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A BIOPSYCHOSOCIAL EXAMINATION OF THE RESIDENTIAL ENVIRONMENT AS A SOCIAL DETERMINANT OF CARDIOMETABOLIC RISK: THE ROLE OF LATINO ETHNICITY

A Dissertation in

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by

Marina Armendariz

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The dissertation of Marina Armendariz was reviewed and approved by the following:

Linda A. Wray
Associate Professor of Biobehavioral Health
Dissertation Adviser
Chair of Committee

Lindsay Fernández-Rhodes
Assistant Professor of Biobehavioral Health

Shedra Amy Snipes
Associate Professor of Biobehavioral Health

Stephen A. Matthews
Professor of Sociology, Anthropology, and Demography

Thomas J. Gould
Jean Phillips Shibley Professor of Biobehavioral Health
Department Head of Biobehavioral Health

ABSTRACT

Background: Hispanic/Latinos account for 18.5% of the U.S. population. The substantial growth of Latinos is expected to contribute to the nation's racial/ethnic diversity, aging population age structure, and of utmost importance—population health disparities. Scholars are challenged with characterizing salient physical health risks that disproportionately affect Latinos. For example, social, environmental and biological forces shape Latinos' vulnerability to high rates of obesity, diabetes, and undiagnosed or late-stage diagnosed diseases. Limited work, however, has examined the residential environment as a social determinant of cardiometablic risk and dysregulation among Latinos. Particularly, there is scant research detailing within-group ethnic differences among Latino subpopulations regarding place-based health effects.

Aims: The overarching goal of the dissertation was to explore potential social and environmental factors with attention to biopsychosocial pathways linking the residential environment to cardiometabolic conditions, and inflammatory risk among U.S. Latinos. To address the following three dissertation aims, the dissertation was comprised of three studies and a theoretically-driven conceptual framework: ***Aim 1:*** Develop a theoretically-driven conceptual framework to describe potential factors and pathways linking the residential environment to obesity, diabetes, and inflammatory risk; ***Aim 2:*** Examine racial/ethnic differences between midlife and older NHW and Latino adults; and ***Aim 3:*** Examine within-group ethnic differences among midlife and older Latinos.

Methods: Data were derived from the Health and Retirement Study (HRS) across five waves (2006-2014) and examined cross-sectionally. The sample was comprised of 11,943 NHW (n=10,447) and Latino (n=1,496) respondents with complete data on key variables of interest. Key independent variables included race, Latino ethnicity (i.e. Mexican-origin vs non-Mexican

Latinos), nativity status (i.e. foreign-born vs U.S.-born), and perceived neighborhood characteristics, as measured by perceptions of neighborhood physical disorder and negative social cohesion. Key outcomes of interest captured cardiometabolic and inflammatory risk and included body mass index (BMI), glycosylated hemoglobin (HbA1c), and C-reactive protein (CRP)—all risk factors for cardiovascular disease.

Results: Stark socioeconomic and socioenvironmental racial/ethnic differences are documented in ***Aim 2***. Greater negative social cohesion was positively associated with higher BMI and HbA1c, in fully adjusted models. Physical disorder was independently associated with higher CRP levels in unadjusted models, but SES accounted for this association. The limited results from ***Aim 3*** provide preliminary evidence that health effects may differ by Latino ethnicity. Among Latinos, Mexican-origin Latinos experienced poorer cardiometabolic (i.e. BMI) and inflammatory outcomes (i.e. CRP), compared to non-Mexican Latinos, in the association between social isolation (i.e. "don't belong in the area") and physical health.

Conclusion: This work sheds light on the socioenvironmental exposures experienced by midlife/older Latinos in relation to physical and physiological health outcomes—an emergent area of study. Although limited, there is some evidence to suggest perceived negative exposure to physical and social neighborhood conditions are adversely related to BMI, HbA1c, and CRP. However, these findings must be replicated using larger sample sizes, as well as among younger Latino populations. The projected growth of Latinos in the U.S. and their heterogeneous geographic patters across the U.S. landscape merit attention, particularly in population health studies. Subsequently, I conclude by calling for research that carefully considers structural, socioenvironmental, and ethnic factors to improve health inequalities that disproportionately affect racial/ethnic minority populations across the life course.

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CHAPTER 1

INTRODUCTION

Background

Hispanic/Latinos[1] are the largest racial/ethnic minority group in the United States (U.S.), accounting for 18.5% of the U.S. population, and are expected to make up 26% of the U.S. population by 2050 (U.S. Census Bureau). Latinos are an ethnically heterogeneous population comprised of Mexicans, Puerto Ricans, Cubans, Central and South Americans, and other groups from Latin America; and may racially identify as White or Black (Sáenz & Morales, 2015). Mexican-origin Latinos make up the largest proportion of Latino subgroups followed by Puerto Ricans (U.S. Census Bureau). Historically, migration from Mexico to the U.S. has contributed to vast Latino growth in the U.S; however, migration from other Latin American countries has grown.

Additionally, the rise of Latinos is expected to change the nation's demographic profile. For instance, the U.S.-born Latinos will contribute to the rise of this population due to declines in the share of foreign-born immigrants. Further, the U.S. is expecting a rapid growth in Latinos aged 65 and older by 2050, with projections of the older Hispanic population to increase from 8.6% in 2020 to 18.4% by 2050 (Ortman, Velkoff, & Hogan, 2014). Lastly, the geographic dispersion of Latinos across non-traditional regions and counties in the South is growing rapidly. In turn, the dynamic rise of Latinos in the U.S. and heterogeneity of Latinos in the U.S. merit attention, particularly in population health studies.

[1] Terms used to refer to this population include: "Hispanic", "Spanish", "Latino" and "Latinx" (López, 2014). For consistency, the term Latino is used to refer to the target population throughout the paper, except in instances where study findings are being reported using the term Hispanic, non-Hispanic white, and non-Hispanic black.

Social determinants drive disparities in health

Health disparities are well-documented among racial/ethnic minority groups in the U.S., with countless reports highlighting the urgency to reduce health disparities and address the social determinants of health (López & Gadsden, 2017). Like other racial/ethnic minority groups, Latinos tend to have limited socioeconomic resources and live in socioeconomically deprived residential environments characterized by high rates of poverty, urbanization, residents of low socioeconomic status, and lack health-promoting resources. Subsequently, social, environmental and biological forces have modified the Latino health profile leaving certain Latino subgroups more vulnerable to high rates of obesity, diabetes, and undiagnosed or late-stage diagnosed diseases (Ruiz, Campos, & Garcia, 2016).

Scholars are challenged with understanding how the Latino population distinctively contributes to the U.S. health profile, particularly since certain Latino subgroups demonstrate similar or better mortality profiles relative to non-Hispanic Whites (NHW), in spite of Latinos' known disadvantaged socioeconomic status (Balfour, Ruiz, Talavera, Allison, & Rodriguez, 2016; Davidson et al., 2007). One common critique is the tendency to describe Latinos as a monolithic group in population health studies, despite Latinos' racial/ethnic heterogeneity, distinctive settlement histories, and differences in their social and economic integration in the U.S. Another critique relates to a culture-based focus for explaining health and behavior outcomes among Latino populations. Notably, sociocultural factors matter for this population; however, an individual culture-based framework does not sufficiently address the potential effects of external social and environmental forces in shaping Latinos' health profile (Viruell-Fuentes, Miranda, & Abdulrahim, 2012).

The social determinants of health framework (SDoH) posits that various social, economic, and physical conditions where people are born, grow, work, live and age ultimately impact health (WHO, 2008). Further, the SDoH framework points to the influence of unequal social, economic, and structural conditions as potential drivers in population health disparities, especially given the unequal distribution of poor health and healthcare resources across race/ethnicity, age, and/or geography. One widely studied SDoH is the residential environment (herein used interchangeably with neighborhood environment) because it is often shaped by unequal socioeconomic and structural influences that limit racial/ethnic minorities' life chances, and in turn, contribute to health inequities. Particularly, understanding the relationship between how populations experience their social and environmental conditions are key determinants of health. However, the current understanding of neighborhood environments and poor health outcomes reveals persistent black-white disparities, whereas the neighborhood-health association for Latinos is less understood. Therefore, the purpose of the present dissertation was to examine the residential environment as a potential social determinant of health, particularly as it relates to the cardiometabolic conditions, including obesity, diabetes and other cardiovascular risk factors experienced in Latinos.

Dissertation Overview

Using a health disparities lens, I aimed to investigate social and health inequalities for Latinos, with attention to the residential environment as a social determinant of cardiometabolic risk. Further, the present dissertation explored potential biopsychosocial pathways linking race/ethnicity, the residential environment, and cardiometabolic health risk among U.S. Latinos. Given the expected demographic shift of aging populations and Latinos' diversity, I utilized a nationally-representative sample of midlife/older adults from the Health and Retirement Study

(HRS) to empirically examine the relation between sociodemographic factors, perceived neighborhood characteristics, and three outcomes: obesity, diabetes, and inflammation. The following broad objectives were identified:

(1) Develop a conceptual framework to describe potential factors and pathways linking the residential environment to obesity, diabetes, and inflammatory risk

(2) Examine racial/ethnic differences between NHWs and Latinos

(3) Examine within-group differences among Latinos

Subsequently, the present dissertation is structured as follows. Chapter 2 provides a literature review summarizing the following content areas: 1) Latino health paradox; 2) cardiometabolic burden among Latinos; 3) the residential environment as a social determinant of health; 4) biological consequences of the residential environment. Also included in this chapter are results from a systematic scoping review describing the dearth of studies examining residential environments and inflammation among U.S. Latino samples. In Chapter 3 (Aim 1), I present a theoretically-driven conceptual model that served to inform the two empirical studies (Aims 2 & 3). Next, Chapter 4 covers the methodology of the two empirical studies, including a description the data source (the HRS) as well as the methods employed. Next, Chapter 5 is comprised of the results of the studies. Lastly, Chapter 6 concludes with a discussion of summary findings, study implications, and recommendations for future directions.

CHAPTER 2

LITERATURE REVIEW

SECTION I: Overview of Latinos' Physical Health and Socioenvironmental Risk

Latino Health Paradox or "Longer and Linger"?

A large body of literature posits that despite Latinos' disadvantaged socioeconomic status, Latinos experience similar or better morbidity and mortality outcomes comparable to non-Hispanic whites (NHW)—this phenomenon is known as the Latino health paradox (Markides & Coreil, 1986; Markides & Eschbach, 2011). Conversely, the "longer and linger" phenomenon (Ruiz, Hamann, Mehl, & O'Connor, 2016) suggests Latinos are living longer with more chronic health conditions, including obesity, diabetes, or other cardiovascular risks such as increased inflammatory risk (Zhang, Hayward, & Lu, 2012). Thus, the relevance of this so-called "longer and linger" phenomenon warrants continued investigation among aging Latinos since the projections of Latinos aged 65 and older are projected to increase. In sum, Latinos' health advantages for mortality outcomes coupled with increasing cardiovascular risk point the importance of improving the quality of health and well-being for this growing and aging population.

Cardiometabolic Burden among Latinos

Among Latinos, cardiovascular disease (CVD) is now the second leading cause of death, for which Latinos face a high burden of cardiometabolic conditions associated with increased cardiovascular risk and mortality (Rodriguez et al., 2017). Examples of cardiometabolic conditions disproportionately experienced by Latinos include obesity, type 2 diabetes, and metabolic syndrome (Dominguez et al., 2015; Vega, Rodriguez, & Gruskin, 2009). Consequently, cardiometabolic conditions increase risk for incidence CVD, which refers to

clinical events associated with conditions of the heart such as stroke, heart attack, heart failure, or congenital heart disease. Obesity and diabetes are highly prevalent among Latinos, with prevalence rising rapidly for this population; therefore, I focus mainly on these cardiometabolic conditions as risk factors associated with poor cardiovascular health. Additionally, I point to chronic inflammation as an additional marker of disease linked to cardiovascular risk. For instance, elevated inflammatory risk is a strong predictor of poor physical health outcomes, including type 2 diabetes and CVD (Bertoni et al., 2010).

Obesity

Latinos are disproportionately represented in the obesity epidemic across the lifespan (Isasi et al., 2015). For example, Latino male children present greater risk for being overweight as early as preschool ages compared to Black or non-Hispanic White children (Liu et al., 2015). This poses an early threat as the risk of obesity in adulthood is exacerbated by childhood obesity. For adult obesity, evidence suggests that obesity is increasing progressively among older Latinos (Samper-Ternent & Snih, 2012). The burden of obesity is alarming given its underlying link to multiple physiological systems, including the cardiovascular, metabolic, and immune systems, as well as being a risk for the onset of chronic disease outcomes in later ages (Ben-Shlomo & Kuh, 2002), highlighting the need to acknowledge cardiometabolic risk for Latinos across the life course.

Diabetes

Diabetes is the fifth leading cause of death for Latinos compared to the national rank of seven (CDC, 2020). In the U.S., the overall prevalence rate of diabetes for Latino adults is 12.5% compared to 7.5% for non-Hispanic whites. Further, type 2 diabetes morbidity rates have increased dramatically, with Latinos experiencing higher mortality for type 2 diabetes (Vega et

al., 2009). As of 2015, reports showed lower all-cause mortality among Latinos; however, Latinos had higher mortality rates for diabetes (51%) compared to NHWs (Dominguez et al., 2015). In addition to the disproportionate mortality rates compared to NHWs, type 2 diabetes prevalence varies within Latinos by subgroup. For instance, Mexican-origin and Puerto Ricans have the highest rates within Latinos, 14.4% and 12.4%, respectively (CDC, 2020). This is problematic as these two origin groups are the largest subgroups represented in the U.S. Latino population. These between- and within- group differences of race/ethnicity constitute continued examinations to reflect the heterogeneity of Latinos' social and health trajectories.

Inflammation

Further, one biological pathway hypothesized to negatively impact cardiovascular health is through dysregulation of the immune system. Particularly, chronic low-grade inflammation, has been utilized to assess persistently high levels of inflammatory cytokines, such as C-reactive protein (CRP) (Guardino et al., 2017; Ridker, 2003). CRP, a systemic biological marker of inflammation, is widely used as an early marker of stress and disease linked to deleterious health (GBD, 2015; Ridker, 2003). Disparities in inflammation are patterned along social lines, including race/ethnicity, socioeconomic status, and gender. Using data from the National Health and Nutrition Examination Survey (NHANES) 2007-2010, Richman (2018) found inflammation disparities between non-poor NHWs and middle-aged black men and women, as well as Hispanic middle-aged men. While this study expands on prior research by examining chronic inflammation at the intersection of race/ethnicity, gender, socioeconomic status, and age group, they were unable to examine the differential influence of external or psychosocial factors contributing to disparities in inflammation.

Place matters: The Residential Environment as a Social Determinant of Health

The residential environment is widely recognized as a social determinant of health because it lends itself to describing the contextual living conditions, health-promoting resources, and socioeconomic opportunities that shape health (Williams & Collins, 2001). Indeed, Black and Latino communities are largely represented in low socioeconomic metropolitan areas, although the growth of Latinos is becoming geographically dispersed in non-metropolitan settings where Latinos may face increased barriers or disadvantage (Lee, Martin, & Hall, 2017). Consequently, unequal social and economic opportunities have the capacity to hinder upward mobility, thereby creating barriers to health and well-being for racial/ethnic minority populations living in disadvantaged environments (Link & Phelan, 1995; Phelan, Link, & Tehranifar, 2010). Such socioeconomic obstacles create a myriad of disadvantaged social and environmental encounters in daily life, including limited access to health and healthcare resources, concentrated neighborhood poverty, as well as increased exposure to stressful conditions (Velasco-Mondragon, Jimenez, Palladino-Davis, Davis, & Escamilla-Cejudo, 2016). For this reason, racial/ethnic minority groups, especially Black and Latinos' lives, are characterized by chronically precarious and challenging environments (Jackson, Knight, & Rafferty, 2010). Subsequently, I introduce a chain of potential mechanisms that may help to explain the effect of challenging neighborhood environments on adverse health outcomes.

Racial vs. ethnic residential segregation

The notion that place matters for health has received much research attention, especially in the context of racial residential segregation. The exact structural causes of residential segregation are beyond the scope of this review, but undeniably stem from the social, economic and political disenfranchisement of racial/ethnic minorities created by long-standing systemic

racism and unfair discriminatory housing policies (Riley, 2018). Williams and Collins (2001) offered six pathways whereby the neighborhood context, particularly residential segregation, leads to poor health: 1) limited socioeconomic mobility limits access to quality education and preparation for higher education or employment opportunities; 2) conditions created by concentrated poverty and segregation make it difficult to practice good health behaviors; 3) concentrated poverty can lead to elevated exposures of economic hardship and stressors at the individual, household, and neighborhood level; 4) weakened community and neighborhood infrastructure can negatively impact social connections and relationships; 5) institutional neglect of built and environmental conditions can lead to poor quality housing or exposure to environmental toxins; and 6) adversely affect both access to care and the quality of care. Significant research demonstrates that racial residential segregation is particularly harmful for Black residents relative to NHWs; however, studies establishing a link between residential segregation and harmful health has yet to be established for other non-minority groups (i.e. Latinos).

