-square test statistic (Satorra-Bentler chi-square) that is robust to non-normality. In addition to the Satorra-Bentler Scaled χ^2 (32), the Comparative Fit Index (CFI) (33), the Root Mean Square Error of Approximation (RMSEA) (34), and Standardized Root Mean Square Residual (SRMR) (35) were used to evaluate goodness of fit. Cutoff criteria used for goodness of fit models were as follows: CFI$\geq$0.90, RMSEA$\leq$0.08, and SRMR$\leq$0.08 (35).

CFAs were used to assess group invariance across language groups and Latino heritage groups. Nested models were compared using the chi square difference test (Δ-B χ^2) between the less and more restrictive models, to determine the best-fitting model. Configural models were the least restrictive, followed by the metric invariance model, and then the factor variance invariance model. Because the ΔS-B χ^2 is sensitive to sample size, changes in other fit statistics were examined to determine factorial invariance between nested models. Values of ΔRMSEA and ΔSRMR less than or equal to 0.015 were considered invariant (36).

Three models (i.e., configural invariance, metric variance, factor variance invariance) were tested using maximum likelihood estimation for the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. For determining language invariance, the configural invariance model (i.e., the baseline model) tested whether the English and Spanish languages had the same factor structure across groups with no equality constraints on factor loadings imposed. The metric invariance model tested whether each item of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale loaded equivalently onto its factor for both language groups by constraining equivalence. The factor variance invariance model tested whether the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale demonstrated equivalent factor variance in both English and Spanish. For determining invariance across the six Latino heritage groups, the previously described process was performed for both the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale.

Results

Participant demographics are presented in Table 2.1. Weighted descriptive analyses indicated that 54.7% of participants were female, with 49.0% either married or living as married. Participants had a mean age of 42.8 years (*SE* = .97), with 67.4%

having a high school education or greater. Over 72% had resided in the US for 10 or more years, with 76.9% of participants choosing to complete the interview in Spanish.

Internal Consistency

Item level data for the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale are presented in Table 2.2. Reliability coefficients for both scales are presented in Table 2.3. Internal consistency for the Neighborhood Social Cohesion Scale was acceptable for the entire sample, and across the language and Latino heritage groups (α = 0.63-0.72). Internal consistency for the Neighborhood Problems Scale was adequate for the entire sample, and across the language and Latino heritage groups (α = 0.74-0.79).

Confirmatory Factor Analyses

Results of the Confirmatory Factor Analyses testing the fit of the one-factor model to the Neighborhood Social Cohesion Scale data and the Neighborhood Problems Scale data are presented in Table 2.4. For the Neighborhood Social Cohesion Scale, the one-factor model presented an adequate fit to the data for the entire sample (S-B χ^2 = 182.27, df = 5, p < 0.001, CFI = 0.95, SRMR = 0.04, RMSEA = 0.08). Unstandardized factor loadings for individual items were statistically significant (values ranged from 0.32 to 1.02; SE's ranged from 0.02 to 0.03) (data not shown). For the Neighborhood Problems Scale, the one-factor model represented an adequate fit to the data for the entire sample (S-B χ^2 = 719.54, df = 14, p < 0.001,

CFI = 0.89, SRMR = 0.05, RMSEA = 0.10). Unstandardized factor loadings for individual items were statistically significant (values ranged from 0.51 to 1.25; SE's ranged from 0.03-0.04) (data not shown).

Multiple Group Confirmatory Factor Analyses across Language

Multiple group Confirmatory Factor Analyses were conducted to assess configural invariance, metric invariance, and factor variance invariance for the Spanish and English language groups. Goodness of fit statistics are presented for the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale in Table 2.4.

Configural Invariance. The configural invariance model tested whether the English and Spanish languages had an equivalent factor structure for the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale across both groups, with no equality constraints imposed. For the Neighborhood Social Cohesion Scale, the one-factor model presented an adequate fit of the data for the Spanish group (CFI = 0.95, SRMR = 0.04, RMSEA = 0.09), and for the English speaking group (CFI = 0.96, SRMR = 0.03, RMSEA = 0.07). For the Neighborhood Problems Scale, the one-factor model presented an adequate fit of the data for the Spanish group (CFI = 0.90, SRMR = 0.05, RMSEA = 0.09), and fell just short of meeting fit requirements for the English speaking group (CFI = 0.87, SRMR = 0.07, RMSEA = 0.12). As shown in Table 2.5, all unstandardized factor loadings for both the Neighborhood Social Cohesion and Neighborhood Problems Scale were statistically significant (*ps* $\leq$ .001).

Metric Invariance. The metric invariance model tested whether each item of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale loaded equivalently onto its factor for both Spanish and English groups by constraining each item's factor loading to equivalence between language groups. For the Neighborhood Social Cohesion Scale, the one-factor model presented an adequate fit of the data (CFI = 0.93, SRMR = 0.05, RMSEA = 0.08). For the Neighborhood Problems Scale, the one-factor model fell just short of meeting fit requirements for the data (CFI = 0.85, SRMR = 0.07, RMSEA = 0.10). Nested model comparisons between the metric model and configural model were conducted on the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. These nested model comparisons examined changes between SRMR and RMSEA. For both scales, the comparisons resulted in changes that were less than 0.015 for SRMR and RMSEA, confirming measurement invariance for the metric model of both scales across language groups (data not shown).

Factor Variance Invariance. The factor variance invariance model tested whether the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale factors demonstrate equivalent factor variance in both Spanish and English. For the Neighborhood Social Cohesion Scale, the model presented an adequate fit to the data (CFI = 0.93, SRMR = 0.06, RMSEA = 0.08). For the Neighborhood Problems Scale, the one-factor model fell just short of meeting fit requirements for the data

(CFI = 0.85, SRMR = 0.07, RMSEA = 0.10). To examine changes between SRMR and RMSEA, nested model comparisons between the factor variance invariance model and metric model were conducted on the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. For both scales, the comparisons resulted in changes that were less than 0.015 for SRMR and RMSEA, confirming measurement invariance for the factor variance invariance model of both scales across language groups (data not shown).

Multiple Group Confirmatory Factor Analysis across Latino Heritage Groups

Configural Invariance. Similar to the process stated above, configural invariance across the six Latino heritage groups was examined for both the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale. Baseline one-factor models of the Latino heritage groups for the Neighborhood Social Cohesion Scale all demonstrated adequate fit on two of the three indexes (CFIs > 0.90 and SRMR < 0.08). For the Neighborhood Problems Scale, only one index demonstrated adequate fit (SRMR < 0.08). As shown in Table 2.6, all unstandardized factor loadings for items on the Neighborhood Social Cohesion and Neighborhood Problems Scale were statistically significant (*ps* < .001).

Metric Invariance. Metric invariance was examined for both the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale by constraining factor loading to equivalence across the six Latino heritage groups. For the Neighborhood Social Cohesion Scale, metric invariance met or exceeded goodness of fit recommendations (CFI = 0.91, SRMR = 0.07, RMSEA = 0.08). However, goodness of fit recommendations were not met for the Neighborhood Problems Scale (CFI = 0.81, SRMR = 0.08, RMSEA = 0.10). Nested model comparisons between the metric model and configural model were conducted on the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. These nested model comparisons examined changes between SRMR and RMSEA. For the Neighborhood Social Cohesion Scale, changes less than 0.015 were seen for RMSEA only (SRMR = 0.03) (data not shown). Similarly, for the Neighborhood Problems Scale, changes less than 0.015 were seen for RMSEA only (SRMR = 0.02) (data not shown). Based upon these data, measurement invariance is not supported for the metric invariance model of the scales, meaning that factor loadings did not load equivalently across Latino heritage groups.