Ethnic enclaves

Latinos, especially foreign-born Latinos, often reside in areas referred to as ethnic enclaves or "barrios" characterized by high concentrations of co-ethnics/immigrants, high poverty rates, and residents of lower SES, factors indicative of disadvantaged neighborhood environments (Eschbach, Ostir, Patel, Markides, & Goodwin, 2004; Lee & Ferraro, 2007). There is considerable debate regarding the potential risks and resources that ethnic enclaves may confer for its residents. For instance, it has been theorized that enclaves produce strong social networks among Latino residents due to shared cultural resources, language, and migration patterns leading to protective health effects for mortality (Eschbach et al., 2004) and physical

disability (Aranda, Ray, Snih, Ottenbacher, & Markides, 2011). However, evidence suggests enclaves are not protective for cardiometabolic risk, including obesity-related behaviors in Latino populations due to unfavorable social and physical neighborhood conditions, such as poor obesogenic built environments (Osypuk, Diez Roux, Hadley, & Kandula, 2009). Beyond this context of co-ethnic density, little is known about the psychosocial processes by which the residential context may or may not influence other cardiometabolic conditions, such as diabetes.

Obesogenic environments

It is hypothesized that poor obesogenic environments produce obesity-related disparities because access to health resources are constrained by the social and physical environment. Indeed, prior research concludes that Black, Latino, and low SES individuals are at a disadvantage with respect to poor obesogenic built characteristics, including limited access to healthful food stores, increased exposure to fast food outlets, and inadequate exercise facilities (Lovasi, Hutson, Guerra, & Neckerman, 2009). Additionally, there is evidence that neighborhoods with high percentages of Latino and Black residents have high numbers of liquor stores or alcohol retailers. In turn, increased exposure or lack of such health-aversive infrastructure can foster unhealthy behaviors, including smoking, drug or alcohol use, and overreating of comfort foods, especially in the psychosocial context of coping. Previous evidence suggests residents living in chronically stressful conditions often cope with stressors by engaging in unhealthy behaviors, particularly to offset adverse mental health effects. Consequently, an increased number of unhealthy behaviors is associated with a greater number of chronic conditions like obesity (Jackson et al., 2010). Together, poor obesogenic environments and resulting unhealthy coping behaviors have important implications for racial/ethnic minorities

living in challenging environmental conditions that lack the socioeconomic resources to engage in healthy environments.

Neighborhood deprivation

According to the deprivation amplification model, residents in deprived areas experience concentrated poverty in addition to low individual-level socioeconomic status, and lack the socioeconomic opportunities and neighborhood conditions that lead to good health and well-being (Kawachi & Berkman, 2003). Black and Latinos are vulnerable to living in socioeconomically deprived neighborhoods (herein referred to as neighborhood socioeconomic deprivation), characterized by adverse social and environmental conditions such as concentrated poverty, unkempt physical characteristics (i.e. litter/vandalism), and/or crime rates—to name a few. Previous research links neighborhood deprivation to higher levels of body mass index (BMI) and glycosylated hemoglobin—a marker of blood sugar control (HbA1)—among a racially/ethnically diverse group of adults (Laraia et al., 2012). Further, neighborhood deprivation and high racial/ethnic density negatively impact obesity, hypertension, diabetes, and mortality outcomes through multiple systems and pathways, as described below (Acevedo-Garcia, Lochner, Osypuk, & Subramanian, 2003; Booth & Jonassaint, 2016; Diez-Roux Kershaw, & Lisabeth, 2008).

Evidence suggests deprived neighborhoods have a paucity of socioeconomic resources that impedes residents from engaging in healthy behaviors (Macintyre, 2007). For example, residents may lack the socioeconomic resources for purchasing certain foods, have limited food choices, and lack exercise-promoting conditions (i.e. green space), which may contribute to obesity and diabetes disparities (Epel et al., 2004). Further, socioeconomically deprived neighborhoods have high crime rates and unkempt living areas marked by litter and property

vacancies, which may increase threat and induce a stress response (Carbone, 2019; Duncan & Kawachi, 2018). Stressful conditions, such as perceived threat, are associated eating for reasons other than caloric need (aka non-homeostatic eating), which has been linked to the stress-induced consumption of foods high in fat and refined sugars (Epel et al., 2004). Such findings are critical given Latinos' disadvantaged exposure to obesogenic environments and risk for living in socioeconomically deprived neighborhoods.

Moreover, emergent empirical evidence demonstrates that residents living in deprived neighborhoods characterized by high poverty, unemployment, crowding, and poor safety are indeed at increased risk for physiological dysregulation (Nazmi et al., 2010; Ribeiro et al., 2018). It is theorized that individual-level low socioeconomic status as well as poor neighborhood socioeconomic environments may result in physiological dysregulation due to exposure to stressful circumstances in daily life, thereby exacerbating risk for cardiometabolic conditions, such as obesity and cardiovascular risk factors (Goosby, Cheadle, & Mitchell, 2018; Taylor, Repetti, & Seeman, 1997). Thus, place-health studies have given attention to biological consequences linked to harmful neighborhood environments to cardiovascular disease progression, including chronic stress, allostatic load, and inflammation, to help explain health disparities among racial/ethnic minorities (Ribeiro, Amaro, Lisi, & Fraga, 2018).

Does the Neighborhood Environment "get under the skin"?

First described as "weathering" (Geronimus, 1992) and later elaborated by McEwen and Stellar (1993) as allostatic load, it is theorized that maladaptation to stressful circumstances in daily life may "get under the skin" (Taylor, Repetti, & Sherman, 1997) as a result of chronic dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, thereby leading to "wear and tear" on a number of biological regulatory systems. Weathering, or rapid aging, is well-

established for Black Americans resulting from a lifetime of excessive stress due to socioeconomic inequalities, discrimination, and living in neighborhoods characterized by disadvantage (Geronimus, 1992;2006). Allostatic load, similarly, refers to weathering, or a cascading impact of wear and tear on organs and tissues in response to chronic stress, predisposing individuals to disease. Subsequently, place-health studies are increasingly investigating whether physiological adaptations to stressful social and environmental neighborhood conditions "get under the skin." To do so, researchers have incorporated objective biological markers (herein referred to as biomarkers) in population health studies to assess stress exposure and health, in part, because biomarkers are effective measures to assess physical health manifestations (Harris & Schorpp, 2018).

Neighborhood studies have utilized allostatic load biomarkers because of their capacity to provide a cumulative assessment of "wear and tear" across the body's physiological systems: cardiovascular, metabolic, immune, and neuroendocrine. For example, using a cumulative allostatic load score, Merkin et al. (2009) found a strong association between low neighborhood socioeconomic status and higher allostatic load scores, particularly for Black residents. Although Latinos also experienced greater dysregulation, the association was weaker and less consistent for Latino residents relative to white residents, bringing attention to the paradoxical inference that tends to be observed between Black and Latino residents.

Furthermore, Nazmi and colleagues (2007) examined both cross-sectional associations and longitudinal associations of neighborhood characteristics and inflammatory risk using the multi-ethnic study of atherosclerosis (MESA), a population-based study comprised of NHW, Black, Hispanic, and Chinese respondents. In the cross-sectional analysis, higher neighborhood deprivation (percent vacant housing, percent with no telephone, percent with no vehicle, percent

unemployed, median household income, and percent poverty) was associated with higher levels of three inflammatory markers (fibrinogen, interleukin-6 and C-reactive protein). Despite being one of the few studies to examine inflammatory risk as a potential underlying mechanism linking place and health among a racially/ethnically diverse sample, there were no consistent patterns across race/ethnicity.

Conclusion

In sum, Latinos have limited socioeconomic resources that contribute to challenging social and environmental neighborhood conditions, potentially increasing cardiometabolic risk through concentrated poverty, obesogenic environments, and/or poorly perceived neighborhood characteristics—and ultimately increased stress exposure. Thus, the residential environment serves as a potential social determinant of health contributing to the cardiometabolic burden of risk for Latino populations. However, the current understanding of neighborhood effects and health for Latinos remains unclear, despite the known negative impacts of social disadvantage in Black and Latino communities. To date, existing studies fail to show a consistent association between neighborhood effects and cardiometabolic conditions, including obesity and diabetes risk among U.S. Latinos (Durazo, Mbassa, & Albert, 2016). Also needed are examinations of the biological consequences associated with greater stress responses to help reveal additional mechanisms underlying the place-health association for Latinos. Thus, the next section takes a deeper examination of place-health studies examining inflammatory risk as a biological indicator of chronic stress, among U.S. Latinos.

SECTION II: Does the residential environment get "under the skin"?

A Scoping Review of U.S. Latinos

Study Rationale

There is limited understanding of the downstream effects of place on health for Latinos, with existing neighborhood studies showing weak or inconclusive associations for physical health outcomes among Latino populations (Durazo et al., 2016; Ribeiro et al., 2018). To my knowledge, few studies have investigated associations between neighborhood characteristics and inflammatory risk, and to a lesser extent within Latino populations. Given the complexity of Latinos' paradoxical health outcomes and heterogeneity relevant to Latinos' racial or ethnic background, it may serve to examine ethnic differences within this population. Therefore, the purpose of the scoping review was to examine whether inflammation serves as a biological consequence that directly or indirectly contributes to cardiovascular health risk in the place-health association for Latinos. To conduct this scoping review, I posed the following research question: *What is known about the association between residential environments (i.e. neighborhoods/place-based characteristics) and inflammation in U.S. Latinos?*

The present scoping review employed systematic approaches to: (1) synthesize findings of neighborhood/place-based studies that measured at least one marker of inflammation as a primary outcome; (2) identify secondary predictors (i.e. chronic stress; acculturation) relevant to Latinos in these place-based contexts; and (3) identify gaps in knowledge for future empirical studies and/or interventions that aim to integrate residential environments as a health determinant for racial/ethnic minorities, particularly Latinos. Findings from this review may provide ideas for future investigations to move beyond explanations of lifestyle and culture to identify how external social conditions of one's geographic context influence physical health. Therefore, this

scoping review concludes with gaps in knowledge and recommendations for future investigations.

Scoping Review Methods

Study Protocol

Scoping reviews share similar systematic recommendations and methods used for conducting systematic literature reviews; however, their intended purposes differ. The scoping review was drafted using guidelines from the Preferred Reporting for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (Tricco et al., 2018). The final protocol has not been registered. See (Tricco et al., 2018) for an explanation and additional information on scoping reviews.

Eligibility Criteria

In this scoping review, the residential environment was operationalized as "neighborhood or place" to capture the socioenvironmental context of where one lives. Therefore, in addition to neighborhoods as traditional geographic areas of interest, I also identified how other place-based contexts have been utilized among Latino samples. Further, in an effort to identify a range of residential experiences or exposures, this scoping review was not limited to studies examining neighborhood disadvantage.

To be included in the review, selected papers needed to focus on two concepts: a measurement of place, with a focus on neighborhoods, and assessment of at least one inflammatory marker (i.e. C-reactive protein) that has been linked to a cardiometabolic outcome (cardiovascular, diabetes, obesity risk). Peer-reviewed journal articles were included if: they involved human participants, described an indicator of place and/or neighborhoods, included an entire or subsample Latino population, and assessed a(n) inflammatory marker(s). Although

quantitative studies were the preferred method of study, qualitative studies were considered if they provided ways to measure place and met inclusion criteria. Papers were excluded if they did not include an indicator of place nor if the study focused on genes and genetic markers associated with cardiometabolic outcomes. Moreover, because stress is often viewed as a causal pathway in inflammatory outcomes, studies that included stress, chronic stress, or stress-related factors were also considered as secondary outcomes.

Information sources

The following bibliographic databases were used to identify potentially relevant studies and articles: PubMed/MEDLINE, Web of Science (WOS) and CINAHL. The search strategies were drafted by the reviewer (MA); however, the search strategies were reviewed and approved by an experienced health science librarian (Christina Wissinger (CW), PhD). The final search results were exported into EndNote and duplicates were removed using the software's de-deduplication feature. An additional manual removal of duplicates was conducted by the reviewer (MA).

Selection of search strategy

To ensure that a comprehensive search would be conducted, it was advised by CW to create a broad search strategy. The study aimed to broadly assess what is known about the association between neighborhoods/place and inflammation, particularly how neighborhoods/place have been operationalized in studies that include a Latino population. Therefore, to avoid missing potential terms for place/neighborhood and its associated terms, the search strategy captured two broad concepts: "Latinos" "Hispanics" and "inflammation" as well as any of their associated search terms. See *Appendix A* for the final search strategy for PubMed.

Selection of sources of evidence

Upon completion of the search strategy, a "de-duplicated" EndNote file was uploaded to a web application, Rayyan. Rayyan is designed for performing and collaborating review processes, including but not limited to systematic reviews. Rayyan was used as a tool to systematically screen for a total of 6,353 publications. The researcher (MA) screened titles and abstracts independently for a full-text review of potentially relevant publications. Further analysis of the full-text articles was evaluated using an Excel data spreadsheet. For publication purposes, a second reviewer would be required to follow the protocol of MA to identify titles, abstracts, and full-text publications. Disagreements will be resolved on study selection by consensus and discussion between the two reviewers. Lastly, additional studies were reviewed and added using references from a recent scoping review conducted by Ribiero and colleagues (2018), which reviewed the association between neighborhood deprivation and allostatic load.

Data Charting/Coding Process

A data-charting form was independently developed by a reviewer to determine which variables to extract from the full-text article review. The items selected for extraction were based on the purpose of the study. This was an iterative process that required continuous updating on the data-charting form. If studies did not fit into the charting/coding scheme, the article was removed and not charted. For example, if during the charting process, a study did not include a place indicator nor a biological inflammatory variable, the coding process would not continue for such study.

Data items

Thus, primary extracted information from full-text articles that met initial inclusion criteria included: author, year of publication, whether the study included both a place indicator

and an inflammatory biological marker (coded as 0=no; 1=yes), geographic area (or place indicator), study design, sample characteristics (size, % of Latino population, median age), neighborhood/place measurement, and inflammatory variable(s) of interest. Secondary extracted data included: type of study (qualitative vs quantitative), primary outcome of interest when inflammation was not the primary outcome of interest, as well as information of additional variables such as covariates, measures of chronic stress, and/or acculturation. Assessment of covariates, chronic stress measures, and acculturation were charted to identify whether these variables are vital to the context of the target population and outcomes of interest: Latinos and inflammation.

Synthesis of results

Tables and figures were created to display and summarize results of studies included in the present review. Data for studies included in the final full-text review were organized by chronological order of data publication. Next, data was synthesized according to the study's scope of interest, specifically the studies were grouped by type of geographic area (or neighborhood/place indicator). Lastly, summary findings were summarized in tables by publication year, study design, geographic area, neighborhood/place measurement, inflammatory measure, and summary findings for each study.

Results

Selection of sources of evidence

Figure 1 displays a diagram of the study selection process. After removal of duplicates, a total of 4,843 articles were identified from searches of the three electronic databases and screened at the title and abstract level. Based on the title and abstract review, 4,805 articles/citations were removed, with 38 full-text articles remaining for review. Of these, 28 were

excluded for the following reasons: 12 did not assess an inflammatory marker, 5 did not assess place, 3 were conducted outside of the U.S. mainland, 2 included a non-adult sample, 2 were a college sample (decision to exclude later in the process because college residence may not be generalizable), and 2 were not included until a second reviewer can assess whether they are eligible for full review. Lastly, two studies were excluded because they could not be retrieved. The remaining 10 studies were eligible for review. Additionally, a manual search of studies from Ribeiro and colleagues' (2018) scoping review yielded 2 additional studies that examined neighborhood context on AL index, but included at least one inflammatory parameter; therefore, they were also reviewed.

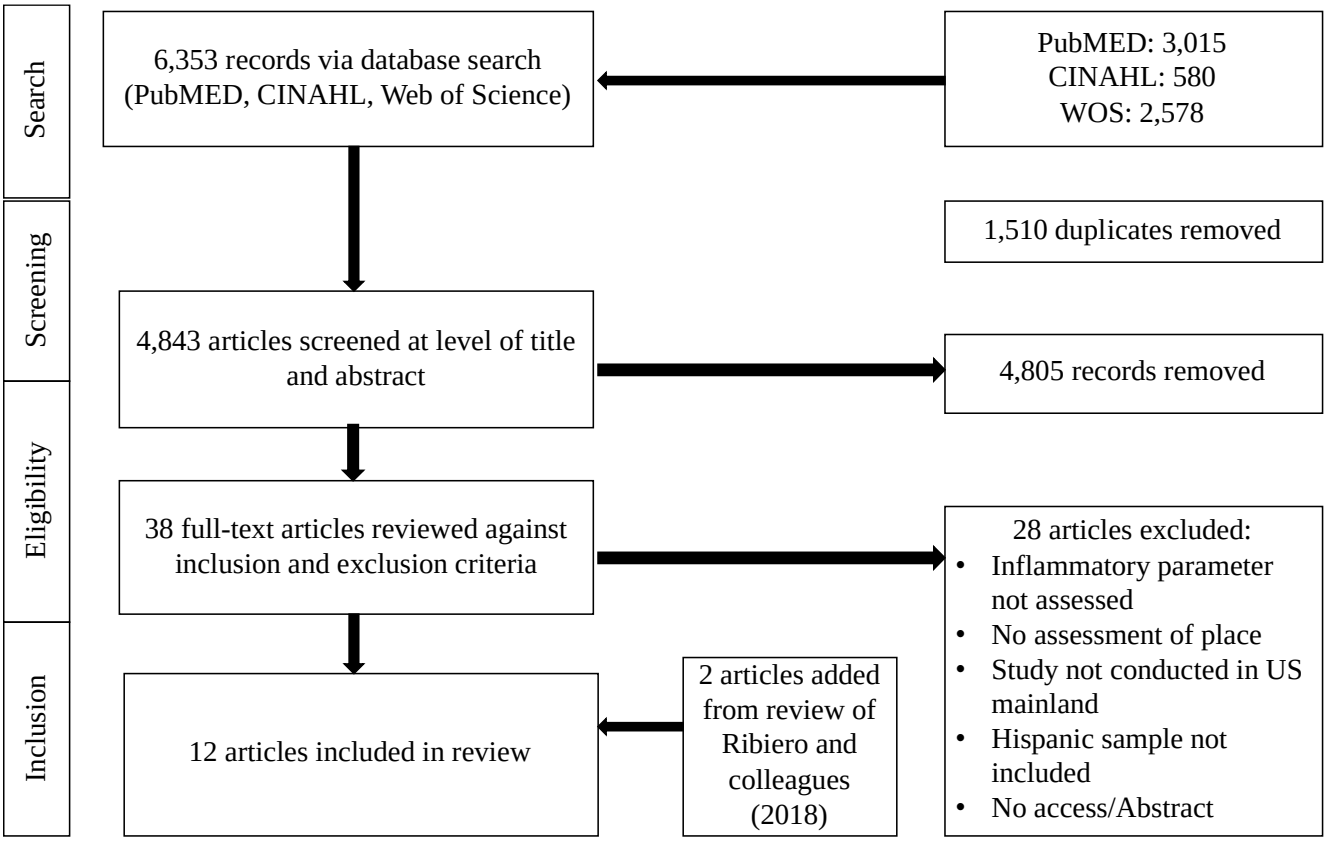

Figure 1. PRISMA-ScR (PRISMA extension for Scoping Reviews) diagram of the study selection process.

Findings: Characteristics of evidence sources

1. General characteristics

The final literature search yielded 12 eligible studies, published from 2009-2018. Per eligibility criteria, all studies were conducted in the U.S. mainland. The mean sample size was 2,819 participants, with mean ages ranging from 21 to 71 years of age (mean 40.8) across all studies. Six studies included a racially/ethnically diverse sample of participants—non-Hispanic whites, non-Hispanic blacks, and Hispanic—and the other six studies exclusively focused on a Latino subgroup. All studies included at least a subsample of Latinos: three studies broadly categorized their subsample as Latinos, two studies included an all Puerto Rican sample, and the remaining seven studies included an all (or majority) Mexican origin sample. Most of the studies utilized a cross-sectional design (n=8), while four studies utilized longitudinal data/design (n=4).

2. Geographic area

Figure 2 displays a summary depiction of geographic area as well as the operationalizations of neighborhoods/place across the studies. A total of seven studies assessed neighborhoods as their geographic area, or unit of analysis, while the remaining five studies used broader assessments of place, which I call "people in places" (Entwisle, 2007). Six studies used census tracts or census blocks as their geographic area to inform their definition of residential neighborhood. For instance, three studies used census tracts to define neighborhood (Bird et al., 2010; Gallo et al., 2012; Merkin et al., 2009); one used neighborhood clusters where each cluster consisted of two census tracts (King, Morenoff, & House, 2011); another used focal neighborhoods based on a stratified random sample of neighborhood clusters (Slopen, Non, Williams, Roberts, & Albert, 2014); and block-groups (Jiménez, Osypuk, Arevalo, Tucker, & Falcon, 2015). Moreover, Gay et al. (2015) used census block data, specifically income census

block quartiles, but they did not examine neighborhood context. Rather, they used this geographic unit to inform data collection for their target population residing in a US-border town. Conversely, Guardino et al. (2017) used a qualitative assessment of neighborhood; thus, they did not utilize an administrative boundary to define neighborhood. Lastly, the geographic areas in the remaining studies varied and are as follows: residential traffic exposure using geocoded addresses (Rioux et al., 2010); residential locales (McClure et al., 2015); an urban city (Cepeda, Nowotny, Frankeberger, Onge, & Valdez, 2018); and transnational networks (Torres et al., 2018).

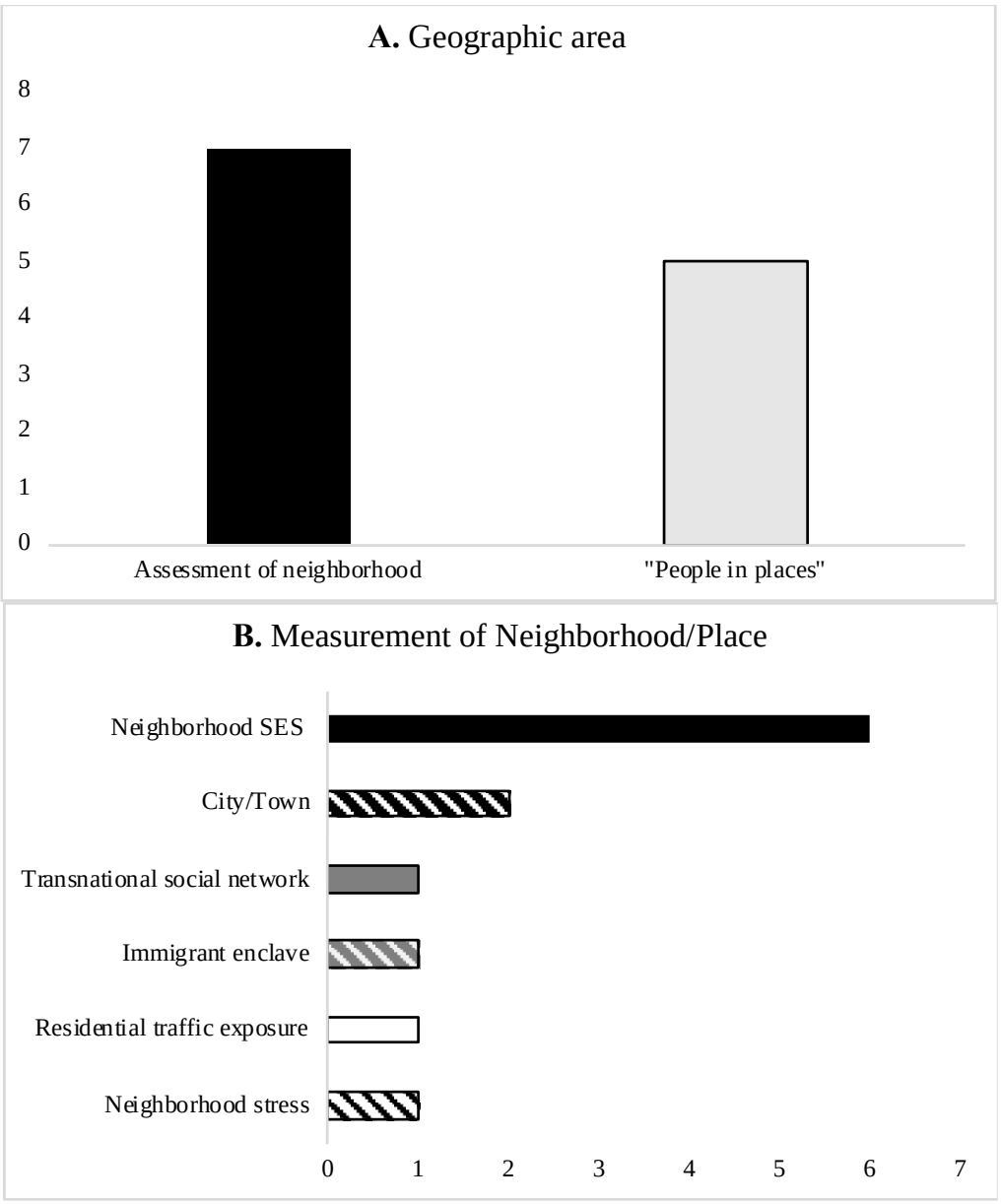

Figure 2. Summary depictions of A.) geographic area and B.) measurements of neighborhood/place utilized in the investigations.

3. Measurement of neighborhood or place

Again, most studies utilized a measure of neighborhood context (n=7). As depicted in Figure 2b, the most consistent measure of neighborhood context was neighborhood SES (NSES) (n=6), which was assessed using a multivariable index. These 6 studies utilized standardized sums of similar NSES measures derived from the following census variables: income (i.e. household income, percentage of men 16 and older employed in professional/managerial occupations); education (i.e. percentage of adults aged >25 with less than a high school education); poverty (percentage of families in poverty); public assistance (i.e. percentage of households on public assistance); homeownership (percentage owning a home); and unemployment rate. Higher scores indicated higher SES. Four of the six studies examined the independent effects of NSES as the sole independent variable. However, in addition to NSES as a measure for neighborhood context, Jiménez et al. (2015) also included a measure of relative income. This measure was intended to capture stressful social comparisons with neighbors. A negative value suggested an individual was relatively disadvantaged in comparison to neighbors. Slopen et al. (2014) examined the moderating effect of NSES, specifically neighborhood affluence, as opposed to its independent effect. Lastly, one study examined neighborhood stress as a source of chronic stress (Guardino et al., 2017). Neighborhood stress was measured as a 5-point score based on open-ended questions regarding neighborhood conditions, ranging from (1) exceptionally positive conditions to (5) exceptionally negative conditions.

The remaining studies did not measure neighborhood context, rather they provided a broader context for assessing place associated with the target population and inflammation (n=5). For example, McClure et al. (2015) measured community context using two residential locales to examine, stress, place and physiological risk: 1) a white majority locale and 2) an ethnic enclave.

Categories resulted from three farming housing locations in Oregon: 1) a white majority rural town, 2) a white majority outskirt town, and 3) an established Mexican ethnic enclave. Next, Rioux et al. (2010) measured residential traffic exposure and traffic density exposure to elucidate the effects of residing in an area with such exposures and its associated risk for elevated inflammation.

Three studies included indirect investigations of place; however, they are indicative of one's contextual and/or social environment, such as racial/ethnic composition, area-level SES, or crime (Nandi & Kawachi, 2011). For example, in the Gay et al. (2015) study, the population of interest were Latino residents living a US-border town in rural Texas. While this is not a direct measure of place, it was indicative of one's compositional place-based context, including but not limited to ethnic and immigrant concentration and low-income concentration. Similarly, Cepeda and colleagues (2018) indirectly measured place and its context by studying a gang-affiliated population from an urban city, San Antonio, TX. They described it as an area with high poverty concentration, crime, drug trafficking, and street gang activity, suggestive of a gang-affiliated member's social environment. Lastly, Torres et al. (2018) also used an indirect assessment of place; however, it is an area of work that warrants consideration in place-based research for Latino populations. This study measured transnational social networks by measuring zero or any connection with place (country) of origin, as well as individuals' local social relationships. Social networks have been utilized to contextualize place effects resulting from one's social environment.

4. Measurement of inflammatory markers

Seven out of the twelve studies examined at least one inflammatory marker as part of a total allostatic load (AL) index (n=5) or a cumulative biological risk (CBR) score (n=2). All

studies that used either an AL index or CBR score included secondary outcomes reflecting the cardiovascular, metabolic, or immune (inflammation) systems. Of these seven studies, only two assessed inflammation as a sub-index independently from the total AL index (Bird et al., 2010; Gay et al., 2015). AL indices ranged in total number of biological markers assessed, from 6-9. In these seven studies, C-reactive protein (CRP) was the most commonly used biomarker of inflammation; however, one study also included albumin (Bird et al., 2010). Additionally, all seven studies used a standard protocol of assessing "high risk" categories of inflammation, for both CRP (≥ 3 mg/L) and albumin (≥3.8 mg/L).

Regarding inflammatory markers specifically, all twelve studies utilized CRP as an inflammatory marker of interest. Other markers of inflammation included albumin, IL-6, TNF-alpha, sICAM-1. Seven studies assessed inflammation using a single measure of inflammation, specifically CRP, while the other studies used a multivariable index of two (n=2) or three inflammatory markers (n=3). For example, Bird et al. (2010) and Rioux et al. (2010) both assessed CRP and albumin. Gallo and colleagues (2012) were the only research group to examine sICAM-1 as an inflammatory marker, along with CRP and IL-6. Both Gay et al., (2015) and Torres et al., (2018) assessed CRP, IL-6, and TNF-alpha.

5. Place-health associations

Table 1 includes a summary of the main findings for each study as well as descriptive information regarding each study's measurement of neighborhood/place and which inflammatory marker(s) were assessed. Overall, the association between neighborhood SES and AL or CBR was consistently negative, meaning lower neighborhood SES indicated higher risk (Bird et al., 2010; King et al., 2011; Merkin et al., 2009). Moreover, Bird and colleagues (2010) tested whether the effects of neighborhood would be stronger on certain biological systems. They found

that there was only a significant association with the cardiovascular and metabolic sub-indices, but not for inflammation. These results were consistent across racial/ethnic groups, including Hispanics. Jimenez et al., (2015), however, did not find a significant association between neighborhood context on AL, specifically between baseline and two-year follow up. They did find a significant association between relative income and AL; this inverse association indicated that relative income disadvantage was associated with higher risk. In terms of neighborhood disadvantage, King et al. (2011) did not find a significant association with CBR.

Of the five studies that assessed inflammatory risk as their outcome of interest or independently from total AL indices (n=2), the associations varied and so did their indicators of neighborhood/place. Two studies found positive associations, two studies found inverse associations, and three found no association. More specifically, of the positive associations (n=2), (Rioux et al., 2010) found a positive association between traffic density exposure and CRP levels in high versus low density areas. Cepeda et al. (2018) found that gang-affiliated men living in San Antonio, TX had higher CRP compared to a general sample. Cepeda and colleagues' findings point to the potential deleterious effects of stress-related experiences from living in urban environments, such as exposure to poverty, crime, and gang membership.

Next, of the inverse associations (n=2), Gallo et al. (2014) found neighborhood SES was negatively associated with inflammatory risk (CRP, IL-6, sCIAM-1), indicating that residents in more advantaged neighborhoods had lower risk; and Gay et al. (2015) found that residents living in a US-border town who engaged in more physical activity had lower inflammatory risk (CRP, IL-6, TNF-alpha). Lastly, McClure et al. (2015), Guardino et al. (2017) and Torres et al. (2018) found no association between their place indicator and inflammation. McClure et al. (2015) found no differences in CRP levels between Mexican farmworkers living in either a majority

white locale or an established ethnic enclave; Guardino et al. (2017) found no association between neighborhood environment stress and higher CRP for mothers at neither 6 months nor 12 months postpartum; and Torres et al., (2018) found no significant association between cross-border social connections and inflammation (CRP, IL-6, TNF-alpha) but gender comparisons revealed different findings for men and women.

6. Assessment of chronic stress and acculturation

Lastly, it should be noted that acculturation stress was not examined in the neighborhood studies. However, proxies for acculturation were used as individual-level controls, including preferred language choice (Jiménez et al., 2015) and nativity (Merkin et al., 2009). McClure et al. (2015) was the only study to assess the link between community context and acculturation-related stress and chronic social stress, although for a total AL index. There were no significant findings for acculturation-related stress (i.e. discrimination); however, low social support was associated with higher AL for women living in white majority communities. For chronic stress, Guardino et al. (2017) a measure of neighborhood environment as a domain of chronic stress. However, they did not find neighborhood environment to be a significant stressor for CRP outcomes across racial/ethnic groups.

Table 1. Summary of the study findings reflecting a measurement of neighborhood/place, an inflammatory marker, and reported findings for Latinos in chronological order by year of publication.

Author(s) & Year	Study Design	Sample Characteristics	Geographic Area	Measurement of Neighborhood/Place	Inflammatory Marker	Main findings
Merkin, S. S., Basurto-Dávila, R., Karlamangla, A., Bird, C. E., Lurie, N., Escarce, J., . . . Seeman, T. (2009)	Cross-sectional; NHANES III 1988-1994	n=13,199; 30% Mexican origin taken from a nationally-representative sample	Neighborhood; census tracts; 1,772 neighborhoods	Neighborhood SES (NSES): income, poverty, education, and unemployment; categorized into quintiles based on summary scores (higher values = higher NSES)	High risk CRP ≥3mg/L (taken from an AL index score of 9 biologic indicators of elevated risk)	After adjusting for individual level covariates, there was an inverse relationship between cumulative risk (AL) and NSES, such that NSES is associated with higher cumulative biological risk, particularly for black residents and less robust for Hispanics. For Hispanics, a stronger association for NSES and AL was observed in urban areas. No specific findings were reported for inflammation.
Bird, C. E., Seeman, T., Escarce, J. J., Basurto-Dávila, R., Finch, B. K., Dubowitz, T., . . . Lurie, N. (2010)	Cross-sectional; NHANES III 1988-1994	n=13,184; 6% Mexican origin taken from a nationally-representative sample	Neighborhood; 1805 census tracts within 83 counties	NSES: 1) % of adult aged >25 with less than a high school education, 2) % male unemployment, 3) % of households with income below the poverty line, 4) % of households receiving public assistance. 5) % of female headed households, 6) mean household income (higher values = higher NSES)	High risk CRP ≥3mg/L and high-risk albumin ≥3.8 mg/L; (Inflammation sub index taken from an AL index score)	NSES was negatively associated with total AL and AL sub-indices, but not associated with the inflammation sub index. No findings specific to Mexican Americans.