Factor Variance Invariance. The factor variance invariance model tested whether the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale factors demonstrate equivalent factor variance across the six Latino heritage groups. For the Neighborhood Social Cohesion Scale, goodness of fit data met the cutoff point of recommendations (CFI = 0.90, SRMR = 0.08, RMSEA = 0.08). For the Neighborhood Problems Scale, the one-factor model presented an inadequate fit of the data (CFI = 0.80, SRMR = 0.10, RMSEA = 0.10). To examine changes between SRMR and RMSEA, nested model comparisons between the factor variance invariance model and metric model were conducted on the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale. The comparisons resulted in changes that were less than 0.015 for SRMR and RMSEA, confirming measurement invariance for the factor variance invariance model of the Neighborhood Social Cohesion scale across Latino heritage groups (data not shown). For the Neighborhood Problems Scale, the changes were less than 0.015 for RMSEA only (SRMR = 0.02), confirming a lack of measurement equality for the factor variance invariance model of the scale across Latino heritage groups (data not shown).

Discussion

Group-level neighborhood effects include social and environmental factors that play a role in the health status of individuals living within a given neighborhood (1-8). Although frequently measured at the census level, and evaluated from an ecometric perspective, this study focused on the use of self-reported perceptions of neighborhood social cohesion and neighborhood problems. The Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale are moderately reliable scales, each comprised of a single underlying latent factor. Measurement invariance was demonstrated for the both the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale.

Internal consistency results indicate acceptable reliability coefficients for the Neighborhood Social Cohesion Scale. This supports previous findings from studies that used the same Neighborhood Social Cohesion Scale and also reported high reliability coefficients (14, 15). Similar to these reliability coefficients, internal consistency data for the Neighborhood Problems Scale indicated acceptable reliability. Data from other studies using this scale have not reported reliability (7).

Results indicate that both the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale each comprise a single underlying latent factor. Factor analyses for the Neighborhood Social Cohesion Scale indicated adequate fit of the one factor model for both language groups and for the six Latino heritage groups. The Neighborhood Social Cohesion Scale demonstrated measurement invariance for the metric and factor variance invariance models, indicating that items loaded equivalently onto the single factor for both language groups and across all six Latino heritage groups. However, results for the Neighborhood Problems Scale indicated a less than optimal fit of the one factor structure, as data for multiple indices were above cutoff values across language groups and Latino heritage groups. Although the Neighborhood Problems Scale does not clearly demonstrate measurement invariance for both language groups and Latino heritage groups, taken as a whole, the data indicate satisfactory fit. Multiple goodness-of-fit indices were used to assess model fit, and while all the indices did not meet their respective cutoff criteria, at least one index met cutoff criteria for the configural, metric, and factor variance invariance tests. These data indicate that using these instruments among diverse Latino heritage groups is acceptable. Researchers have not used a standardized approach with validated and reliable measure to assess the constructs of neighborhood social cohesion and neighborhood problems. Using these validated measures can assist in researchers taking a standardized approach to assessing the constructs of neighborhood social cohesion and neighborhood problems. This may aid in understanding the relationships among neighborhood-level effects and individual health outcomes.

Study strengths include the use of a large, diverse Latino sample, representing six Latino heritage groups, including Dominicans, Cuban Americans, Central Americans, Mexican Americans, Puerto Ricans, and South Americans. Study participants were randomly selected from four large urban areas, including the Bronx, Miami, San Diego, and Chicago, ensuring good representation of diverse Latino heritage groups. The study, however, does have limitations, including the inability to generalize to other US Latino populations, such as those residing in rural areas. Also, due to small sample sizes for specific countries, participants from Central and from South America were grouped together, rather than by individual country or commonwealth, as was done for Dominican, Mexican, Puerto Rican, and Cuban participants. Because there were no additional objective measures of neighborhood conditions, conclusions about convergent validity cannot be made. Future research using the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale could address these limitations by assessing convergent validity with an objective measure of neighborhood, such as asking other individuals in the neighborhood to report on neighborhood conditions. Discriminant validity could be measured by surveying the same participants to assess the extent of positive social and environmental neighborhood features, including availability of places to be physically active, and places that foster cohesiveness including community centers. Test-retest reliability of the instruments could ensure consistency of the measures from one time point to another.

Conclusions

Various iterations of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale have been used to determine the relationship among neighborhood characteristics and individual health outcomes. Examining the psychometric properties of scales and using validated instruments to assess neighborhood social cohesion and neighborhood problems will ensure comparability in results. Because of the limited research conducted among Latinos, these data will inform future studies assessing these constructs and their relationship to Latinos' health.

Acknowledgment: This chapter is currently under review. The reference information will be as follows: Nanette V. Lopez, John P. Elder, et al., Measurement Properties of the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale: Findings from the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study. A full listing of co-authors is unable to be determined at this time.

Table 2.1: Weighted Sample Characteristics for the Total Sample and by Hispanic/Latino Heritage Group ($N = 5{,}172$)

	Overall (n = 5,172)		Dominican (n = 534)		Central American (n = 553)		Cuban (n = 775)		Mexican American (n = 2,080)		Puerto Rican (n = 880)		South American (n = 350)	
Characteristic	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Age (*M*, *SE*)	42.79	0.38	40.03	1.06	41.04	0.86	48.51	0.81	39.50	0.58	45.21	0.82	45.19	0.97
Women	54.65	0.97	61.98	3.33	56.02	2.44	49.30	1.65	56.01	1.52	52.65	2.39	53.53	3.67
Married or cohabitating	49.03	1.20	41.54	3.35	43.93	2.86	47.77	2.18	59.67	1.75	31.41	2.24	57.64	3.21
Income														
$<10,000	17.87	1.01	17.82	2.70	21.05	2.50	27.30	2.12	11.67	1.57	21.94	2.05	12.62	2.14
$10,001-20,000	34.03	1.20	39.07	4.57	38.99	2.74	41.36	2.03	27.17	1.85	35.09	2.82	36.87	2.96
$20,001-40,000	31.42	1.13	33.08	3.94	28.69	2.59	24.34	1.87	36.86	1.80	25.54	2.71	35.47	3.54
$40,001-75,000	11.72	0.89	8.34	1.82	10.16	2.20	4.28	0.93	16.73	1.61	12.16	1.50	9.78	1.87
$>75,001	4.96	0.76	1.69	0.68	1.11	0.45	2.82	1.12	7.56	1.62	5.27	1.06	5.27	1.84
Education														
<High School/ GED	32.64	1.09	36.28	3.06	37.74	3.31	26.33	1.93	34.75	1.89	33.70	2.80	22.59	2.95
High School	28.31	0.90	27.23	3.62	23.31	2.60	29.81	1.98	28.53	1.57	28.93	2.39	28.84	2.91
>High School GED	39.05	1.25	36.49	3.02	38.95	3.13	43.87	2.00	36.69	2.14	37.37	3.06	48.67	3.07
Years in US														
<10	27.64	1.49	27.47	3.08	35.10	3.14	50.91	3.00	20.50	1.54	7.29	1.53	38.99	3.79
≥10	72.36	1.49	72.53	3.08	64.90	3.14	49.09	3.00	79.50	1.54	92.71	1.53	61.01	3.79
US born	20.70	1.19	14.96	3.57	7.87	1.99	5.15	1.09	25.15	2.00	45.42	2.29	5.61	1.55
Spanish language	78.86	1.32	76.62	4.43	89.66	2.24	93.16	1.13	78.79	1.90	41.24	2.75	90.53	2.12

(*table continues*)

Table 2.1: Continued

	Overall (*n* = 5,172)		Dominican (*n* = 534)		Central American (*n* = 553)		Cuban (*n* = 775)		Mexican American (*n* = 2,080)		Puerto Rican (*n* = 880)		South American (*n* = 350)	
Characteristic	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Neighborhood Social Cohesion[a]	15.76	0.07	15.35	0.18	15.30	0.19	16.20	0.17	15.84	0.11	15.55	0.20	15.77	0.19
Neighborhood Problems[b]	11.95	0.11	13.22	0.29	12.57	0.22	11.09	0.18	11.24	0.17	13.50	0.23	11.88	0.28

Note. Study participants who identified as more than one ethnicity or had incomplete data for the Neighborhood Social Cohesion Scale or Neighborhood Problems Scale were excluded from analyses, resulting in an analytical sample size of *N* = 5,172.
[a]Neighborhood Social Cohesion (5 items).
[b]Neighborhood Problems (7 items).