Rioux, C. L., Tucke, K. L., Mwamburi, M., Gute, D. M., Cohen, S. A., & Brugge, D. (2010)	Cross-sectional; Boston Puerto Rican Center for Population Health and Health Disparities 2004-2006	n=1,017; 100% U.S. Puerto Ricans	Residential traffic exposure; address geocoordinates in Greater Boston Area	Residential traffic proximity using four indicators (i.e. proximity at <100 and <200 m of a roadway, number of roadways); Traffic density exposure levels (VMT/mi2) using four indicators (i.e. Levels 1-4)	CRP and albumin	In this Puerto Rican sample, there was a positive association between CRP and traffic density levels for residents living in the highest versus lowest density level (VMT/mi2). Moreover, individuals with greater BMI had higher CRP and showed stronger associations to traffic exposure.
King, K. E., Morenoff, J. D., & House, J. S. (2011)	Cross-sectional; Chicago Community Adult Health Study (CCAHS) 2001-2003	n=549; 31% general Hispanic sample	Neighborhood; 343 neighborhood clusters defined as two census tracts with meaningful physical and social boundaries; Chicago, IL	NSES: 1) neighborhood disadvantage: % of households with incomes at least $50,000, % of families in poverty, % households on public assistance, unemployment rate, and % vacant housing units; 2) neighborhood affluence: % individuals 16 and older in professional/managerial occupations, % 25 and older who completed 16 or more years of education, and median household incomes	High risk CRP ≥3mg/L (taken from a cumulative biological risk score of 8 biomarkers)	While neighborhood disadvantage was not associated with cumulative biological risk, neighborhood affluence was associated with lower risk. Hispanic-white disparities in CBR were observed, but after adjustment for neighborhood affluence and individual-level covariates the association was no longer statistically significant.

Gallo, L. C., Fortmann, A. L., de Los Monteros, K. E., Mills, P. J., Barrett-Connor, E., Roesch, S. C., & Matthews, K. A. (2012)	Cross-sectional; primary data collected between 2006-2009 from Latina women	n=284; 100% Mexican women	Neighborhood; 65 census tracts in San Diego, CA in high density Latino neighborhoods	NSES: educational attainment, household income, residents receiving public assistance, and residents owning a home	CRP, sICAM-1, and IL-6	In this Mexican women sample, individual and neighborhood level SES was associated with lower inflammation in more advantaged neighborhoods. After adjustment for individual level factors, neighborhood SES was no longer significant.
Slopen, N., Non, A., Williams, D. R., Roberts, A. L., & Albert, M. A. (2014)	Cross-sectional; Chicago Community Adult Health Study (CCAHS) 2001-2003	n=550; 20% general Hispanic sample; 10.2% foreign-born	Neighborhood; 80 focal neighborhood clusters; Chicago, IL	NSES: 1) % employed 16 and older in professional/managerial occupations, 2) % individuals 25 and older with 16 or more years education, and 3) median home values.	High risk CRP ≥3mg/L (taken from a cumulative biological risk score of 8 biomarkers)	After adjusting for individual level demographic and behavioral characteristic, there was a positive association between childhood adversity and cumulative biological risk. No independent findings were reported by race/ethnicity or independent effects of inflammation.
Gay, J. L., Salinas, J. J., Buchner, D. M., Mirza, S., Kohl, H. W., 3rd, Fisher-Hoch, S. P., & McCormick, J. B. (2015)	Cross sectional; Cameron County Hispanic Cohort (CCHC) from 2008-2010	N=334; 100% Mexican origin	Regional area; Cameron County, TX	US border town; first and third income census block quartiles in Cameron county	CRP, IL-6, TNF-alpha (taken from a total allostatic load risk score)	In this Mexican origin sample, higher physical activity was associated with lower total allostatic load and lower inflammatory risk.

Jiménez, M. P., Osypuk, T. L., Arevalo, S., Tucker, K. L., & Falcon, L. M. (2015)	Longitudinal/multilevel; Boston Puerto Rican Health Study (BPRHS); baseline 2004-2009; second wave 2006-2011	n=1504 at baseline; n=1258 at 2-year follow-up (second wave); 100% Puerto Rican older adults	Neighborhood; 318 block-groups from greater Boston Area	1) NSES: % adults over 25 with less than HS education, %household with income below poverty, % households receiving public assistance, % female-headed households with children, and median household income. Higher values = higher NSES. 2) Relative income calculated by subtracting Census 2000 median income in the neighborhood from respondent's household income. Negative values indicate individual is relatively more deprived/disadvantaged than neighbors.	High risk CRP ≥ 3 mg/L (taken from AL index)	In this Puerto Rican sample, they did not find an association between neighborhood socioeconomic context and allostatic load over a two-year follow-up. There was an inverse association between relative income deprivation on AL. This study did not assess inflammation separately but it was included in the AL index.
McClure, H., Josh Snodgrass, J., Martinez, C., Squires, E., Jiménez, R., Isiordia, L., . . . Small, J. (2015)	Cross-sectional; primary collection of farm workers	N=126; 100% Mexican immigrant farmworkers	Community context; residential locales in Oregon	Two residential locales based on three farming housing locations in: 1) a white majority rural population; 2) white majority outskirt town and 3) within a town of an established Mexican ethnic enclave resulting in a white majority locale and Mexican ethnic enclave	High risk CRP ≥ 3 mg/L (taken from a total allostatic load index of 6 biomarkers)	There were no significant differences by locale in AL scores for women. However, women in White dominant locales with low support were 8 times more likely to have higher AL scores. Lastly, there were no significant differences in inflammation between the two residential locales.

Guardino, C. M., Dunkel Schetter, C., Hobel, C. J., Gaines Lanzi, R., Schafer, P., Thorp, J. M., & Shalowitz, M. U. (2017)	Longitudinal; Community Child Health Network (CCHN) study 2008-2011; examines over 1-year postpartum	N=1,206; 23% Latina/Hispanic low-income women	Neighborhood; neighborhood environment in 3 urban cities and 2 rural cities	Neighborhood stress (chronic life stress measure): open-ended responses based on objective conditions and scored on a 5-point Likert scale ranging from (1) exceptionally positive conditions to (5) exceptionally negative conditions	CRP at 6- and 12-months post-partum (T2 and T3, respectively)	Neighborhood environment stress was not associated with higher CRP at any time point; however, financial strain was associated with CRP at two time points. Moreover, in fully adjusted models with financial stress as a predictor of CRP, Latino ethnicity was associated with higher CRP at 6 months postpartum and residence in eastern North Carolina (rural area) at 1-year postpartum was associated with higher CRP.
Cepeda, A., Nowotny, K. M., Frankeberger, J., Onge, J. M. S., & Valdez, A. (2018)	Longitudinal; 15-year primary collection of former gang-affiliated young men vs cross-sectional sample of men from NHANES 2007-2008	N=179; 100% Mexican origin former gang-affiliated men from San Antonio, TX (non-immigrant) and N=155 from 2007-2008 NHANES sample	Regional area; San Antonio, TX	Urban area known as San Antonio's West Side: characterized by a high concentration of poverty, unemployment, crime, drug trafficking, and Mexican American street gangs	High risk CRP ≥3mg/L	Non-immigrant, Mexican men in the gang-affiliated population were more likely to have high risk values of CRP compared to a general sample of Mexican origin men.
Torres, J. M., Epel, E. S., To, T. M., Lee, A., Aiello, A. E., & Haan, M. N. (2018)	Longitudinal; Sacramento Area Latino Aging Study (SALSA)	n=1,789; 100% of Mexican or Central American origin (majority Mexican)	Transnational social networks	Cross-border social connection measured as any vs no connection to place (country) of origin and local social relationships (0-3)	IL-6, TNF-alpha, and CRP at baseline and 5-year follow-up	No significant association between cross-border social connection with inflammation, but gender differences were observed. There was a persistent beneficial association between cross-border ties and CRP markers for immigrant men, yet some adverse associations were observed between cross-border connections and inflammation for women.

Discussion

The purpose of this scoping review was to synthesize and analyze the state of knowledge in the association between residential environments and inflammation among Latinos living in the United States. A total of 12 studies were identified for this investigation. I note that some studies were tangentially related, but again, this scoping review was mainly intended to be exploratory. Nevertheless, findings from the present scoping review demonstrated: 1) there are few empirical studies examining the association between neighborhood and/or place in relation to inflammation, particularly among Latinos in the U.S.; and 2) there is marked heterogeneity in the assessment of neighborhood/place measures, as well as inflammatory markers across studies. While the findings in this review do not show a consistent association between neighborhoods/place and inflammation in Latinos, they bring awareness to limitations in existing studies and gaps in knowledge.

Study design

Eight of the twelve studies utilized a cross sectional design; therefore, causation cannot be determined in the association between neighborhoods and physiological health. Longitudinal studies examining baseline changes in health are warranted, but more importantly longitudinal assessments of residential trajectories are missing in the literature. Additionally, seven studies used population-based surveys, or secondary data sources, for analysis. Major strengths of using these data include the ability to access larger sample sizes, access to biological data that would otherwise be costly, and they can be publicly accessed (Rosinger & Ice, 2019). Nevertheless, a limitation is these Latino samples tend to be of Mexican-origin because there are insufficient sample sizes in other Latino subgroups.

On the other hand, Gallo and colleagues (2012) collected primary data from Mexican women living in socioeconomically diverse neighborhood, which limited the generalizable implications to all Latinos due to small sample size. Generalizability to all Latino subgroups should be inferred with caution when primary data collection efforts obtain small sample sizes. Nevertheless, both population-based sample from nationally-representative data sources and all-Latino samples from primary data collections are needed to inform this research area on Latinos, neighborhoods/place, and health.

Measurement of neighborhood/place and inflammation

Neighborhood socioeconomic status (NSES) was a common measure of neighborhood social characteristics (n=6). NSES in these neighborhood studies largely focused on the socioeconomic neighborhood effects, with little consideration of additional social contexts of the neighborhood. Compositional effects (i.e. concentration/clustering), neighborhood disorder (i.e. safety), and social cohesion (i.e. social capital) warrant attention as potential psychosocial mechanisms in the association between neighborhood and stress-induced health outcome (Nandi & Kawachi, 2011). For instance, there is evidence to suggest that ethnic enclaves, an area marked by high Latino (ethnic) concentration and strong social ties, is protective for a number of health outcomes; yet, studies fail to show an association for certain cardiometabolic outcomes, such as diabetes (Durazo et al., 2016). Moreover, a number of studies (n=7) examined neighborhood context as the primary geographic area of analysis, suggesting that individuals spent their time only in neighborhoods. Yet, we know that where people work and "play" is also important to consider.

Next, this scoping review aimed to examine inflammation as a primary outcome of interest. Many of the studies in this review—both the neighborhood investigations and those

examining other contexts of place—utilized allostatic load (AL) or cumulative biological risk (CBR) as the outcome of interest to demonstrate physiological dysfunction across systems. For the purpose of exploring inflammatory risk, only those that included at least one inflammatory biomarker were included for review. Using AL and CBR in neighborhood studies presents many strengths and has the capacity to demonstrate that NSES gets "under the skin" by impacting health through multiple biological systems (Bird et al., 2010; Merkin et al., 2009). Of the studies that assessed inflammatory risk as their main outcome of interest or used a sub-index of inflammation, Torres et al. (2018) found that stratification by gender yielded gender differences. Men were more likely to benefit from social connections to place of origin, whereas women were likely to experience adverse inflammatory outcomes from social connections to place of origin. The intersection of gender and ethnicity may play a role in shaping how chronic stress is experienced in the place-based context.

Latino samples

Studies specific to Latinos are limited in the neighborhood-health research, as many examinations utilize a Latino sample from a racially/ethnically diverse sample for comparison. While such findings may unveil disparities across groups, it may present issues where findings for one group present as more robust compared to another. For example, Merkin et al. (2009) found that the association between low NSES and increased biological risk was more robust for Blacks than for Latinos. Moreover, Latinos in this study were not stratified by nativity (US born vs. foreign-born), rather they controlled for nativity status at the individual-level. Potential group differences may be underestimated as experiences may operate differently between groups—Latinos vs. blacks; US born Latinos vs. foreign-born Latinos; and/or Latino vs Latino. Nevertheless, Jimenez and colleagues' (2015) investigation is one of the few studies to test the

physiological health effects of the negative neighborhood context within a Latino sample of Puerto Ricans. In their study, they assessed NSES and a measure of relative deprivation as a proxy for stressful social comparisons, which was negatively associated with AL, but NSES was not. Moreover, measures of NSES and/or placed-based characteristics should include mechanisms for demonstrating how stress-related experiences of one's living environment contribute to such associations.

Lastly, only one study examined acculturation stress in Latinos (McClure et al., 2015). However, Jiménez et al. (2015) controlled for language preference (i.e. English vs Spanish) as an individual-level proxy of acculturation. Examinations of how acculturation differentially impacts Latinos' health are needed, including measures of nativity, length of residence in the U.S, and acculturative stress, which is specific to stressors associated with being an immigrant or being an ethnic minority. In turn, chronic stress is presented as a potential mechanism between neighborhood/place context, yet not all studies examined specific stress pathways. However, among those that did, McClure et al. (2015) found low social support to be a psychosocial stressor associated with higher CRP for Mexican immigrant women living in a rural white majority community. Additionally, Guardino et al. (2017) examined neighborhood stress as a chronic stressor in the association between stress and inflammation; however, there was no association.

Limitations

This scoping review is not without limitations. Although the eligibility criteria were narrow for the intended purpose of this review, a broad systematic search of keywords, including Hispanic/Latinos, place, neighborhoods, and inflammation were conducted. In turn, the broad nature of the research question, the search strategy resulted in a sizeable amount of references,

leading to a possibility of overlooked studies. This presents the potential for missing references that would have otherwise fit the aim of the research question. Next, because neighborhood and place can be conceptualized in various contexts and differently across disciplines, this scoping review is subject to some bias. Nevertheless, the reviewer consulted with an experienced health science librarian (CW) for approval of the search strategy and the reviewer followed a systematic approach for excluding, coding, and including sources. Lastly, the examination of neighborhood and/or place and physiologic dysregulation is still growing; yielding a limited number of empirical studies with inconsistent findings. Therefore, a systematic review nor a meta-analysis would have been appropriate, particularly since their primary purpose is to make recommendations for interventions. Nonetheless, this scoping review utilized systematic approaches to explore main concepts and topics, summarize methodologies and evidence, and subsequently identified gaps in knowledge related to this topic.

GAPS IN KNOWLEDGE

Finally, this section concludes with gaps in knowledge. While much is to be learned regarding the downstream effects associated with the neighborhood environment, the body of work presented in this scoping review adds to our understanding of place-health associations. In this section, I identify some gaps in knowledge which could help inform approaches for future place-based studies, including those with a biopsychosocial lens of identifying how place-based inequality is embodied among racial/ethnic minority groups. In other words, for understanding how unequal exposure to place-based social and environmental conditions “get under the skin” to affect physical and physiological health and functioning (Petteway, Mujahid, & Allen, 2019).

Stress-related Pathways

Chronic exposure to stress for racial/ethnic minorities has detrimental effects for risk and disease, especially among groups from disadvantaged backgrounds (Richman, 2018). Latinos, for example, face a number of disadvantaged conditions in daily life that are shaped by socioeconomic and structural factors (Velasco-Mondragon et al., 2016). For instance, Latinos who live in ethnically concentrated areas, known as ethnic enclaves, have limited socioeconomic mobility and, in turn, inadequate access to health care. Ethnic enclaves tend to be concentrated in low socioeconomic and urban areas, thereby increasing unequal stress exposure and health risk (Viruell-Fuentes et al., 2012). Nevertheless, Latinos are not limited to ethnic enclaves or urban settings. Thus, an understanding of stress-related mechanisms may advance our knowledge of how negative social and environmental exposures are embodied within the Latino population in and across geographic areas.

A promising mechanism to consider are individual-level perceptions of stress exposures. Perceived neighborhood characteristics may help disentangle the stress process and their effects on health for individuals living in disadvantaged communities. For example, individuals form negative perceptions when they observe physical disorder, such as graffiti, abandoned property, and/or disorderly conduct (Sampson & Raudenbush, 2004). Of particular need are studies that examine the deleterious physiological effects due to negative neighborhood perceptions. For example, examinations of stress-related outcomes, such as chronic inflammation, that link negative appraisals to health risk may help reveal whether negative social and environmental experiences “get under the skin.”

Theoretical Perspectives

Contextualizing lived experiences of racial/ethnic minorities provides population health researchers with the opportunity to position inequality in the appropriate social, cultural, historical, and/or structural context. In turn, future place-based health research should draw from various theoretical perspectives, including those grounded in public health and sociology, as well as biology, to gain a comprehensive sense of the multiple processes and mechanisms that shape health disparities. For example, a promising framework is the stress process model, which was developed to better conceptualize the social distribution of stress using both sociological and biological explanations of lived experiences (Pearlin, 1989). The stress process model has been utilized to frame how SES disparities and differential chronic stress exposure contribute significantly to racial/ethnic health disparities in mental, physical, and physiological health (Turner, 2013). However, despite the growing area of neighborhood studies examining the deleterious health effects of exposure to disadvantaged conditions and to my knowledge, this framework has yet to be applied.

Moreover, researchers have called for studies to examine the social processes of the neighborhood context, including assessments of the intermediate processes that potentially link to the social environment to cardiometabolic risk (Leal & Chaix, 2011). Thus, the social disorganization theory (Shaw & McKay, 1942) offers a number of concepts to draw from, especially those related to physical and social processes in the neighborhood context. Given the intricate processes and mechanisms that situate "people in places" (Entwisle, 2007) and those that contribute to inequality, it would be difficult to draw from a single theoretical perspective. Therefore, I propose weaving concepts from multiple perspectives to explore notions of how "place" relates to physical and physiological functioning among vulnerable populations.

Measuring Residential Environments

There is little consensus on the operationalization of place, even more specifically on measuring neighborhoods (Duncan & Kawachi, 2018). In turn, methodological issues plague the place-health research, especially in regard to measuring neighborhood effects (Sampson, Morenoff, & Gannon-Rowley, 2002). A possible explanation for this gap in knowledge points to the notion that research on neighborhood effects commonly uses data collected for other purposes (Chaix, 2009). Therefore, the broader implications of neighborhood studies require careful consideration when selecting measures that assess characteristics of the residential environment.

Potential solutions include drawing from the discipline of spatial demography. For example, health researchers should incorporate "spatial thinking" and "spatial analytic perspectives" when addressing neighborhood and other place-based health effects (Matthews & Parker, 2013). Further, an emergence of using innovative methods have given rise to the use of geospatial data, which is utilized to link people to place (Entwisle, 2007). The use of spatial analytic methods, such as spatial econometrics, multilevel modeling, and spatial pattern analysis could be useful methodologic tools for exploring the spatial distribution of risk and disease among racial/ethnic minority groups, including Latinos. Further, ecological studies using spatial methods to explore Latino concentration, immigrant concentration, and health outcomes along with associated health risks could inform how health outcomes and risks are geographically dispersed.

Conclusion

Scholars utilizing a health disparities lens to study Latino health are challenged with identifying and theorizing macro- (i.e. anti-immigration policies), meso- (i.e. neighborhood

characteristics), and/or micro- (i.e. health behaviors) level determinants of place and health. Of particular need are neighborhood studies that takes a biopsychosocial approach to conceptualize between links between social and environmental exposures and individual outcomes. Psychosocial factors, including perceived discrimination and chronic or perceived stress have received less attention in place-health studies in comparison to studies examining the health effects of unfavorable objective neighborhood measures. Perceived stress, particularly within the neighborhood context, is a potential psychosocial factor that also contributes to poor biological outcomes, yet requires further elucidation to understand how it matters in the place-health association.

In line with the aforementioned objectives, I also address the following specific dissertation aims to address some gaps in existing knowledge:

DISSERTATION AIMS

AIM 1: Develop a theoretically-driven conceptual framework to describe potential factors and pathways linking the residential environment to obesity, diabetes, and inflammation

a) Draw from the biological and social sciences to identify relevant theoretical perspectives
b) Conceptualize how unequal social, and environmental exposures contribute to psychosocial experiences and shape health disparities, with attention to how and why the place-based context matters for physical health, including physiological dysregulation

AIM 2: Examine racial/ethnic differences between NHWs and Latino midlife and older adults

a) Describe between-group differences for sociodemographic factors, perceived neighborhood characteristics and markers of obesity, diabetes, and chronic inflammation

b) Test the association between race/ethnicity, perceived neighborhood and three markers of obesity, diabetes, and chronic inflammation: 1) Body Mass Index (BMI), 2) glycosylated hemoglobin A1c (HbA1c), and C-reactive protein (CRP)

AIM 3: Examine ethnic differences among midlife and older Latinos

a) Describe both between- and within-group differences among Latinos, specifically by Mexican-origin and non-Mexican origin Latino subgroups and nativity (i.e. foreign-born) status for sociodemographic factors, perceived neighborhood characteristics and markers of obesity, diabetes, and chronic inflammation

b) Test the association between Latino ethnicity, perceived neighborhood characteristics and 1) BMI, 2) HbA1c, and CRP.

CHAPTER 3

CONCEPTUAL FRAMEWORK

AIM 1: Develop a theoretically-driven conceptual framework to describe potential factors and pathways linking the residential environment and cardiometabolic risk

a) Draw from the biological and social sciences to identify relevant theoretical perspectives
b) Conceptualize how unequal social, and environmental exposures contribute to psychosocial experiences and shape health disparities, with attention to how and why the place-based context matters for physical health, including physiological dysregulation.

Introduction

The numerous possible causes contributing to persistent racial/ethnic health disparities can leave population health scholars with more questions than answers, calling for multiple iterations to existing conceptual and methodological conventions in health research (Ford & Airhihenbuwa, 2010). Recent developments in the conceptual framing of residential effects on health add to our understanding of the place-health association (Daniel, Moore, & Kestens, 2008; Krieger, 2012); however, the ongoing discourse around why, when, and how place matters for health disparities warrant critical assessments of existing theories to define, analyze, and conceptualize how disease is distributed across geographies and populations (Chaix, 2009; Sharkey & Faber, 2014). Put differently, what theories and concepts can be employed to describe the potential biopsychosocial mechanisms through which residential environments influence adverse health outcomes, particularly among racial and ethnic minority groups? In this chapter, I provide a theoretical foundation to conceptualize how disadvantaged statuses, such as race/ethnicity, contribute to unequal social and environmental stress exposures as well adverse psychosocial outcomes; and ultimately shape disparities in obesity, diabetes, and/or

inflammation. Throughout the remainder of this chapter, I position race/ethnicity as a central concept in relation to disparities in socioeconomic status, health and socioenvironmental stress exposures.

To address Aim 1, I developed a theoretically-driven conceptual framework entitled the *socioenvironmental stress model*. To do so, I leveraged concepts from three theoretical perspectives across public health, sociology, and the biological sciences: the ecosocial theory, social disorganization theory, and the stress process model. Second, I discuss a breadth of structural, social and environmental factors that may inform biopsychosocial links between race/ethnicity, perceived neighborhood characteristics as a measure of stress, and physical health outcomes associated with cardiometabolic risk—particularly obesity, diabetes, inflammation. Although various factors are identified, I proposed exploring only a subcomponent of the socioenvironmental stress model. Subsequently, the chapter closes with an introduction to the empirical studies conducted in the dissertation, which examine the relationship between perceived neighborhood characteristics and cardiometabolic risk factors among midlife/older NHW and Latinos.

THEORETICAL PERSPECTIVES

Myriad theoretical frameworks can be applied to conceptualize health disparities in population health research. For the purpose of the dissertation, however, I propose employing concepts from three frameworks: 1) the ecosocial theory; 2) the social disorganization theory; and 3) the stress process model. In combination and individually, these three theoretical conventions provide an interdisciplinary approach for conceptualizing how disadvantaged status and increased socioenvironmental stress exposure among racial/ethnic minorities influence persistent health disparities. First, the ecosocial theory provides a population health framing of

"people in places" (Entwisle, 2007), emphasizing that individuals are not the sole contributors of disease outcomes, rather inequalities in health are rooted in larger socio-structural systems. Second, the social disorganization theory adds a sociological perspective for understanding the neighborhood social and physical environment, including concepts such as neighborhood disorder and social cohesion. Third, the stress process model considers a number of social, psychological, and biological (biopsychosocial) factors that contribute to unequal stress exposure, disproportionately impacting racial/ethnic minorities. Subsequently, the following section briefly covers the principal components of each framework as well as its application to health disparities research.

ECOSOCIAL THEORY

A Public Health Framework

The ecosocial theory was first proposed by Nancy Krieger (1994) to describe the broad and complex causal relationships in disease distribution. The ecosocial theory serves as a broader public health framework, specifically social epidemiology, for understanding population health outcomes and disparities. It was originally conceptualized to systematically link relationships at multiple levels of organization across space and time, from the individual to neighborhood (spatial) as well as across the life course (temporal) (Kramer, 2016; Krieger, 2011). The ecosocial theory conceives that the health-disease process is a consequence of unequal social influences becoming "literally embodied" into individuals' bodies.

Embodying inequality

Krieger posits that individuals are not the sole contributors of health and disease, rather individuals biologically embody their social context. Racial/ethnic minorities' vulnerability to both social and health inequalities are influenced by various socio-structural determinants,

including the hierarchy of social status (i.e. race/ethnicity, class, and gender), historical context, and the political economy (Krieger, 2011). The ecosocial theory postulates that population health disparities along with inequitable access to resources and political power are rooted in larger socio-structural contexts of the U.S. Figure 3 depicts the linking pathways to embodying inequality.

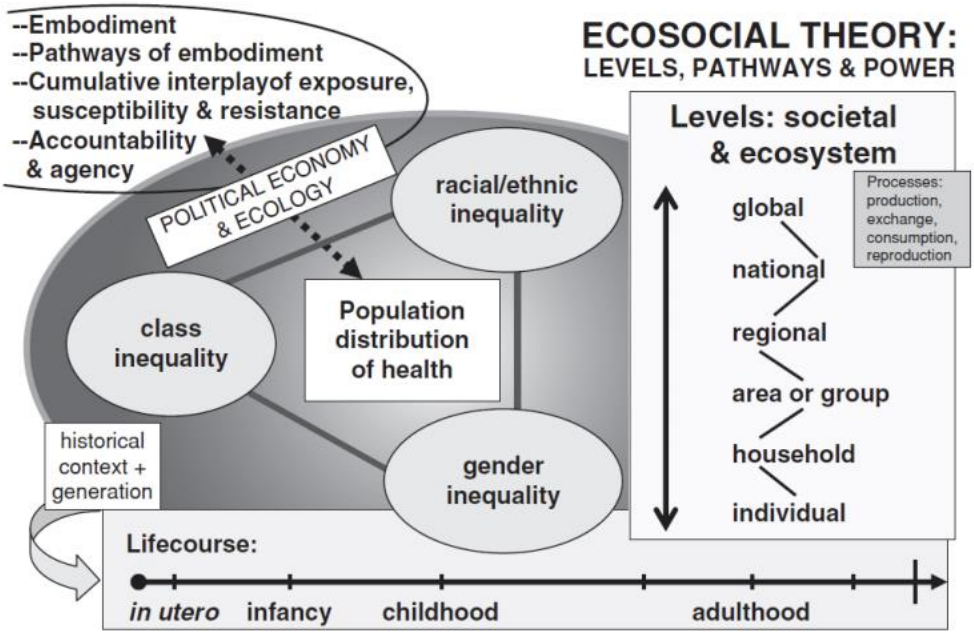

Figure 3. Ecosocial theory: Pathways to embodying inequality and associated core constructs. *Note:* Image from: Epidemiology and the People's Health. *Chapter 8*. Ecosocial Theory of Disease. Krieger, 2011

The following four key concepts were developed from this theory (Krieger, 1994; Krieger & Davey Smith, 2004):

1) Embodiment—posits that exogenous determinants, such as racial/ethnic discrimination and/or social-class inequality, shape population disease patterns because they reflect how populations biologically embody their societal and ecological context;

2) Pathways to embodiment— refers to the interacting pathways in which individuals biologically adapt to their lived experiences, such as the behavioral, emotional, and cognitive responses to adverse social and economic exposures;

3) Cumulative interplay of exposure, susceptibility, and resistance— describes how the joint interactions occur at multiple levels, including how accumulated responses of embodied exposures may occur across the life-course and across space; and

4) Agency and accountability— refers to the ways social and health inequities are monitored, addressed, and analyzed by systems in power (i.e. sociopolitical), such that policies may hinder food, housing, and medical access for vulnerable groups

Socio-structural inequality

Beyond SES as a fundamental cause of health (Link & Phelan, 1995), recent developments have declared structural racism as a fundamental cause of health inequalities (Phelan & Link, 2015). Persistent health inequalities result primarily because racism is a root cause of racial differences in SES; and inequality in power, prestige, freedom, neighborhood context, and health care, have fundamental associations with health beyond SES (Phelan & Link, 2015). For example, a historical legacy of systemic racism marked by residential segregation, limits residential mobility for Black and may explain persistent health disadvantages compared to other racial/ethnic groups (Kramer, Black, Matthews, & James, 2017). For Latinos, anti-immigration laws represent an additional structural determinant of health, with evidence suggesting the "embodiment of institution racism" can negatively alter health and well-being (Castañeda et al., 2015; Martinez, Ruelas, & Granger, 2018). For this reason, racial and ethnic minority groups in the U.S. are marked by socially imposed disadvantages.

Although the measurement of structural or institutional factors are out of the scope of the dissertation, it is critical to provide an understanding of the larger socio-structural context that undeniably upholds inequity among racial/ethnic minority populations. Scholars have argued that unequal social and economic opportunities, as well as racial/ethnic health disparities, can be attributed to a legacy of structural and institutional practices, laws, and policies that disproportionately affect racial and ethnic minority groups (Ford & Airhihenbuwa, 2010; Williams, Priest, & Anderson, 2016). Subsequently, the ecosocial theory has been applied to health studies examining race and place (Kramer, 2016), discrimination (Krieger, 2012), and demographic neighborhood changes (Arcaya et al., 2016). Therefore, I believe it adds theoretical value the proposed conceptual model, particularly through a health disparities lens.

SOCIAL DISORGANIZATION THEORY

A Neighborhood Framework

Second, the social disorganization theory is grounded in sociological principles, particularly in the criminological literature (Shaw & McKay, 1942). The social disorganization theory is widely employed for theorizing how social or physical organization is spatially distributed across neighborhoods and shaped by crime, racial and/or ethnic heterogeneity, or socioeconomic conditions. A central tenant of this theory is that communities can be characterized along a continuum of organization, ranging from socially organized communities on one end to socially disorganized communities at the other end (Kubrin, 2009). The causal model of the social disorganization posits that exogenous characteristics marked by impoverished conditions or racial/ethnic heterogeneity weaken social ties, which lessen informal social control among residents, leading to increased crime (Kubrin, 2009). Although this theory has its roots in crime, the theory has served as a theoretical foundation for assessing

neighborhood quality, including physical disorder and cohesion, in relation to health (Cagney et al., 2009).

The Neighborhood Environment: Physical disorder and social cohesion

Cagney et al. (2009) employed the social disorganization theory and collective efficacy to inform the development of measures to assess two neighborhood social processes: physical disorder and social cohesion. Physical disorder encompasses the disorganization perspective and is denoted by visible signs of deterioration, such as vacant lots and graffiti, along with indicators of social decline, including crime and safety. Conversely, social cohesion would represent a socially organized neighborhood. However, on the opposite end of social cohesion would be negative social cohesion, or in other words—limited social interactions, mistrust, and lack of collectivism (Kubrin & Mioduszewski, 2019; Sampson, Raudenbush, & Earls, 1997). Furthermore, measures of hostility, mistrust, and conduct disorder have been linked to perceived disorder.

The narrative is that disorder is negative and, in turn, could have harmful consequences for health and well-being. The presence of disorder tends to cluster in disadvantaged neighborhoods, which may impact health through direct pathways, such as pollution or violence, and indirectly through influences on physical activity, diet, and psychological distress (Jessica L. McCurley et al., 2019). Indeed, perceptions of neighborhood disorder have been linked to physical health decline, psychological distress, and perceived powerlessness (Sampson & Raudenbush, 2004).

STRESS PROCESS MODEL

A Biopsychosocial Perspective

Third, the stress process model provides a biopsychosocial perspective of how racial/ethnic minority status places individuals at differential risk of chronic stress exposure and various health trajectories, including physiological dysregulation. The stress process model was developed by Leonard Pearlin and colleagues (1981) and modified to emphasize the need to consider the structural and social contexts that contribute to stressful life events and conditions in daily life (Pearlin, 1989). Accordingly, the stress process is formed by three main conceptual components: 1) source(s) of stress, 2) the mediators of stress, and 3) the manifestations of stress.

It is evident that stress does not occur in isolation— that is, stress is likely formed by a cluster of stressors or conditions in daily life and over time, commonly referred to as chronic stressors. For example, the loss of a job may be the leading source of stress but can lead to additional stress including financial strain— a common source of chronic stress. Some individuals or populations, however, may be at greater risk for experiencing persistent exposures to stress than others, especially those with limited socioeconomic resources. For example, residents living in disadvantaged environments may experience negative psychosocial stress (i.e. poor perceived safety), a paucity of resources (i.e. lack of quality healthcare), and/or concentrated poverty (i.e. high unemployment rates). Consequently, chronic exposures to social stressors have been linked to the onset and persistence of physical health outcomes, such as diabetes, hypertension, and other cardiovascular risk factors as a result of maladaptive psychological and behavioral coping (Goodman, McEwen, Huang, Dolan, & Adler, 2005). In this section, I discuss the utility of the stress process framework in health disparities research and

point to chronic stress exposures experienced by Latinos linked to the neighborhood environment.

Adapting the Stress Process to Understand Health Disparities

Guided by Pearlin's stress process framework, Turner (2009) presented an adapted stress process model, noting its promising utility in health disparities research (shown in Figure 4). In Turner's elaboration of the model, a series of dimensions are recognized, including both individual- and neighborhood- level social characteristics and chronic stress exposures. Moreover, he describes both personal and social resources such as social support to help explain why individuals exposed to similar social and environmental contexts may or may not suffer the same health consequences (Pearlin, 2010; Turner, 2009). Furthermore, Turner (2009) argued that the incorporation of biomarkers of health allows for a unique understanding of the patterns and risks underlying persistent racial/ethnic health disparities.

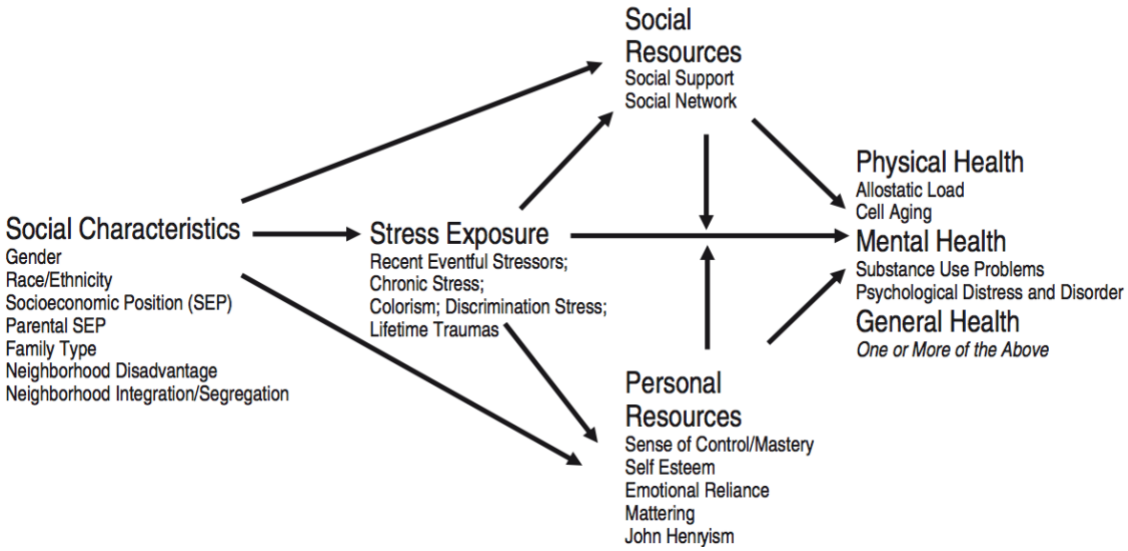

Figure 4. Turner's (2009) adapted stress process model.