Table 2.2: Neighborhood Social Cohesion 5 Item-Level and Neighborhood Problems 7 Item-Level Descriptive Characteristics (N = 5,172)

	Item	*M*	*SD*
	Neighborhood Social Cohesion[a]		
Item 1	This is a close knit neighborhood.	3.13	1.08
Item 2	People around here are willing to help their neighbors.	3.30	0.99
Item 3	People in this neighborhood generally don't get along with each other.	3.32	0.92
Item 4	People in this neighborhood can be trusted.	3.15	0.97
Item 5	People in this neighborhood do not share the same values.	2.88	0.96
	Neighborhood Problems[b]		
Item 1	Excessive noise.	1.83	0.92
Item 2	Heavy traffic or speeding cars.	1.98	0.97
Item 3	Lack of access to adequate food shopping.	1.40	0.68
Item 4	Lack of parks or playgrounds.	1.68	0.91
Item 5	Trash and litter.	1.75	0.95
Item 6	No sidewalks or poorly maintained sidewalks.	1.51	0.79
Item 7	Violence.	1.81	0.97

[a]Item scores ranged from 1-5, with increasing scores indicating greater agreement with statement.
[b]Item scores ranged from 1-4, with increasing scores indicating greater agreement with statement.

Table 2.3: Descriptive Statistics for the Neighborhood Social Cohesion Total Score and Neighborhood Problems for the Total Sample, Language Groups, and Latino Heritage Groups (*N* = 5,172)

	Neighborhood social cohesion[b]			Neighborhood problems[b]		
Variable	*M*	*SE*	*α*	*M*	*SE*	*α*
Total	15.76	.07	.69	11.95	.11	.78
Language						
English	15.60	.15	.69	12.94	.23	.79
Spanish	15.81	.08	.69	11.65	.13	.78
Ancestry						
Dominican	15.35	.18	.70	13.22	.29	.78
Central American	15.30	.19	.70	12.57	.22	.78
Cuban	16.20	.17	.77	11.09	.18	.74
Mexican	15.84	.11	.63	11.24	.17	.78
Puerto Rican	15.55	.20	.72	11.95	.11	.78
South American	15.77	.19	.71	11.95	.11	.78

[a]Scale scores range from 5-25, with increasing scores indicating greater social cohesion.
[b]Scale scores range from 7-28, with increasing scores indicating greater number of problems.

Table 2.4: Goodness of Fit Statistics for the One-Factor Model of the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale with Tests of Factorial Invariance across Language and Latino Heritage Groups (*N* = 5,172)

	Neighborhood Social Cohesion Scale						Neighborhood Problems Scale					
Model	S-Bχ^2	*df*	*p*	CFI	SRMR	RMSEA	S-Bχ^2	*df*	*p*	CFI	SRMR	RMSEA
One factor	182.265	5	0.00	0.95	0.04	0.08	719.538	14	0.00	0.89	0.05	0.10
English	28.304	5	0.00	0.96	0.03	0.07	195.050	14	0.00	0.87	0.07	0.12
Spanish	158.789	5	0.00	0.95	0.04	0.09	504.388	14	0.00	0.90	0.05	0.09
Configural	187.093	10	0.00	0.96	0.04	0.08	699.438	28	0.00	0.89	0.06	0.11
Metric	289.316	18	0.00	0.93	0.05	0.08	994.116	40	0.00	0.85	0.07	0.10
Factor var. invariance	293.057	19	0.00	0.93	0.06	0.08	1017.991	41	0.00	0.85	0.07	0.10
Dominican	8.586	5	0.13	0.99	0.03	0.04	120.349	14	0.00	0.85	0.06	0.12
Central American	25.347	5	0.00	0.96	0.05	0.09	65.805	14	0.00	0.92	0.05	0.08
Cuban	38.435	5	0.00	0.96	0.04	0.09	63.789	14	0.00	0.93	0.04	0.07
Mexican	91.370	5	0.00	0.93	0.05	0.09	325.125	14	0.00	0.87	0.06	0.11
Puerto Rican	28.399	5	0.00	0.97	0.03	0.07	172.820	14	0.00	0.86	0.07	0.11
South American	13.870	5	0.02	0.97	0.04	0.07	43.948	14	0.00	0.93	0.05	0.08
Configural	206.007	30	0.15	0.96	0.04	0.08	791.836	84	0.00	0.89	0.06	0.10
Metric	441.647	70	0.00	0.91	0.07	0.08	1281.191	144	0.00	0.81	0.08	0.10
Factor var. invariance	468.581	75	0.00	0.90	0.08	0.08	1330.516	149	0.00	0.80	0.10	0.10

Note. CFI = comparative fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation.

Table 2.5: Unstandardized Factor Loadings and Descriptive Statistics from Baseline Models of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale by Language Groups (*N* = 5,172)

	Spanish		English	
Item	Loading	*M (SE)*	Loading	*M (SE)*
Neighborhood Social Cohesion Scale				
1	1.00	3.12 (.027)	1.00	3.12 (.062)
2	1.00	3.31 (.023)	1.02	3.24 (.043)
3	0.38	3.33 (.023)	0.79	3.37 (.042)
4	0.69	3.17 (.023)	0.79	3.10 (.052)
5	0.29	2.88 (.020)	0.47	2.78 (.049)
Neighborhood Problems Scale				
1	1.00	1.74 (.025)	1.00	2.08 (.053)
2	0.98	1.92 (.026)	0.90	2.18 (.050)
3	0.56	1.39 (.015)	0.42	1.47 (.047)
4	0.79	1.70 (.028)	0.53	1.66 (.061)
5	1.31	1.68 (.028)	1.22	1.94 (.051)
6	0.92	1.50 (.020)	0.56	1.47 (.037)
7	1.23	1.71 (.030)	1.19	2.13 (.068)

Note. The factor loading for the first item was fixed to 1 to set the metric for the latent variable; all *ps* < .001.