Conclusion

It is important to recognize that individuals are nested within their geographic, occupational, and social environments. Thus, I developed a conceptual model entitled the "socioenvironmental stress model" (shown in Figure 5), which draws concepts from the ecosocial theory, social disorganization theory, and stress process model. In combination and individually, these three theoretical conventions provide an interdisciplinary approach for conceptualizing the biopsychosocial mechanisms that link the residential environment to health, especially adverse physical health outcomes that disproportionately impact racial and ethnic minorities.

CONCEPTUAL FRAMEWORK

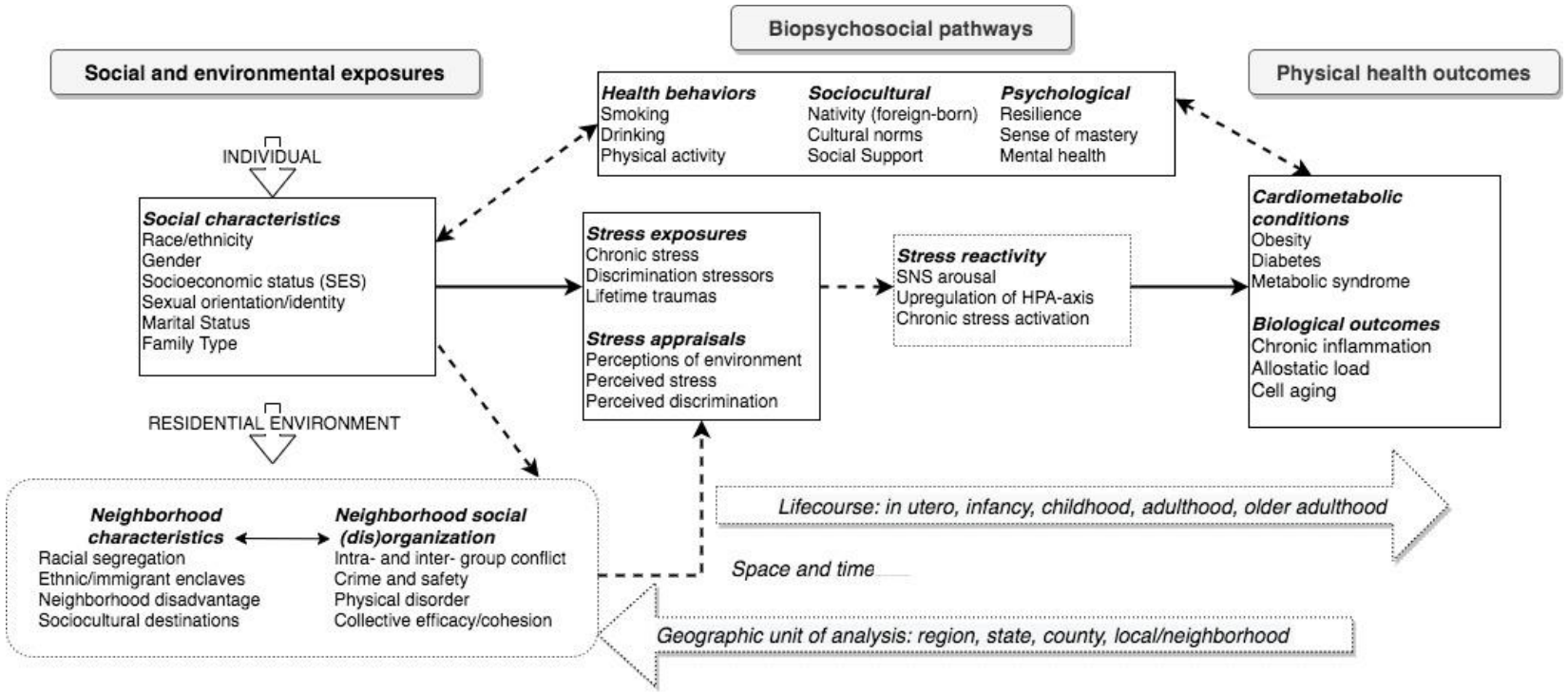

Figure 5. ***Socioenvironmental stress model***

Notes: **1)** Solid arrows and boxes indicate a pathway that will be tested. **2)** Dotted boxes indicate factors or concepts that are relevant in the disease's etiology but will not be tested directly in the dissertation**. 3)** Dashed arrows indicate indirect pathways.
4) Abbreviations: SNS=Sympathetic nervous system, body's response to stressful situations; HPA-axis = hypothalamic pituitary adrenal (HPA) axis, responsible for adaptation of the stress response.

SOCIOENVIRONMENTAL STRESS MODEL

Social and Environmental Exposures

"For whom and in what contexts?"

Individual Social Characteristics

Social status is defined as a multi-dimensional concept that encompasses both ascribed (age, sex/gender, and race/ethnicity) and achieved statuses (i.e. socioeconomic status (SES)—income and education (Alwin & Wray, 2005). In fact, race and ethnicity are widely recognized as fundamental causes of disease due to their association with health at the intersection of socioeconomic, cultural, geographical, and historical contexts (Link & Phelan, 1995; Richman, 2018). Further, disadvantaged social statuses, including being female, poor, or a minority are linked with higher psychosocial stress and deleterious health (Williams et al., 2016; Richman, 2018).

Latinos, on average, have lower levels of education, income, and are more likely to live in areas surrounded by co-ethnic with similar socioeconomic profiles. This SES disadvantage varies by nativity status—with foreign-born individuals faring worse than U.S. born Latinos, depending on the socioeconomic outcome (JEC, 2015). For instance, Latinos are four times less likely compared to whites to complete a high school diploma; however, this varies by generational status where we observe increases in higher educational attainment among 2+ generations (JEC, 2015). Furthermore, immigrants from Mexico and Central America have the lowest educational attainment compared to immigrants of other Latin American countries.

Individuals with low socioeconomic status and of Latino ethnicity are at increased risk for certain cardiometabolic outcomes (Gallo, Monteros, Ferent, Urbina, & Talavera, 2007) and inflammatory risk (Dinwiddie, Zambrana, Doamekpor, & Lopez, 2015). Education is particularly

relevant to Latinos due to their lower levels of educational attainment compared to non-Hispanic whites. Previous studies have found lower education levels to be associated with metabolic syndrome, specifically risk factors such as increased waist circumference and high plasma glucose levels, in a sample of Latina women (Gallo et al., 2007). Conversely, among U.S.-born Mexican women, higher educational attainment was found to be associated with diabetes (Dinwiddie, Zambrana, & Garza, 2014). In turn, immigrant-native disparities within groups seem to be present for both health and socioeconomic outcomes. For the purpose of the dissertation studies, I examined race (NHW), ethnicity (Latino), nativity, SES and gender among midlife/older adults.

Neighborhood Social Characteristics

Next, neighborhood socioeconomic status, racial/ethnic composition, and segregation/integration, are shown in the current model to acknowledge how lived experiences may be shaped at both the individual- or group-level. Further, multiple disadvantaged social statuses may also limit residential mobility and good health. Indeed, according to the deprivation amplification model, residents in poor neighborhoods are not only personally poor, but tend to live in neighborhoods lacking the social and economic resources to achieve good health and well-being (Macintyre, 2007). Subsequently, neighborhood context matters for various aspects of individuals' well-being, including physical and mental health, social participation and cohesion, and psychosocial experiences (i.e. discrimination). In addition to aspects of the visible neighborhood environment mattering for health, subjective appraisals of the neighborhood context are influential as well (Stokes, 2019).

Physical conditions, such as graffiti presence, litter, and abandonment are important for shaping neighborhood perceptions and potentially ensuing health consequences. For example,

neighborhood problems tend to be clustered in disadvantaged areas and may influence health directly, such as through environmental hazards or violence, as well as indirectly through physical activity, diet, and psychological distress (McCurley et al., 2019). Furthermore, Sampson and Raudenbush (2004) suggest perceptions of the neighborhood environment, including physical and social disorder are shaped by racial, ethnic, and socioeconomic structural factors. Thus, in the dissertation I examine neighborhood perceptions, which may serve as an intermediate component in the neighborhood-health association.

Biopsychosocial Pathways

"Why and how?"

Exposures to social stressors have been linked to the onset and persistence of chronic physical health outcomes, such as diabetes, hypertension, and other cardiovascular risk factors as a result of maladaptive psychological and behavioral coping (Goodman, McEwen, Huang, Dolan, & Adler, 2005). Further, residents living in disadvantaged environments may be exposed to negative psychosocial stress (i.e. poor safety), unequal distribution of resources (i.e. lack of quality healthcare), and/or poverty (i.e. high unemployment rates) that can lead to declines in health. The stress process model suggests that physiological stress reactivity and maladaptation manifest contribute to poor physical health vis-à-vis stress-induced dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis (Bird et al., 2010; Goosby et al., 2018; Taylor et al., 1997). This section briefly covers the social distribution of chronic stress and its effects, stress appraisals, and stress reactivity.

Chronic Stress Exposures

Chronic stress is defined as a "prolonged, uncontrollable state of homeostatic imbalance that arises by exposure to systemic stressors embedded in life conditions or repeated acute-

incident stressors with effects that extend beyond the initiating event" (Daniel et al., 2008, p. 124). Minority social status has been linked to poor health outcomes through increased exposure to chronic stress (Sternthal, Slopen, & Williams, 2011). For example, Gallo et al. (2014) found chronic stress burden was related to higher prevalence of coronary heart disease and diabetes among a diverse sample of Hispanic/Latino adults. Further, Brown, Mitchell, and Ailshire (2018) found that Black and Latino groups experience a greater burden of chronic stress, such as ongoing stress due to financial strain and residential conditions.

Latinos, like other racial/ethnic minorities, generally experience lower achieved statuses, including significantly lower educational attainment as well as lower income wages and median household incomes compared to NHW. These SES inequalities coupled with their intersecting ascribed social statuses (i.e. age and gender), Latinos are vulnerable to a number of social and environmental stress exposures, including living in high crime neighborhoods, limited access to resources (i.e. personal and social resources), and lower access to quality health care (Ruiz, Sbarra, & Steffen, 2018). In addition to SES-related factors, some Latino groups like Mexican immigrants may be vulnerable to facing unique stressors than their native-born or Latino counterparts. For example, fear of deportation can induce stress for undocumented individuals and/or their family members (Castañeda et al., 2018).

Stress Appraisals

Individuals are nested within their social environments; however, not all individuals in the same environment experience it the same way nor are equally affected. In other words, subjective interpretation of the environment, particularly stressors, play an important role in determining an individual stress response (McEwen, 1998). Indeed, researchers recommends including appraisal-based measures to better understand pathways that contribute to health

outcomes for racial/ethnic minorities (Brown et al., 2018). Moreover, perceptions of stressful conditions, despite level(s) of exposure, are critical to the affective and physiological cascade that occurs —and ultimately have long-term health impacts (Ruiz et al., 2018). For the dissertation, I aim to focus on perceptions of the social neighborhood environment as a potential mechanism in the stress process.

Stress Reactivity

Stress proliferation can result when frequent stress exposures in daily life accumulate and increase the burden of adaptation on the body's physiological systems (Pearlin, 2010; Seeman et al., 2008). A cascade of physiological events occurs when the HPA-axis is triggered, including the release of stress hormones (i.e. cortisol) (Goodman et al., 2005). Subsequently, both direct effects and feedback loops are produced throughout the brain, specifically between the hypothalamus, the pituitary gland, and the adrenal gland (McEwen & Gianaros, 2010). Moreover, the HPA-axis is responsible for regulating metabolic and immune function, including production of blood glucose and for modulating inflammatory responses (McEwen & Gianaros, 2010). As a result, stress reactivity via the HPA-axis is a key mediator of stress responsivity and health consequences (Goosby et al., 2018). Population health studies utilize primary and/or secondary biomarkers to reveal the biological mechanisms through which social and psychosocial factors may impact physical health, such as cardiometabolic conditions, cardiovascular disease, disability and mortality (Crimmins & Seeman, 2004). In the dissertation studies, I examined two biomarkers: HbA1c and CRP.

Individual Attributes

Geographic, occupational, and/or social environments constitute the contexts in which individual predictors promote or hinder health and well-being (Taylor et al., 1997). For example,

individual predictors of physical health are well-documented in the literature, including health behaviors such as smoking, social factors such as social support, and psychological factors such as depression. Briefly, I describe them below as potential attenuating and/or moderating individual attributes.

Health Behaviors

Risk-associated behaviors, including smoking, heavy drinking, and limited physical activity are associated with adverse physical health outcomes. It has been hypothesized that in the face of stressful daily social, economic, and environmental conditions in daily life, such as poverty, crime, poor residential environments, etc., individuals engage in unhealthy behaviors (i.e. smoking, drinking, overeating) to cope with stress (Jackson et al., 2010). Indeed, for Black individuals, unhealthy behaviors were associated with increased chronic conditions, thereby suggesting negative behaviors impose negative health effects as well. For Latinos, behavioral outcomes seem to been patterned by nativity, gender, and country of origin. For example, Dinwiddie and colleagues (2015) found unhealthy behaviors to be associated with cardiovascular risk for both U.S.-born and foreign-born Mexican-origin women, but was worse for U.S.-born women who smoked. In turn, I have included health behaviors given the above findings related to negative stress conditions and the direct effects on poor health outcomes.

Nativity

For Latinos, nativity status adds another dimension of social status or social stratification. First-generation immigrants tend to have better health outcomes compared to their U.S.-born ethnic counterparts, despite the aforementioned disadvantages. However, evidence suggests that health advantages tend to erode and more so over time as immigrants become more integrated into U.S. society (Brown, 2018). Additionally, given patterns for a number of risks and outcomes

among Latinos by foreign-born and U.S. born status, I introduced nativity as a sociocultural influence. Substantial support of the Latino health paradox points to good health outcomes for foreign-born Latinos, despite their doubly marginalized status—ethnic minority status and immigrant status. For example, U.S.-born Hispanics demonstrate similar patterns of stress accumulation and exposure, while there is evidence to suggest that foreign-born Hispanics have similar stress profiles to Whites (Sternthal et al., 2011). In turn, nativity serves as a potential moderator among Latino populations. In this model, cultural norms and social support are presented as additional sociocultural factors but not tested. These findings have important implications for considering the role or nativity when disentangling the effects of stress on health.

Psychological

In addition to the cardiometabolic burden experienced by Latinos, concurrent psychological depression is also prevalent (McCurley et al., 2019). Thus, I include depression as an individual attribute that may be linked to poor morbidity and mortality outcomes, including cardiovascular risk. However, depression also presents as a noteworthy mental health outcome that could be examined in future work that seeks to examine the mental health effects of neighborhood context—a limited area of research.

Physical Health Outcomes

"What happens?"

Obesity, Diabetes, and Inflammation

Racial/ethnic disparities are well-documented, with minority groups at disproportionate risk for experiencing poor chronic health conditions (Adler & Rehkopf, 2008; LaVeist-Ramos, Galarraga, Thorpe, Bell, & Austin, 2012). In this section, physical health encompasses chronic

conditions associated with the metabolic, cardiovascular, as well as immune systems and were characterized as being cardiometabolic conditions or biological outcomes. Cardiometabolic conditions include type 2 diabetes, metabolic syndrome, and obesity, which are considered chronic conditions that occur as a result of risk exposures over the life course (Ben-Shlomo & Kuh, 2002). The listed biological outcomes represent stress-related pathways that have been used examined among racial/ethnic minority groups, including allostatic load—a more comprehensive, multisystem measure, cell aging, and chronic inflammation. Nevertheless, I focus mainly on measures of obesity, diabetes, and inflammation—specifically CRP. Together, cardiometabolic conditions and inflammatory dysfunction represent greater risk for long-term health effects, especially cardiovascular outcomes (Alley et al., 2006; Pepys & Hirschfield, 2003).

Spatiotemporal Effects

The integration of the life-course as it relates to place and health is important for advancing this area of research; thus, I have included it in this model to acknowledge the importance of cumulative exposure over the life-course in response to social environments, stress and health. However, for the purpose of this dissertation I did not employ a longitudinal approach. Instead, I looked for patterns and associations between race/ethnicity, neighborhood perceptions, and physical health outcomes in a pooled sample of non-Hispanic white and Latino adults (as described in the following chapter).

Lastly, in the model I make note of the various geographic units of analysis, ranging from the state to the neighborhood unit. I acknowledge this aspect because the geographic dispersal of racial and ethnic groups may provide additional context for interpreting any given findings. For example, historically, Latinos are regionally concentrated in parts of the Southwest (i.e.

California, Texas, Arizona) and are largely urbanized (Fischer & Tienda, 2006; Tienda & Fuentes, 2014). In more recent decades, immigration from outside of Mexico as well as new settlement into non-traditional areas, has contributed to increased diversity and geographic scattering of Latinos into non-urban destinations (Lichter, 2012). Therefore, I included urban/non-urban typologies and region to conduct a preliminary examination of how these factors influence neighborhood perceptions.

Conclusion

In sum, the socioenvironmental stress model provides the footing for the two empirical studies of the dissertation, which serve to address Aims 2 and 3. Further, because I have approached this dissertation with a health disparities perspective, the main goals of Aims 2 and 3 are to examine both racial/ethnic group differences as well as within-group differences in a sample of midlife/older adults above age 50. For a more simplified version of the model, Figure 6 displays a subcomponent of the socioenvironmental stress model to indicate what factors and proposed associations will be tested in the empirical studies. The rationale and objectives of the empirical studies are introduced below. Subsequently, Chapter 3 follows with a description of the methodology used, including data source, data measures, and the analyses plan.

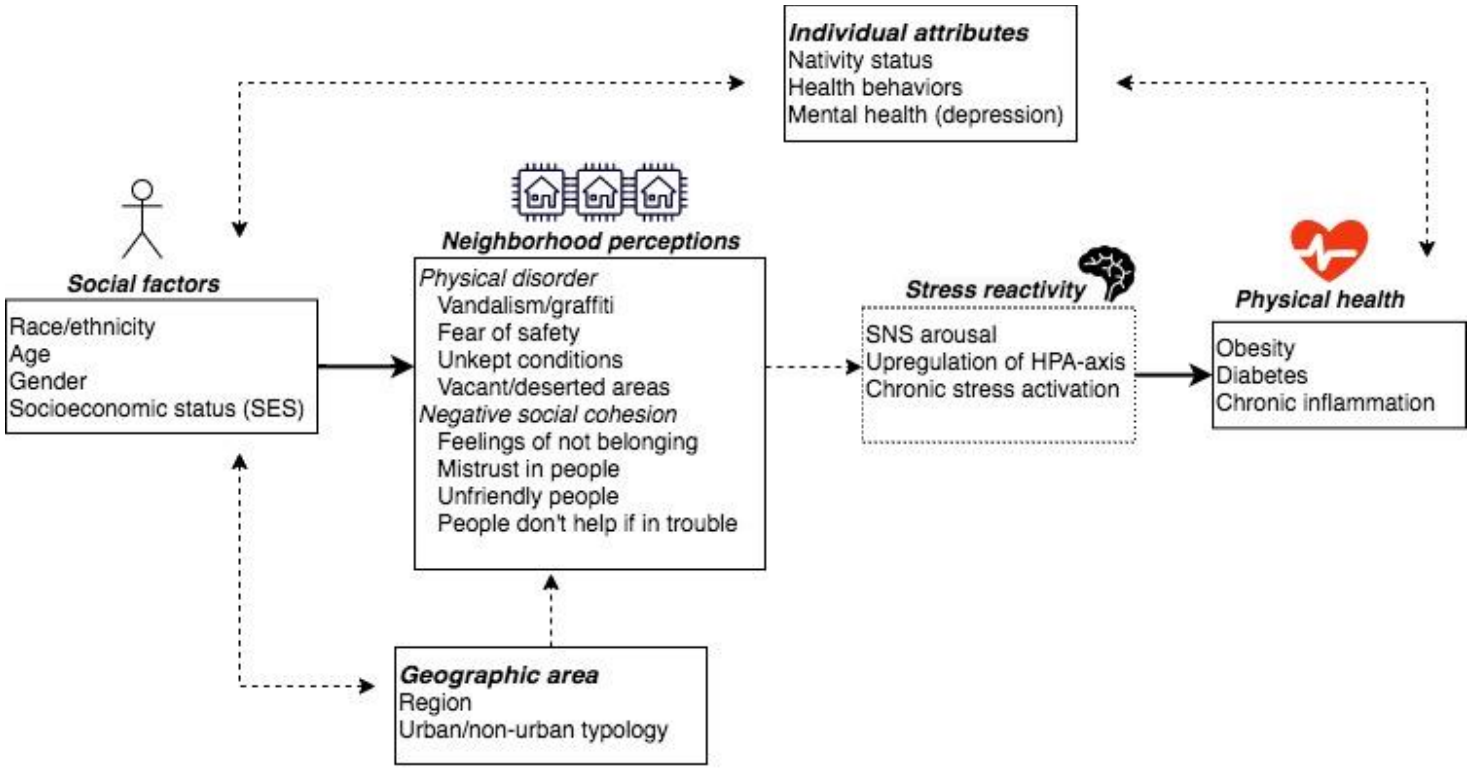

Figure 6. Simplified socioenvironmental stress model. Note: The indicated factors and pathways will be tested.

Race/ethnicity, Perceived Neighborhood Characteristics, Cardiometabolic Conditions, and Inflammatory Risk: An Empirical Examination of Midlife/older Adults

Study Objectives

In the remaining portion of the dissertation, I shift the focus to two empirical studies that address Aims 2 and 3. The objective of Aim 2 is to document NHW-Latino differences in midlife/older adults for a number of factors, including sociodemographic factors, the residential environment, as well as physical health outcomes. Furthermore, I recognize that SES and health disparities are substantially covered in the Latino literature; therefore, I aim to highlight differential exposures between NHWs and Latinos regarding perceived neighborhood characteristics. Socioeconomic status is key for obtaining and maintaining resources; thus, SES disadvantages experienced by Latinos point to limited economic resources that may contribute to socioenvironmental stress exposure (Ruiz et al., 2018). In turn, I test for the independent associations between race/ethnicity and perceived neighborhood characteristics to three physical health outcomes: 1) obesity, 2) diabetes, and 3) inflammation.

Next, the objective of Aim 3 is to provide an in-depth analysis to explore the health effects of the perceived neighborhood environment among Latinos. Given the heterogeneity of Latinos' ethnic backgrounds, socioeconomic integration, and geographic dispersion across the U.S., this analysis is a step towards unpacking details that could otherwise be obscured when treating Latinos as a monolithic group. Therefore, I aim to compare ethnic group differences by Mexican-origin and those of non-Mexican origin backgrounds to assess whether social and environmental factors impact these groups similarly or differently. Because Aim 3 is largely exploratory, I conduct a descriptive analysis that will inform the variables selection for a regression analysis, including potential moderations that can also be tested.

Study Rationale

Although limited, previous research examining the effects of the disadvantaged social and economic neighborhood conditions in relation to stress-related dysregulation has advanced our knowledge of the neighborhood-health association. More recently, closer attention has been given to the pathways linking disadvantaged neighborhood context to health declines, particularly stress-related mechanisms as they relate to health risks and disease. For example, using the Midlife in the United States (MIDUS) Study, Carbone (2019) found an inverse relationship between perceptions of negative neighborhood conditions and allostatic load among adults aged 25-74. This association was observed even after controlling for objective neighborhood characteristics, such as census-derived neighborhood socioeconomic status, suggesting that perceptions of the neighborhood are salient for health beyond objective indicators. Using a disparities lens, Thierry (2019) documented black-white differences for negative perceptions of the neighborhood social environment, specifically physical disorder and social "discohesion," or lack of social cohesion. That is, accelerated cell aging as measured by telomere length, was observed in relation to poor perceptions of physical disorder and negative social interactions among older Black adults compared to NHW older adults (Thierry, 2019). These studies add to the body of literature on neighborhood perceptions and physical health among aging populations. Nevertheless, population health studies examining the social and environmental conditions of neighborhood characteristics as they relate to Latino health disparities are merited.

CHAPTER 4

METHODS

Secondary data sources which provide access to nationally representative samples of racial/ethnic minority groups are useful sources for accessing biological data that would otherwise be challenging and costly (Rosinger & Ice, 2019). Given the relevance of biological health data, the present dissertation utilizes the Health and Retirement Study (HRS), an ongoing study of a nationally-representative sample of aging adults and their health transitions. Using the HRS, this chapter describes the methodology employed to conduct the empirical studies of the dissertation. This chapter is structured in two parts. First, I provide additional details about the HRS, including 1) an HRS overview, 2) the HRS study design and sampling procedures, and 3) the data sources utilized from the HRS. Second, I describe dissertation-specific data procedures, including 4) study measures, 5) study sample selection, and 6) an overview of the analytic strategy.

THE HEALTH AND RETIREMENT STUDY (HRS)

An Overview of the HRS

The HRS is a longitudinal panel study that surveys a nationally-representative sample of adults 51 years and older living in the contiguous United States (U.S.). Since 1992, the HRS routinely collects information regarding demographic background, socioeconomic status, geographic information, as well as health risks and conditions from over 20,000 respondents at both the individual- and household- level. In addition, the HRS began collecting blood-based biomarker data in 2006. Biomarkers are a range of physiological, metabolic, endocrine and genetic measures that can serve as both proximate indicators of disease or as early signs of potential disease (Crimmins et al., 2013; Weir, 2008). Further, the incorporation of biological

health in large surveys has allowed social science researchers to incorporate objective health measures to examine the morbidity-mortality process in shaping population health outcomes (Crimmins, Kim, & Vasunilashorn, 2010). Thus, the HRS is a suitable source given the dissertation's "biopsychosocial" approach to incorporating the following content areas: 1) neighborhoods/place; 2) aging Latinos; and 3) biological markers as objective indicators of stress and health.

Strengths: The utilization of the HRS is fitting for examining the association between neighborhood perceptions and objective measures of cardiometabolic health, including inflammation, among aging Latinos living in the U.S. The HRS collects a wide range of psychosocial, contextual, and biological data from midlife and older adults. Moreover, I note that the Hispanic Established Populations for the Epidemiologic Study of the Elderly (H-EPESE), a public source for examining aging Latinos in the U.S., presents an alternative option to using the HRS. However, the H-EPESE does not include biological health data and is comprised of Latinos concentrated in the Southwest. Therefore, in future work, current findings of aging Latinos in the HRS can be compared to those of the H-EPESE.

Limitations: There are potential limitations in using the HRS, particularly for the selection of neighborhood measures and other geographic units of measurement. First, local geographic areas, including census-tract information, are restricted in the HRS and therefore are not included in the de-identified publicly available data. In turn, I am unable to assess objective neighborhood characteristics, such as neighborhood deprivation or racial/ethnic density in a given census-tract (i.e. neighborhood). Second, although geographic areas, such as regions and urban-rural typologies are publicly available, the HRS has masked unique state and county identifiers. Therefore, limiting the inferences that can be made in the dissertation related place

and health. Lastly, I acknowledge a weakness in not using these data for longitudinal purposes. However, I pool data across five collection waves (i.e. 2006, 2008, 2012, and 2014) to produce the maximum available sample size of NHW and Latinos from each wave.

HRS Study Design

HRS sample collection

Since 1992, the HRS has conducted participant core interviews every two years, adding a new cohort of older adults to the survey every six years. Each two years is considered a wave. Additionally, the HRS design oversamples racial/ethnic minority groups, including Latino and Black residents to ensure that the sample is racially/ethnically diverse (Heeringa & Connor, 1995). Further, Florida residents across all racial and ethnic groups are oversampled to allow for nationally-representative state-level analysis of data from the HRS Florida residents (Heeringa & Connor, 1995).

Respondents in the HRS study were selected through a multi-stage area probability sample design that consisted of four stages of selection. First, respondents were selected based on geographic location (i.e. U.S. Metropolitan Statistical Areas (MSAs) and non-MSA counties), which are then narrowed into smaller geographic units (i.e. census blocks or group of blocks). Third, specific households were selected for participation within these smaller segments (i.e. housing units). Lastly, within each housing unit, individual respondents' eligibility was determined based on whether at least one age-eligible respondent, who could be single or married, lived in the household unit. Spouses of respondents, regardless of age-eligibility were also interviewed; however, only respondents aged 51+ are examined in the dissertation to preserve the national representativeness of aging adults. The dissertation will only include respondents aged 51 and above to preserve the national representativeness.

All respondents were required to provide their consent for their participation in the study; and additional written consent was required when the respondent was selected for additional modules (e.g., biomarker data collection). The HRS is approved by the University of Michigan's Institutional Review Board. Further details about the HRS study design and sample collection are available elsewhere (Juster & Suzman, 1995; Weir, 2017).

Sample selection for EFTF interviews

Since 2006, the HRS has conducted enhanced face-to-face (EFTF) interviews. During the EFTF interview, interviewers collected anthropometric physical measures as well as biological blood or saliva measures (herein referred to as the "biomarker data"). Additionally, as part of the EFTF interviews, respondents were instructed to complete a psychosocial questionnaire, called the Leave-Behind (LB) questionnaire, upon completion of the core interview. Respondents were given the option to mail back the LB questionnaire or complete in-person.

Figure 7 provides an example EFTF assignment from the HRS. A rotating, random half sample of respondents from the HRS core was randomly assigned to one of two EFTF samples, EFTF A or EFTF B. In 2006, the first random one-half sample was selected to participate in an EFTF interview (i.e. EFTF A), where the aforementioned physical, biomarker, and psychosocial measures were collected. In 2008, the second one-half sample was assigned to another EFTF interview (i.e. EFTF B) where the same measures were collected. Next, a refresher sample was introduced in 2010 and assigned to either the EFTF A or EFTF B. In 2010, a random half sample of the 2010 refresher was assigned to EFTF A and the 2006 half sample was also re-interviewed in this wave. In 2012, the second random half sample of the 2010 refresher was assigned to EFTF B and the 2008 half sample was re-interviewed in this wave. Lastly, in 2014, a refresher sample was introduced and assigned to EFTF A.

	2006	2008	2010	2012	2014
EFTF Sample	A	B	A	B	A

A=First random half sample
B=Second random half sample

Figure 7. Example of EFTF assignment from the HRS.

Note: Image taken from https://hrs.isr.umich.edu/sites/default/files/Intro-to-HRS_0.pdf

The empirical studies presented in the dissertation utilized HRS data from the 2006 to 2014 waves, reflecting respondents that participated in the EFTF interviews. Data management steps were taken to remove duplicate respondents; thus, ensuring one record for each respondent. These data management steps are described in a subsequent section. Subsequently, the next chapter section is intended to outline the data preparation process used for constructing the sample and variables of interest for analyses. First, I describe the HRS data modules and/or data files used in this dissertation. Second, I provide details of the measures, or variables of interest, as well as how they have been operationalized in both the HRS and in the dissertation. Third, I illustrate the sample selection process for the starting sample and as well as the final analytic sample.

HRS Data Sources

Data were accessed through the HRS website (https://hrs.isr.umich.edu/), which is provided as a public resource for downloading various HRS data releases. For the purpose of the dissertation, the following data releases from the HRS were selected: 1) the leave-behind psychosocial module (located in the HRS core); 2) biomarker data files (sensitive health data); 3) health risk and conditions (located in the RAND file); and 4) cross-wave demographic and

geographic data files (HRSxRegion file). With the exception of sensitive health data (i.e. biomarker data), which required an application process, all other data releases have been de-identified and were available for public use. I provide additional details below for each data release.

1. **Leave-behind psychosocial questionnaire.** The Leave-Behind (LB) questionnaire is comprised of six key domains: subjective well-being, lifestyle and experiences of stress, quality of social ties, personality traits, work-related beliefs, and self-related beliefs. The LB questionnaire covers an assortment of stressors and experiences, including measures of neighborhood perceptions. Therefore, the LB questionnaire was selected specifically to analyze respondent-level information for neighborhood perceptions of physical disorder and social cohesion.

The LB questionnaire is located in the HRS core file, which contains household-level and respondent-level interview information. The LB questionnaire was first piloted in 2004 as the Psychosocial and Lifestyle Questionnaire (and later termed LB questionnaire). Since 2006, the LB questionnaire has been implemented as part of each EFTF interview. This questionnaire evaluates respondents' life circumstances, subjective well-being, and lifestyle (Smith, Ryan, & Sonnega, 2019). Upon completion of each EFTF interview, respondents complete the questionnaire in-person or mail-in their responses at a later time. In Figure 8, you will notice the response rates remained high throughout each wave, but were lower for the 2010 cohort.

Table 2: Psychosocial and Lifestyle SAQ Response Rates by Wave

Wave	All Eligible Respondents	Panel Respondents	2010 New Cohort Respondents
2004	76.8	--	--
2006	87.7	--	--
2008	83.7	--	--
2010	73.1	78.1	59.4
2012	72.7	76.9	63.1
2014	77.8	81.1	69.8

Figure 8. Response rates from the leave-behind psychosocial questionnaire (2004-2014).

2. Biomarker data. The HRS has biomarker data releases for each 2006-2014 wave (i.e. 2006, 2008, 2010, 2012, and 2014). Biomarker data files contain sensitive health information for five blood-based biomarkers: 1) total cholesterol; 2) high-density lipoproteins (HDL) cholesterol—an indicator of poor lipid levels; 3) percent glycosylated hemoglobin (HbA1c)—an indicator of glycemic control related to diabetes; 4) C-reactive protein (CRP)—a non-specific marker of systemic inflammation; and 5) cystatin C—an indicator of kidney function. The HRS utilized the dried-blood spot (DBS) method, which entailed having participants' fingers pricked and spots of blood dripped onto cards. The DBS method has no temperature control requirements for preserving the blood, which makes transportation, storage, and processing of these blood-based samples suitable for population-based studies (Crimmins et al., 2013).

In the dissertation, CRP and HbA1c were examined as the two biomarkers of interest. In 2006 and 2008, the consent rates were 83% and 87%, respectively. Additionally, the overall completion rates for blood-based collection from 2006 to 2014 go as follows: 81% (2006), 87% (2008), 84% (2010), 86% (2012), and 87% (2014) (Crimmins et al., 2013).

3. RAND HRS. The RAND HRS contains user-friendly data derived from 1992-2016. This file contains variables that are asked of respondents at all (or nearly all) waves, and later combined into a single data file with similar naming conventions across waves (RAND, 2016).