Table 2.6: Unstandardized Factor Loadings and Descriptive Statistics from Baseline Models of the Neighborhood Social Cohesion Scale and Neighborhood Problems Scale by Latino Heritage Groups (N = 5,172)

	Dominican		Central American		Cuban		Mexican American		Puerto Rican		South American	
Item	Loading	*M* (*SE*)	Loading	*M* (*SE*)	Loading	*M* (*SE*)	Loading	*M* (*SE*)	Loading	*M* (*SE*)	Loading	*M* (*SE*)
Neighborhood Social Cohesion Scale												
1	1.00	3.05 (.097)	1.00	3.10 (.062)	1.00	3.18 (.052)	1.00	3.09 (.039)	1.00	3.20 (.057)	1.00	3.11 (0.70)
2	0.94	3.27 (.051)	1.04	3.13 (.050)	.094	3.43 (.045)	1.11	3.28 (.033)	0.94	3.22 (.052)	1.08	3.25 (.065)
3	0.37	3.15 (.057)	0.38	3.23 (.056)	.047	3.47 (.043)	0.36	3.36 (.031)	0.58	3.26 (.050)	0.40	3.40 (.063)
4	0.78	3.10 (.086)	0.85	2.96 (.056)	0.68	3.17 (.042)	0.66	3.28 (.033)	0.69	2.99 (.051)	0.61	3.15 (.058)
5	0.22	2.77 (.053)	0.24	2.89 (.048)	0.47	2.95 (0.36)	0.29	2.84 (.033)	0.30	2.86 (.053)	0.38	2.83 (.057)
Neighborhood Problems Scale												
1	1.00	2.04 (.082)	1.00	1.88 (.059)	1.00	1.59 (.036)	1.00	1.69 (.030)	1.00	2.20 (.052)	1.00	1.86 (.057)
2	0.90	2.13 (.065)	1.09	2.06 (.053)	0.79	1.91 (.039)	1.12	1.82 (.038)	0.87	2.34 (.054)	0.95	1.92 (.070)
3	0.47	1.56 (.068)	0.58	1.44 (.036)	0.54	1.32 (.029)	0.58	1.36 (.023)	0.45	1.49 (.048)	0.64	1.45 (.049)
4	0.52	1.87 (.089)	1.05	1.84 (.057)	0.78	1.86 (.050)	0.97	1.50 (.031)	0.50	1.68 (.055)	0.82	1.72 (.061)
5	1.09	1.95 (.063)	1.55	1.88 (.051)	1.17	1.52 (.041)	1.55	1.63 (.036)	1.14	2.05 (.060)	1.43	1.76 (.062)
6	0.67	1.53 (.046)	1.12	1.62 (.046)	0.79	1.38 (.028)	1.21	1.52 (.033)	0.58	1.51 (.038)	0.90	1.49 (.057)
7	1.12	2.13 (.085)	1.23	1.83 (.056)	1.04	1.49 (.049)	1.49	1.72 (.040)	1.14	2.22 (.068)	1.10	1.68 (.062)

Note. The factor loading for the first item was fixed to 1 to set the metric for the latent variable; all *ps* < .001.

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CHAPTER 3

Associations of Social Capital Indicators with Cardiovascular Disease Prevalence and Cardiovascular Disease Risk Factors in Hispanic Americans from the Hispanic Community Health Study/Study of Latinos

Abstract

There is little research regarding the health effects of social capital among Latinos, due in part to existing health disparities and inconsistent methods used to measure social capital. To operationalize community-level and individual-level attributes of social capital, four indicators (Interpersonal Support Evaluation List-12, Social Network Index (SNI), Neighborhood Social Cohesion Scale, and Neighborhood Problems Scale) were examined in relation to cardiovascular disease (CVD) risk factors and prevalence in an exclusive Latino sample from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) Sociocultural Ancillary Study (SCAS). CVD risk factors included smoking status, Body Mass Index (BMI), hypertension, dyslipidemia, hypertriglyceridemia, and diabetes; CVD prevalence included coronary heart disease/no angina (CHD), and stroke or transient ischemic attack (TIA). Perceived stress and chronic stress were modeled as covariates due to the role of stress as an independent CVD risk factor. Participants (*N* = 5,172, aged 18-74 years) from four study sites (Bronx, NY, Chicago, IL, Miami, FL, and San Diego, CA) provided information on structural and functional support, along with levels of social cohesion and problems within their individual neighborhoods. Logistic regression analyses were used to examine associations between social capital and CVD prevalence and CVD risk factors. After adjusting for sociodemographic factors and perceived and chronic stress, SNI score was related to a lower prevalence of CHD (odds ratio [OR; 95% confidence interval], 0.87 [0.78-0.98]) and ISEL-12 score was related to a higher prevalence of CHD (1.03 [1.00-1.05]). In regards to CVD risk factors, after adjusting

for sociodemographic factors and stress, all four social capital indicators were related to diabetes (ISEL-12: 0.98 [0.96-1.00]; SNI: 0.92 [0.86-0.99]; Neighborhood Social Cohesion: 1.06 [1.02-1.10]; Neighborhood Problems: 1.04 [1.01-1.07]), SNI score was related to a lower prevalence of hypertension (0.92 [0.87-0.98]) and smoking (0.87 [0.80-0.93]), and Neighborhood Problems was related to a higher prevalence of smoking (1.04 [1.01-1.07]). Because CVD is the leading cause of mortality among Latinos, future studies are needed to identify and confirm the effects of social capital on cardiovascular health.

Introduction

Empirical evidence suggests that social capital is a determinant of health (1-3). Higher levels of social capital are associated with better health1 and lower mortality (2, 3). Social capital refers to the social involvement of people and groups, including social networking, civic engagement, and recreational activities (4). Conceptualization of social capital can be divided into two dimensions: a structural dimension that includes a social network element and a cognitive dimension that includes norms of reciprocity and trust (5). Social capital is often examined at the community level, by evaluating neighborhood social cohesion and the extent of physical problems in the neighborhood. It can also be examined from an individual level, by evaluating social networks and the resulting social support derived from those networks.

Social networks are a key element of social capital (5), and subsequent social support has a direct effect on cardiovascular health (6-10). In a prospective study of over 32,000 US male professionals, socially isolated men were nearly twice as likely to die from cardiovascular disease compared to men with the highest level of social networks (6). Socially isolated, stable coronary heart disease (CHD) patients in the Heart and Soul study had a higher rate of mortality compared to patients with more extensive social networks (7). Researchers have also examined the relationship between social networks and the resulting social support with cardiovascular risk factors. For example, compared to those individuals with fewer social network members, those with larger social networks have lower hypertension (8), better HbA1c levels (9), and report less smoking (10).

At the community level, specific locations in neighborhoods contribute to social capital by fostering social interactions (11). For example, a greater amount of park space is associated with higher social capital (12). Pedestrian-oriented, mixed use neighborhoods are associated with greater social capital (13). This is due to neighborhood residents having a greater sense of trust and knowing their neighbors better compared to those living in car-oriented neighborhoods. This greater amount of neighborhood social cohesion contributes to the cardiovascular health status of individual residents. Greater neighborhood social cohesion is associated with less hypertension (14) and reduced mortality from heart attack (15) and stroke (16).

Conversely, neighborhood problems, including the presence of incivilities, such as untidy yards, and lower perceived safety are associated with lower social capital (17). These problems contribute to the cardiovascular health status of individual residents. Among Multi-Ethnic Study of Atherosclerosis (MESA) participants, neighborhood problems including excessive noise, traffic, trash/litter, violence, along with lack of adequate food shopping, parks/playgrounds, and sidewalks were associated with higher levels of inflammatory markers (IL-6, CRP, and fibrinogen) (18).

Stress is an independent psychological and social risk factor for CVD in adults (19). Data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) Sociocultural Ancillary Study indicate that for every additional chronic stressor, there is a 22% increased odds of CHD and 26% increased odds of stroke (20). Furthermore, acute stress from frustration, tension, and sadness more than doubles the relative risk for occurrence of heart attack (21). Daily suffering from neighborhood social and physical stressors, including high crime rates, pollution, and high residential turnover may impact routine life leaving the inability to adequately process other life stressors. For example, in a prospective study of over 78,000 people participating in the Japan Collaborative Cohort Study for the Evaluation of Cancer Risk (JACC), after adjustment for perceived stress at the individual level, neighborhood-level stress was associated with a higher likelihood of death from heart disease (22). Therefore, it is important to consider the role of stress when evaluating social capital correlates for CVD and CVD risk factors.

There is little research regarding the health effects of social capital among Latino groups. No studies have examined the relationship between social capital indicators and clinically assessed CVD risk factors and CVD prevalence in an exclusive Latino population. Because social capital comprises constructs that are inherently abstract and subjective in conceptualization, there is a lack of consistent operationalization and measurement. These difficulties warrant the importance of extracting the individual constructs of social capital and identifying the appropriate unit of analysis to examine their effects. Therefore, the goal of this study is to evaluate the relationship between social capital indicators with CVD risk factors and CVD prevalence, using perceived and chronic stress as covariates. CVD risk factors will include smoking status, BMI, hypertension, dyslipidemia, hypertriglyceridemia, and diabetes. CVD prevalence will include coronary heart disease/no angina (CHD), and stroke or transient ischemic attack (TIA).

Methods

Participants and Procedures

This cross-sectional study involved secondary data analyses from participants of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), who also participated in the HCHS/SOL Sociocultural Ancillary Study (SCAS). Specifics regarding the design and implementation of the HCHS/SOL study were previously published (23). Briefly, the main objective of this multi-center epidemiologic study was to determine the prevalence of, and the risk and protective factors for, cardiovascular disease and other health conditions in diverse US Latino populations. Targeted populations were recruited from neighborhoods in (1) Bronx, New York, (2) Chicago, Illinois, (3) Miami, Florida, and (4) San Diego, California.

Specifics regarding the sampling design and cohort selection were published (24). Briefly, to minimize bias and increase the diversity of the study sample, a two-stage probability sampling design was used. The first stage of sampling was random selection of census block groups, stratified by Latino concentration and socioeconomic status with oversampling from highly populated Latino areas. Random selection of households, with oversampling from those with Latino surnames, was the second stage.

The primary goal of the HCHS/SOL Sociocultural Ancillary Study (SCAS) (25) was to evaluate the relationships among sociocultural, socioeconomic, and psychological risk and protective factors with metabolic syndrome and cardiovascular disease prevalence. HCHS/SOL participants who agreed to a second appointment within 9 months after the baseline examination were eligible to participate in SCAS. Of 7,321 individuals whom recruiters attempted to reach, 5,313 (N = 72.6%) participated. SCAS participants were largely representative of the HCHS/SOL cohort, with the exception of lower participation among some higher socioeconomic strata (25). To avoid inappropriate grouping by ethnicity, the present analyses were limited to all SCAS participants except those who identified as more than one Latino ethnicity (N = 5,172).

Measures

Demographic Variables. A questionnaire assessed sex, age, annual income (less than $10,000, $10,001-$20,000, $20,001-$40,000, $40,001-75,000, and $75,001 or greater), duration of US residence (less than 10 years or 10 or more years), nativity (US born or foreign born), education (less than high school, high school graduate or equivalent, more than high school), language used during the interview (Spanish or English), and Latino background (Dominican, Central American, Cuban, Mexican American, Puerto Rican, South American).

Anthropometrics. Height in meters and weight in kilograms were measured using a standard protocol. Body Mass Index was calculated using the Quetelet index (kg/m^2).

Neighborhood Social Cohesion Scale. The Neighborhood Social Cohesion Scale (26) consisted of five items assessing self-reported relationships among neighbors. Respondents indicated agreement with each statement using a 5-point Likert response format from 1 indicating "strongly disagree," to 5 indicating "strongly agree." Statements included "This is a close knit neighborhood," "People around here are willing to help their neighbors," "People in this neighborhood generally don't get along with each other," "People in this neighborhood can be trusted," and "People in this neighborhood do not share the same values." Scores for the five items were summed with total scores ranging from 5 to 25, with higher scores representing greater neighborhood social cohesion. The scale was shown to load onto one factor and have adequate internal consistency ($\alpha = 0.69$) (N. V. Lopez, MS/MS, unpublished data, April 2015). Spanish versions of scale items were available prior to use with SCAS participants, originally developed for use in the MESA study (27).

Neighborhood Problems Scale. The Neighborhood Problems Scale (26) consisted of seven self-report items assessing social and physical problematic characteristics in participants' neighborhoods (defined as "the area around where you live"). Items asked respondents to indicate the seriousness of seven problems on a 4-point Likert scale, ranging from 1 indicating "not really a problem," to 4 indicating "very serious problem." Problems included excessive noise, heavy traffic or speeding cars, lack of access to adequate food shopping, lack of parks or playgrounds, trash and litter, no sidewalks or poorly maintained sidewalks, and violence. Scores for the seven items were summed with total scores ranging from 7-28. Increasing scores represented a greater number of problems within the neighborhood. The scale was shown to load onto one factor and have adequate internal consistency ($\alpha = 0.78$) (N. V. Lopez, MS/MS, unpublished data, April 2015). Spanish versions of scale items were available prior to use with SCAS participants, originally developed for use in the MESA study (27).

Social Network Index. The Social Network Index (SNI) (28) was used to determine the level of social integration, defined as the quantity and diversity of social ties to friends, family, work, and community (28). Participants reported on the number of social roles with whom there was regular contact, defined as at least once every 2 weeks. Social roles included spouse or partner, children, parents, in-laws or partner's parents, other relatives, close friends, religious contacts, school contacts, employment contacts, neighbors, volunteer contacts, and other contacts. Role scores were summed with a scoring range of 0-12. Higher scores reflected greater structural social support. Spanish versions of scale items were translated by HCHS/SOL staff, prior to use with SCAS participants.

Interpersonal Support Evaluation List (ISEL-12). The Interpersonal Support Evaluation List (ISEL-12) (29) assessed the participant's perceptions about the availability of multiple types of functional support from members of social networks, including appraisal support, tangible support, and belonging support. Appraisal social support included four items (e.g., "I feel that there is no one I can share my most private worries and fears with," "There is someone I can turn to for advice about handling problems with my family"). Belonging social support included four items (e.g., "I don't often get invited to do things with others," "If I wanted to have lunch with someone, I could easily find someone to join me"). Tangible social support included four items (e.g., "If I were sick, I could easily find someone to help me with my daily chores," "If I was stranded 10 miles from home, there is someone I could call who could come and get me"). Scores ranged from 0-36. Higher scores indicated greater perceived functional support. Spanish versions of scale items were available prior to use with SCAS participants (30). The total score of the ISEL-12 demonstrated adequate reliability and validity, and was recommended for use in Latinos (31).

Perceived Stress Scale (PSS) (32). Participants provided responses to an assessment of 10 stressors over the past 30 days. Examples of the items included were "In the last month, how often have you felt that you were unable to control the important things in your life?" and "In the last month, how often have you felt that things were going your way?" Responses reported on the frequency of occurrence, ranging from "never" to "very often." Sum scores ranged from 0-40. Higher scores indicated greater perceived stress. The scale was shown to load onto one factor and have adequate internal consistency, demonstrating factorial invariance across language versions (English $\alpha = 0.86$; Spanish $\alpha = 0.84$) (20). Spanish versions of scale items were available prior to use with SCAS participants (33).

Chronic Stress Scale (34). Participants provided responses to an assessment of ongoing problems of at least 6-months duration in the following life domains: financial, relationship, caregiving, personal health problems or health problems in an individual close to the participant, employment, alcohol or drug use in an individual close to the participant, or other chronic stressor. A sum score was created for the total number of chronic stressors. Scores ranged from 0 to 8, with higher scores indicating more chronic stressors. Spanish versions of scale items were available prior to use with SCAS participants (35).

Cardiovascular Disease (CVD) Risk Factors

Participants underwent a blood draw using standardized procedures to determine glucose levels, cholesterol levels, and triglyceride concentrations. Diabetes was defined as (1) meeting American Diabetic Association criteria of fasting plasma glucose $\geq$126 mg/dl, 2-hour plasma glucose $\geq$ 200 mg/dl during an oral glucose tolerance test, or A1C $\geq$ 6.5%, and/or (2) current use of anti-diabetic medications (36). Hypertension was defined as clinically assessed systolic and diastolic blood pressure greater than or equal to 140/90 mm Hg and/or if the participant was taking antihypertensive medications. Dyslipidemia was defined as (1) meeting NIH criteria of low-density lipoprotein ≥160 mg/dl, high-density lipoprotein <40 mg/dl, or a triglyceride concentration of >200 mg/dl or (2) current use of lipid-lowering medications (37). Cigarette use was assessed by asking the participant, “Have you smoked at least 100 cigarettes in your entire life?” and “Do you now smoke daily, some days or not at all?” Responses were dichotomized into never smoked or former smoker, and current smoker (38, 39).

Cardiovascular Disease (CVD) Prevalence

Coronary Heart Disease (CHD) was defined as (1) self-report of, or as reported by a doctor, a previous myocardial infarction or procedure (angioplasty, stent, or bypass) or (2) electrocardiogram abnormalities recorded during the clinical baseline examination. Self-reported angina without clinical confirmation of CHD was not included in CVD prevalence. Stroke or Transient Ischemic Attack (TIA) was defined as self-report of stroke or TIA (38).

Procedure and Statistical Analyses

Descriptive statistics included means and standard errors for continuous variables and percentages for categorical variables. Logistic regression analyses were used to examine associations of the set of four social capital indicators (neighborhood social cohesion, neighborhood problems, SNI, and ISEL-12) with CVD prevalence and

CVD risk variables. All models were adjusted for age, gender, annual income, education, language preference, years in the US, nativity, Latino heritage, perceived stress, and chronic stress. Annual income, education, language preference, years in the US, nativity, and Latino background were categorical variables. Triglyceride concentrations were dichotomized so that levels greater than or equal to 150 mg/dL were considered elevated and levels less than 150 mg/dL were normal (40). BMI was categorized into two groups, underweight/normal weight and overweight/obese. Odds ratios with 95% CIs were reported for logistic regression analyses. Social capital correlates (neighborhood social cohesion, neighborhood problems, SNI, and ISEL-12) were standardized ($M = 0$, $SD = 1$) prior to analysis. Inverse of odds ratios less than 1.0 are reported. All statistical analyses were performed using Statistical Analysis System (SAS) Version 9.4 (Cary, NC) (41) to account for study design and sample weighting, with adjustments for sampling probability and non-response (42).

Results

Participant demographic characteristics are reported in Table 3.1. Of the 5,172 participants who completed baseline measures, nearly 55% of the weighted sample was women, with 49% indicating that they were married or living with a partner. Nearly 61% of the weighted sample had at most a high school education. Only 20.7% of the weighted sample was born in the continental US, with 72.4% residing in the US for 10 or more years and nearly 77% completing the interview in Spanish. Nearly 52% of the weighted sample reported annual earnings of $20,000 or less. SNI scores ranged from 0-12, with participants reporting an average of 5.6 social contacts. ISEL-12 scores ranged from 0-36, with an average reported ISEL-12 score of 26.4. Participants reported an average Neighborhood Problems score of 12.0, on a scale of 7-28. Neighborhood Social Cohesion score averaged 15.8, ranging from 5-25.

Regression Analyses

CVD Prevalence. Results from the logistic regression analyses examining social capital correlates of CVD prevalence are in Table 3.2. When controlling for perceived stress and chronic stressors, along with demographic variables, the SNI score and the ISEL-12 score were significantly related to CHD prevalence. For every one standard deviation increase in the SNI score, there was a 14% lower odds of CHD. For every one standard deviation increase in the ISEL-12 score, there was a 3% higher odds of CHD. Initial significant associations between neighborhood social cohesion and CHD in the unadjusted model and the model adjusted for perceived and chronic stress were attenuated upon adjustment with the demographic variables ($p = 0.084$). Initial significant associations between social network roles and stroke/TIA in the unadjusted model and the model adjusted for perceived and chronic stress, were attenuated upon adjustment with the demographic variables ($p = 0.079$). No other significant associations were seen between social capital indicators and CHD or Stroke/TIA.

CVD Risk Factors. Results from logistic regression analyses examining social capital correlates of CVD risk factors are presented in Table 3.3. When controlling for perceived stress, chronic stress, and demographic variables, all social capital variables (i.e., ISEL-12, SNI, Neighborhood Problems, and Neighborhood Social Cohesion) were significantly associated with diabetes prevalence. One SD unit increases in ISEL-12 and SNI scores were associated with a 2% and 9% lower odds of diabetes, respectively. One SD unit increases in Neighborhood Problems and Neighborhood Social Cohesion were associated with a 4% and 6% higher odds of diabetes, respectively. Only social SNI score was related to hypertension prevalence, with a one SD increase in SNI score associated with a 9% lower odds of hypertension. SNI scores and Neighborhood Problems were related to smoking prevalence. A one SD increase in SNI score was associated with a 15% lower odds of smoking, while a one SD increase in Neighborhood Problems was associated with a 4% higher odds of smoking. No other significant associations were seen between social capital indicators and CVD risk factors.

Discussion

Of the set of four social capital indicators, social network and social support were significantly associated with CHD. While social network was associated with lower odds of CHD, social support was associated with higher odds of CHD. Upon adjustment with sociodemographic variables, perceived stress, and chronic stress, none of the social capital indicators were associated with Stroke/TIA. Of the six CVD risk factors examined, the entire set of social capital indicators were significantly associated with diabetes. Social network score was significantly associated with hypertension, and social network score and Neighborhood Problems were significantly associated with cigarette smoking.

Social network was associated with lower odds of CHD. These findings are consistent with results from the Heart and Soul study. Among 1,019 stable CHD participants who were followed for an average of 7 years, there was a 61% increased mortality risk among those patients reporting one social network connection, compared to patients who reported two or more (11). However, data from one study indicate that, among Latinos, increased numbers of adults in the household are negatively associated with self-rated health (43). These results suggest that stress may result from overcrowding in the home, contributing to the negative self-assessment. As evidenced in the Coronary Artery Risk Development in Young Adults (CARDIA) cohort, non-Hispanic white women who were in unstable housing situations were at five times greater risk for incident hypertension compared to women in stable home environments (44). Additionally, more social contacts could increase the potential for stressful conflict, resulting in detrimental health effects. Among 9,875 participants in the Danish Longitudinal Study on Work, Unemployment, and Health, conflicts with members of one's social network were associated with two to three times increased mortality risk (45). However, research conducted among Latinos identified extended social networks as health protective by promoting access to routine health care use (46), including cancer screenings (47). Furthermore, Latinos who live in predominantly Spanish-speaking neighborhoods have better access to health care (48), suggesting extended community social networks within same-ethnicity enclaves are health protective.

Although social network was health protective in the current study, social support was associated with higher odds of CHD. This result conflicts with a review of epidemiological research that suggests low social support is associated with increased risk of development and progression of CHD (49). However, other data indicate a lack of an effect of social support on the etiology of CHD. A summary of three studies that assessed the impact of functional support on myocardial infarction risk found limited evidence for the negative impact of low functional support on CHD incidence (50). Another possibility is a lack of discussion of health problems among the members of one's social network, which may be detrimental to health. In particular, Latinos may be less likely to seek help from members of their social networks. In a study examining help seeking behaviors among social network members of non-Hispanic White and Latino caregivers of dementia patients, compared to their White counterparts, Latino caregivers were less likely to seek advice or discuss their problems with members of their social network (51). This may be due to other cultural mechanisms regarding use of social ties to discuss health matters.

All four social capital indicators were significantly associated with diabetes prevalence in the current study. Research indicates that social capital including social networks, community networks, and social support are all related to diabetes. For example, larger social networks were associated with better self-management in a group of 300 patients with chronic illness, including diabetes (52). Among a group of

615 adults with Type 2 Diabetes, lower levels of social support were related to lower glycemic control (53). Other studies reported mixed effects of social capital correlates. For example, among a matched group of 60 controlled and 60 uncontrolled diabetics, there was a null relationship between glycemic control and social groups and networks, yet trust and empowerment capital were significantly related to diabetes control (54). In another study with 294 African-American military veterans in Philadelphia, a neighborhood-level measure of cohesiveness was positively associated with diabetes control (55). Other studies reported a null relationship between neighborhood social and physical disorder and type 2 diabetes prevalence (56).

Data from the current study supports previous research relating social network and hypertension prevalence. A 5-year study assessing workplace social capital and hypertension risk among 60,000 Finnish workers in the Finnish Public Sector Study showed that male employees who worked in low social capital workplaces were 40-60% more likely to develop hypertension compared to male employees in high social capital workplaces (57). Data from the National Social Life, Health, and Aging Project indicated that adults who spent more time with members from their social networks had a lower risk of undiagnosed hypertension, provided that they discussed pressing health problems with those network members (58). A cross-sectional study examining the relationship between social capital and hypertension among 306 Haitian women showed that compared to those with larger social networks, women with smaller social networks had higher odds of hypertension (12).

The current results support data from longitudinal research relating social capital indicators and smoking prevalence. In a 2-year follow-up study of 1,400 Canadian adults, social network capital was associated with a 47% lower odds of reporting smoking (14, 59). The present results are consistent with research among young Latinos that show less acceptance of smoking among those who are foreign-born and speak mostly Spanish, compared to those who are US-born and speak mostly English (60). The current study population is largely foreign-born and Spanish speaking. Research examining neighborhood problems and smoking prevalence supported the findings in the present study. A cross-sectional study conducted in seven urban European cities identified that in areas with greater physical disorder like trash and graffiti, there was a 64% higher odds of smoking among residents (61).

Study strengths include the use of a large, ethnically diverse Latino sample, representing six Latino heritage groups, including Central Americans, Cuban Americans, Dominicans, Mexican Americans, Puerto Ricans, and South Americans. Study participants were randomly selected from four populated cities, including the Bronx, Chicago, Miami, and San Diego ensuring good representation of diverse Latino heritage groups. Rather than relying solely on self-report, clinical measures of CHD were used. A combination of four measures was used as a proxy of social capital, reflecting community and individual attributes. The study, however, does have limitations. Participants were not recruited nationally, and thus, there is a limit to the ability to generalize to other US Latino populations, such as those residing outside urban areas. Also, Central and South American participants were not grouped by individual country, as was done for the other participants. In addition to measuring participants' perceived neighborhood cohesion and problems, an objective, ecometric measurement of these constructs could be used to validate participants' responses.

Conclusions

This is the first study to evaluate the relationship between social capital correlates and clinically assessed CVD risk factors and CVD prevalence in an exclusive Latino population. Results from the current study align with previous research, while other results are contradictory. Future studies are needed to confirm the effects of social capital on cardiovascular health. Because CVD is the leading cause of mortality in the US, it is important to understand all the social determinants that contribute to risk of disease.

Acknowledgment: This chapter is currently under review. The reference information will be as follows: Nanette V. Lopez, John P. Elder, et al., Associations of Social Capital Indicators with Cardiovascular Disease Prevalence and Cardiovascular Disease Risk Factors in Hispanic Americans from the Hispanic Community Health Study/Study of Latinos. A full listing of co-authors is unable to be determined at this time.

Table 3.1: Descriptive Statistics for Sample Demographic Characteristics, Cardiovascular Disease, and Risk Factor Prevalence, Stress Variables, and Social Capital Indicators: HCHS/SOL Sociocultural Ancillary Study (Overall *N* = 5,172)

Variables[a]	*n* (%)	Weighted % (95% CI)
Demographic characteristics		
Women (*n* = 5,172)	3,213 (62.1)	54.7 (52.7-56.6)
Married or cohabitating (*n* = 5,165)	2,604 (50.4)	49.0 (46.7-51.4)
Hispanic/Latino background (*n* = 5,172)		
Central American	553 (10.7)	7.8 (6.3-9.4)
Cuban	775 (15.0)	21.0 (16.5-25.5)
Dominican	534 (10.3)	12.1 (10.1-14.1)
Mexican	2,080 (40.2)	37.8 (33.6-42.0)
Puerto Rican	880 (17.0)	16.3 (14.1-18.5)
South American	350 (6.7)	4.9 (4.0-5.9)
Income (*n* = 4,746)		
$<10,000	867 (18.3)	17.9 (15.9-19.9)
$10,001-20,000	1,637 (34.5)	34.0 (31.7-36.4)
$20,001-40,000	1,538 (32.4)	31.4 (29.2-33.6)
$40,001-75,000	532 (11.2)	11.7 (10.0-13.5)
$>75,001	172 (3.6)	5.0 (3.5-6.5)
Education (*n* = 5,165)		
<High School/GED	1,891 (36.6)	32.6 (30.5-34.8)
High School	1,348 (26.1)	28.3 (26.5-30.1)
>High School/GED	1,926 (37.3)	39.1 (36.6-41.5)
Years in US (*n* = 5,172)		
<10	1,233 (23.9)	27.6 (24.7-30.6)
≥10	3,930 (76.1)	72.4 (69.4-75.3)
US born (*n* = 5,171)	824 (15.9)	20.7 (18.4-23.0)
Spanish language (*n* = 5,172)	4,238 (81.9)	76.9 (74.3-79.4)
Current smoker (*n* = 5,167)	930 (18.0)	20.1 (18.3-21.9)
BMI (*n* = 5,161)		
Underweight/Normal weight	1,010 (19.6)	21.9 (20.2-23.5)
Overweight/Obese	4,151 (80.4)	78.1 (76.5-79.8)

(*table continues)*

Table 3.1: Continued

Variables[a]	n (%)	Weighted % (95% CI)
Cardiovascular disease/Risk factor prevalence		
CHD prevalence (n = 5,171)	250 (4.8)	4.3 (3.6-5.0)
TIA or stroke prevalence (n = 5,171)	126 (2.4)	2.0 (1.6-2.5)
Hypertension (n = 5,172)	1,702 (32.9)	28.2 (26.1-30.2)
Dyslipidemia (n = 5,167)	2,057 (39.8)	38.6 (36.6-40.7)
Diabetes (n = 5,172)	1,063 (20.6)	16.3 (15.0-17.7)
Hypertriglyceridemia (n = 5,167)	1,630 (31.5)	28.4 (26.6-30.2)
	MS (*SE*)	
Demographic characteristics		
Age (n = 5,172), years	42.8 (0.38)	
Stress variables		
Perceived stress (n = 5,037)	14.78 (0.16)	
Chronic stress (n = 5,038)	1.80 (0.04)	
Social capital variables		
ISEL-12 (n = 5,049)	26.40 (0.14)	
SNI (n = 5,039)	5.63 (0.04)	
Neighborhood Social Cohesion (n = 5,098)	15.76 (0.07)	
Neighborhood Problems (n = 5,117)	11.95 (0.11)	

Note. HCHS/SOL = Hispanic Community Health Study/Study of Latinos; CHD = Coronary Heart Disease; TIA = Transient Ischemic Attack. ISEL-12 = Interpersonal Support Evaluation List for perceived social support, sum scores range from 0-36. SNI = Social Network Index Roles for frequent social contacts of the participant, sum scores range from 0-12. Neighborhood Social Cohesion = Measure of the relationships among neighbors, sum scores range from 5-25. Neighborhood Problems = Measure of the problems within the neighborhood, sum scores range from 7-28. Perceived Stress = Measure of 10 stressors over the past 30 days, sum scores range from 0-40. Chronic Stress = Measure of number of chronic stressors over the past 6 months, sum scores range from 0-8.
[a]Individual n values may vary due to missing data.

Table 3.2: Associations between Social Capital Indicators and CHD and Stroke Prevalence: The HCHS/SOL Sociocultural Ancillary Study

	CHD, OR (95% CI)			Stroke or TIA, OR (95% CI)		
Social Capital Indicator	Model 1[a]	Model 2[b]	Model 3[c]	Model 1[a]	Model 2[b]	Model 3[c]
ISEL-12	1.01 (0.99-1.03)	1.01 (0.99-1.04)	1.03* (1.00-1.05)	0.98 (0.94-1.02)	0.98 (0.94-1.02)	0.99 (0.95-1.04)
SNI Roles	0.80* (0.73-0.88)	0.79* (0.71-0.88)	0.87* (0.78-0.98)	0.79* (0.70-0.88)	0.78* (0.70-0.88)	0.86 (0.73-1.02)
Neighborhood Problems	1.03 (0.99-1.06)	1.02 (0.98-1.06)	1.03 (0.98-1.08)	1.04 (0.98-1.10)	1.03 (0.98-1.10)	1.03 (0.97-1.10)
Neighborhood Social Cohesion	1.09* (1.03-1.16)	1.09* (1.03-1.16)	1.06 (1.00-1.13)	1.06 (0.97-1.17)	1.05 (0.96-1.15)	1.03 (0.93-1.13)

Note. HCHS/SOL = Hispanic Community Health Study/Study of Latinos; CHD = Coronary Heart Disease; TIA = Transient Ischemic Attack; ISEL-12 = Interpersonal Support Evaluation List; SNI Roles = Social Network Index Roles; OR = Odds Ratio; 95% CI = 95% Confidence Interval.
$^*p < 0.05$.
[a]Unadjusted model.
[b]Controls for Perceived Stress and Chronic Stress.
[c]Controls for all variables in b and age, sex, Hispanic/Latino ethnicity, nativity, language preference, income, and education.

Table 3.3: Associations between Social Capital Indicators and CVD Risk Factors:
The HCHS/SOL Sociocultural Ancillary Study

	OW/OB BMI	Diabetes	Hypertension	Dyslipidemia	Hypertrigly-ceridemia	Current smoker
Social Capital Indicator	OR (95% CI)[a]	OR (95% CI)[a]	OR (95% CI)[a]	OR (95% CI)[a]	OR (95% CI)[a]	OR (95% CI)[a]
ISEL-12	0.99 (0.97-1.01)	0.98* (0.96-1.00)	1.02 (1.00-1.03)	1.00 (0.98-1.02)	0.99 (0.98-1.01)	1.02 (1.00-1.04)
SNI Roles	1.03 (0.97-1.10)	0.92* (0.86-0.99)	0.92* (0.87-0.98)	1.01 (0.96-1.07)	1.06 (0.99-1.12)	0.87* (0.80-0.93)
Neighborhood Problems	1.01 (0.98-1.04)	1.04* (1.01-1.07)	1.00 (0.97-1.03)	1.02 (1.00-1.04)	1.02 (0.99-1.04)	1.04* (1.01-1.07)
Neighborhood Social Cohesion	1.01 (0.97-1.04)	1.06* (1.02-1.10)	1.00 (0.96-1.03)	1.02 (1.00-1.05)	1.01 (0.99-1.05)	1.01 (0.97-1.04)

Note. HCHS/SOL = Hispanic Community Health Study/Study of Latinos; OW/OB BMI = Overweight/Obese Body Mass Index; ISEL- HCHS/SOL = Hispanic Community Health Study/Study of Latinos; OW/OB BMI = Overweight/Obese Body Mass Index; ISEL-12 = Interpersonal Support Evaluation List; SNI Roles = Social Network Index Roles; OR = Odds Ratio; 95% CI = 95% Confidence Interval.
*$p < 0.05$.
[a]Controls for perceived stress, chronic stress, age, sex, Hispanic/Latino ethnicity, nativity, language preference, income, and education.

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DISCUSSION

This dissertation examined select behavioral and social determinants of cardiovascular health among Latinos. Chapter 1 assessed the relationship of carbohydrate intake and sedentary time with triglyceride concentration and with hypertriglyceridemia among six Latino heritage groups. Chapter 2 examined the internal consistency and construct validity of a Neighborhood Social Cohesion Scale and a Neighborhood Problems Scale administered in two languages (English and Spanish) among six Latino groups. Chapter 3 evaluated the relationships between a set of four social capital indicators with CVD risk factors and CVD prevalence.

Results from Chapter 1 indicate that the estimated mean values of triglycerides differed among the six Latino groups, with the highest estimated triglyceride concentrations seen in Central American men. Estimated mean triglyceride concentrations were not elevated among the Latina women. Predicted carbohydrate intake and BMI were positively associated with triglyceride concentration, whereas only BMI was significantly associated with elevated triglyceride concentration. These results suggest that there may be underlying differences in dietary and activity behaviors among Latino groups. Although Latinos are often categorized into one ethnic group, Latinos are a heterogeneous group with African, European, and Native American ancestries (1). Considering these various ancestries, it is not surprising that dietary habits differ across different Latino heritage groups. Data from the HCHS/SOL study indicate fat and carbohydrate intake vary considerably among the six groups studied (2). Although there is a lack of data examining differences in physical activity behavior and sedentary time among Latino groups, differences may exist. Because diet, physical activity, and time spent in sedentary behaviors play a role in triglyceride metabolism, it is important to understand these differences among Latinos. Rather than grouping Latinos into one large category, future studies that address CVD risk should consider differences among Latino groups.

Data from Chapter 2 indicate that the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale are moderately reliable scales, each comprised of a single underlying latent factor. Measurement invariance was demonstrated for the both the Neighborhood Social Cohesion Scale and the Neighborhood Problems Scale, indicating that use of these instruments among diverse Latino heritage groups and across English and Spanish speaking Latinos is acceptable. This acceptance is necessary to determine whether instruments developed for non-Hispanic White populations can be used effectively in ethnic minority populations, including Latinos (3). Measurement inaccuracies can bias study results by erroneously producing estimates of symptoms and disorders and lead to inappropriate conclusions (3). For example, instruments that are not validated with respect to a particular ethnic group are likely to carry different psychometric properties than the originally developed instruments. Furthermore, the lack of culturally and linguistically appropriate measures limits research conducted in ethnic minority subgroups, contributing to health disparities (4).

Chapter 3 results suggest that select social capital indicators are associated with CVD and CVD risk. Social network was associated with lower odds of CHD, while social support was associated with higher odds of CHD. Among the CVD risk factors examined, the entire set of four social capital indicators were associated with diabetes, social network was associated with hypertension, and social network and Neighborhood Problems were associated with cigarette smoking. Limited studies have reported mixed effects of social capital on health among Latinos. Although data indicate that Latinos may benefit from extended social networks by promoting access to routine health care use (5), increased numbers of adults in the household are negatively associated with self-rated health (6). Furthermore, Latinos may be less likely to seek advice or discuss their problems with members of their social network (6), limiting the possible provision of social support.

Latinos are disproportionately at risk for cardiovascular disease due to biological, sociocultural, and environmental factors. Little research has been performed to address these disparities in risk. Understanding how Latinos are affected by various risk factors will inform future interventions to mitigate risk. For example, triglyceride concentrations in Latino populations may be reduced by suggesting appropriate dietary patterns that can be promoted to Latinos. Using culturally and linguistically valid instruments can help ensure accurate reporting of data. Lastly, understanding the role of social capital indicators may provide researchers with additional insight to mitigate disease risk.

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