Variables such as education, income, and health conditions are provided. Thus, self-reported health risks and characteristics, including body mass index (BMI), diabetes, and health behaviors (i.e. drinking, smoking, physical activity) are included. Income, wealth and education are also included as socioeconomic variables of interest.

4. Cross-wave files. The tracker file has one record for each respondent's basic demographic information (i.e. gender, race/ethnicity) and other information related to the interviews (i.e. country of birth) from all waves since 1992. The tracker file is used to facilitate data within and across waves. Second, census region and rural-urban typologies were taken from the Cross-Wave Geographic Respondents Census Division/Region and Mobility file (herein referred to as HRSxRegion file). Thus, both demographic and geographic information derived from these files.

DISSERTATION STUDY METHODS

Summary of Study Measures

Table 2 provides a summary of all the variables that were included in the dissertation's dataset; however, only select measures were included in the final analyses. Three health outcomes of interest were examined in the dissertation, which included measures of obesity, diabetes, and inflammation. These outcomes broadly capture cardiometabolic risk and conditions. Next, race, Latino ethnicity, nativity, and perceived neighborhood characteristics were examined as the independent variables of interest. Lastly, demographic, socioeconomic, health, and geographic measures are described.

Table 2. Summary of key independent and outcomes of interest, as well as potential covariates examined in the dissertation.

Variable	How measured in HRS	How measured in dissertation	Location in Datasets
OUTCOME VARIABLES			
BMI	Self-report of height at study entry and weight each wave: Variable calculated as weight converted to kilograms divided by square of height in meters (kg/m^2).	1) Continuous BMI for regression analysis; 2) Obese ≥ $30kg/m^2$ 0 = No 1 = Yes	RAND
Diabetes	1) Dried blood spot sample: HbA1C levels; 2) Self-report of doctor diagnosis: Yes/No *Self-diagnosed measure used in preliminary analysis	1) Continuous levels of HbA1c for parallel analysis; 2) High diabetes risk Elevated HbA1c < 6.5% = 0 Elevated HbA1c ≥ 6.5% = 1	RAND and biomarker
C-reactive protein	Dried blood spot sample: C-reactive protein level (mg/L)	1) Log transformed CRP for regression analysis; 2) High risk CRP 0 = Low to mod (0-3 mg/L) 1 = Elevated (>3 mg/L) = 1	Biomarker
INDEPENDENT VARIABLES			
Neighborhood physical disorder	7- point scale: 1. Vandalism/graffiti 2. Safety 3. Cleanliness 4. Vacancies	Average score across the 4 items *deleted if missing >3	HRS Core-LB questionnaire/ module
Neighborhood negative social cohesion	7-point scale: 5. Belonging 6. Trust 7. Friendliness 8. Support	Average score across the 4 items *deleted if missing >3	HRS Core-LB questionnaire/ module

Race	Self-report race: Non-Hispanic white (NHW) Non-Hispanic black (NHB)	0 = NHW 1 = NHB *NHB removed	HRS Tracker; RAND
Ethnicity	Self-report Hispanic ethnicity: Hispanic, Mexican Hispanic, other Hispanic, unknown	1) All Latino subgroups included; 2) subgroup of Mexican-origin 1 = Mexican – origin 0 = non-Mexican origin	HRS Tracker; RAND
SOCIODEMOGRAPHIC VARIABLES			
Age	Self-report age in years	Continuous age in years of those 51 and older	HRS Tracker; RAND
Gender	Self-report: Male Female	0 = Man 1 = Woman	HRS Tracker; RAND
Nativity	Self-report: Born in the U.S. Born in a foreign country	0 = U.S. born Latinos 1 = Foreign-born Latinos	HRS Tracker
Income	Self-report of household income	1) Income quartiles for bivariate analysis 2) Log-income for analysis	RAND
Wealth	Self-report value of all assets and debt (i.e. car, homes, stocks, etc.)	1) Log wealth for analysis; 2) Wealth quartiles used in descriptive analysis	RAND
Education	Self-report of years of education: Number of years of education completed	1) Number of years of education completed (continuous); 2) Educational attainment categories: 2 = Less than H.S. 1 = HS diploma 0 = Some college or more (ref)	RAND; HRS Tracker

HEALTH CHARACTERISTICS			
Smoking	Self-report of past and current smoking status	0 = Never (ref) 1 = Past 2 = Current	RAND
Alcohol use	Self-report of how many drink days per week on average: Less than once per week 1-6 days per week 7 days per week	0 = Never drinker (ref) 1 = Moderate drinker (1-2) 2 = Heavy drinker (2+)	RAND
Physical activity	Self-report moderate physical activity: Never; sometimes moderate activity; often moderate activity	0 = Never 1 = Sometimes 2 = Often (ref)	RAND
GEOGRAPHIC CHARACTERISTICS			
Region	Census region/division of residence: Northeast; South; East; West	0 = Northeast (ref) 1 = Midwest 2 = South 3 = West	RAND; HRSxRegion
Rural-urban continuum	Beale Rural-Urban Continuum 2003: Codes 1-3= metro counties Codes 4-9=non-metro counties	0 = urban (code 1; >100,000,000) 1 = suburban (code 2; >250,000 to 100,000,000 2 = ex-urban (codes 3-9; metro and non-metro counties <250,000) *reference group varied	HRSxRegion

Dependent Variables

Obesity

Height and weight are often utilized in population health studies because of their role in calculating body mass index (BMI), which is a common measure of obesity (Gorber, Tremblay, Moher, & Gorber, 2007). Self-report measures of height and weight are subject to misreporting, particularly underestimations of weight reporting. However, among Latino populations, there is

evidence to suggest that self-reported weight is well-correlated with measured weight, particularly among older age groups (Fernández-Rhodes et al., 2017), suggesting that BMI is an appropriate measure to use in this sample.

Body Mass Index (BMI kg/m^2). In the HRS, weight is asked in lb/kg in every wave and height in m/ft is asked at study entry. These values are carried over to each subsequent wave. The RAND file derives one BMI that is calculated for each respondent as weight divided by the square of height (kg/m^2). In the dissertation, both continuous measures of BMI and BMI threshold categories are examined. Continuous measures of BMI are examined in the main regression analyses. Next, obesity is defined as a BMI index of ≥30 kg/m^2 (CDC & Center for Disease Control, 2020; Fesinmeyer et al., 2013). Thus, a dichotomous variable is created to indicate whether a respondent is not obese (0) or obese (1). The dichotomous measure is reflected in the reporting of descriptive findings.

Diabetes

Glycosylated hemoglobin (HbA1c) concentration is an indicator of average blood glucose over a period of time (i.e. 3 months) and commonly used to monitor levels of control in diabetics (Crimmins et al., 2013; Khaw & Wareham, 2006). Further, high HbA1c levels can be used as a diagnostic tool for diabetes and to assess risk for diabetes-related conditions, such as cardiovascular disease (Khaw & Wareham, 2006). A cut point of 6.5% has optimal specificity for diagnosis of diabetes (Kumar et al., 2010).

Glycosylated hemoglobin (HbA1c %). Percent HbA1c values were derived from the HRS biomarker data. During the EFTF interview, DBS of HbA1c were taken as a summary measure of blood glucose (sugar) levels. These summary measures covered approximately 120 days (Crimmins et al., 2013). The present dissertation includes both continuous values of HbA1c

levels (%) and a dichotomous variable to indicate elevated diabetes risk. The dichotomous variable was created using the following cut points: elevated risk (diabetes) ≥ 6.5% (1) vs low risk (0).

Inflammation

CRP is a biomarker of the immune system, which has been linked to poor health outcomes associated with the metabolic and cardiovascular functioning (García & Ailshire, 2019). CRP is a non-specific measure of systemic inflammation associated with a range of acute and chronic conditions (Ridker, 2003). Elevation in CRP is linked to a healthy immune response; however, chronic elevation is associated with a number of cardiometabolic conditions, including cardiovascular risk, diabetes, and hypertension (Crimmins et al., 2013; Pepys & Hirschfield, 2003).

C-reactive protein (CRP mg/L). Reported measures of high-sensitivity CRP from dried-blood spots (DBS) are included in the HRS biomarker data. In the present work, both raw CRP and log-transformed CRP are included for analysis. Additionally, a dichotomous elevated risk category was created (coded as elevated risk (1) vs low risk (0), using the recommended cut point of > 3mg/L (Ridker, 2003).

Key Independent Variables

Perceived neighborhood characteristics

Self-reported neighborhood perceptions are useful predictors for various outcomes, including physical and mental health outcomes (Roosa, White, Zeiders, & Tein, 2009). Since 2006 and as part of the LB psychosocial questionnaire in the HRS, respondents were asked to complete eight items assessing their neighborhood perceptions related to two neighborhood dimensions— the physical characteristics and the social characteristics (Smith et al., 2019). Of

the eight items, a 4-item subset assessed neighborhood physical disorder while the other 4-item subset assessed neighborhood social cohesion; however, the present dissertation seeks to examine negative perceptions of social cohesion (i.e. negative social cohesion). The individual items and subscales are described below.

Neighborhood physical disorder. The neighborhood physical disorder items in the HRS capture perceptions of physical disorder, such as threatening conditions to the physical state of the built environment (i.e. presence of trash and litter) (Cagney et al., 2009). The 4-item subset of questions ask respondents to rate their perceptions of the local neighborhood physical disorder. The four items are described as:

1. *Vandalism and graffiti are a big problem in this area*
2. *People would be afraid to walk alone in this area after dark*
3. *This area is always full of rubbish and litter*
4. *There are many vacant or deserted houses or storefronts in this area*

Neighborhood (negative) social cohesion. The neighborhood social cohesion items were developed to capture overall cohesiveness and the exchanges/interactions they perceive to exist in their local neighborhood (Cagney et al., 2009). The 4-item subset of questions ask respondents to rate their perceptions of neighborhood social cohesion (i.e. friendliness of people and sense of belonging). Figure 9 provides a sample item from the LB questionnaire. For the purpose of the dissertation, negative social cohesion will be assessed; thus, items used reflected perceptions shown on the right. The four items are described as:

1. *I feel that I don't belong in this area*
2. *Most people in this area can't be trusted*
3. *Most people in this area are unfriendly*

4. *If you were in trouble, there is nobody in this area who would help*

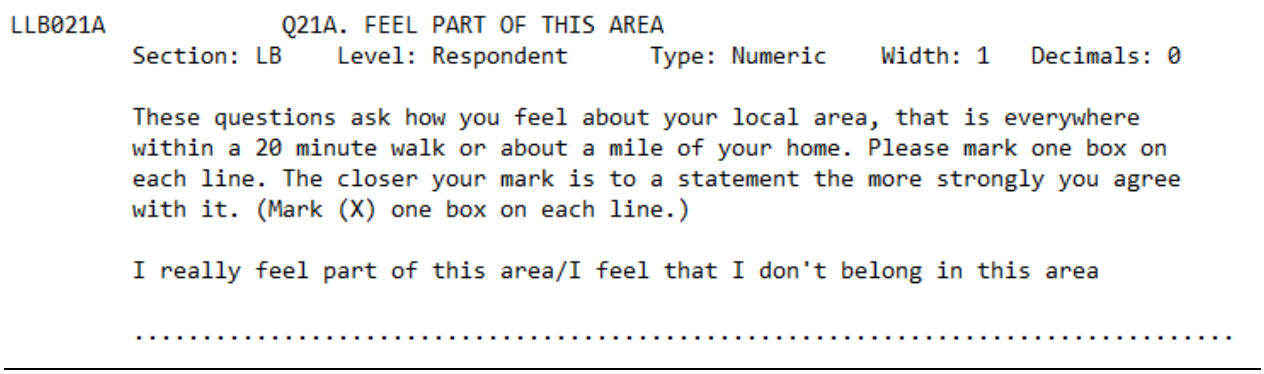

Figure 9. Image of a sample "social cohesion" neighborhood item.
Note: Taken from the LB questionnaire section

Physical disorder and negative social cohesion indices. Responses for each item were scored using a 7-point scale (i.e. 1-7). A rating of one indicates 'strongly disagree,' while a rating of 7 indicates 'strongly agree.' Further, the HRS provides scaling instructions for creating a neighborhood physical disorder index and neighborhood social cohesion index score by averaging the ratings across all four items within each subset (Smith et al., 2019). A higher index score indicates worse perceptions of these neighborhood characteristics. That is, greater ratings of perceived physical disorder and perceived negative social cohesion capture worse neighborhood perceptions. Thus, two dimensions of neighborhood perceptions are included in the dissertation: 1) *physical disorder* and 2) *negative social cohesion*, which refers to a lack of social cohesion. Lastly, the final score for each index was set to missing if there were more than two items with missing values in each index.

Psychometrics of neighborhood scales. Table 3 provides psychometric information regarding the inter-item consistency (reliability) of each scale. With the exception of the Cronbach's alpha value in 2006, the alpha values for these indices are .80 and above, indicating good reliability and validity (Smith et al., 2019). Moreover, these neighborhood measures were

developed and have been validated previously in samples of older adult populations (Cagney et al., 2009). Table 1 provides additional psychometric information pertaining to alpha values for each wave.

Table 3. Psychometrics table: Cronbach's alpha values for neighborhood physical disorder and negative social cohesion indices.

HRS-LB Wave	Alpha value physical disorder	Alpha value for social cohesion (negative)
2006	.64	.82
2008	.83	.86
2010	.82	.86
2012	.83	.86
2014	.84	.86

Note: Values derived from HRS-LB Psychosocial Questionnaire 2006-2014 (Smith et al., 2019).

Race/ethnicity

Race/ethnicity is also included as an independent variable of interest. In the dissertation, I compare a total sample of NHW and Latinos as well as a stratified sample of only Latinos. In this stratified subset, Latinos were grouped as Mexican-origin and non-Mexican-origin respondents.

Hispanic (or Latino). To maintain consistency with HRS terminology, I refer to Latinos as Hispanics in this section. In each wave, respondents were first asked to self-report their Hispanic ethnicity/type (followed by the race question below). The following categories are included in the HRS tracker and coded as the following: 1) Hispanic, Mexican; 2) Hispanic, other; 3) Hispanic, unknown, and 4) non-Hispanic. For the dissertation, all Hispanics subgroups (1-3) are included. The Latino subsample was stratified. "Hispanic, Mexican" respondents were coded as Mexican-origin (1) and the other/unknown Hispanic subgroups were coded as non-Mexican origin (0).

Race. The HRS tracker includes respondents' race. Respondents were asked to report their race as White/Caucasian, Black/African American, or Other. Respondents that reported being non-Hispanic and Black/African were considered non-Hispanic Black (NHB = 0). Respondents that reported non-Hispanic and White/Caucasian were considered non-Hispanic White (NHW = 1). In the dissertation, NHB respondents were removed from the analysis, while NHW were kept and included as the reference group for analysis.

Nativity status

Foreign-born. The HRS tracker contains a variable used to determine whether a respondent was born in the U.S. or in a foreign-country or U.S. territories. In the present study, foreign-born status is used to determine foreign-born status in the HRS. Foreign-born status, interchangeably referred to as nativity, refers to country of birth born (i.e. foreign-born vs native born) (Lopez et al., 2014). Thus, respondents that identified as Hispanic and born in a foreign-country, including U.S. territories, were coded as 'foreign-born Latinos' (1), while those who identified as Hispanic and born in the U.S. were coded as U.S-born or native-born Latinos (0).

Additional Variables of Interest (Covariates)

Next, demographic, socioeconomic, health and place-related variables of interest are briefly described. Previous work suggests age and sex/gender may be used as covariates when assessing biological markers, such as CRP (Khera et al., 2005; Nazmi & Victora, 2007); therefore, both age and sex were included as covariates in regression analyses. Additionally, three measures of socioeconomic status (SES) were included for the descriptive purposes of Aims 2b and 3B. These measures include income, wealth, and education. Poverty and insurance status were also described and included as covariates. Further, the main regression analyses adjusted for SES since it is a key predictor of health. Next, health characteristics such as smoking

status, drinking behavior, physical activity, and depression were also adjusted for in regression analyses. Lastly, two place-based variables were included to examine their relative importance to neighborhood perceptions.

Demographic variables

Gender. Respondents provided their self-reported gender as man (0) or woman (1). Below I provide a justification for the use of gender as a covariate.

Age. Age was assessed as a continuous measure of respondents' age in years. In this dissertation, respondents aged 51 + years were included.

Socioeconomic factors

Income. The HRS-RAND file contains a variable for total household income for each respondent in self-reported dollars (Bugliari et al., 2018). The income variable includes a sum of all income in the respondent's household from the respondent's earned income, their spouse's earned income (if applicable), household capital income (including income from self-employment, stocks, bonds, savings, CDs, rental properties, checking and savings account, etc.), income from the respondent and spouse's pension or annuity, income from social security disability or supplementary security, income from social security retirement, unemployment or worker's compensation, and other sources of income. The raw income value is reported in USD ($) in the descriptive analyses. Ultimately, quartiles of raw income values were created and included in the descriptive analysis as follows: <$20,000; ≥$20,000 to $40,000; ≥$40,000 to $75,000; and ≥$75,000 (reference). Further, log-transformed income values were generated to achieve a normal distribution to be examined in the regression analysis (Bugliari et al., 2018).

Wealth. The HRS-RAND file contains net wealth, which refers to net household assets, and includes the net value of mortgages/land contracts (primary and secondary homes), value of

other home loans; net value of real estate (not primary residence); net value of vehicles; net value of businesses; net value of stocks, mutual funds, among other investments. In the present work, wealth has been constructed following the work of Haas and Rohlfsen (2010) who examined determinants of racial/ethnic disparities using the HRS. First, those with positive values, the natural log is taken. To account for a negative wealth value, the natural log of the absolute value of debt is taken and then multiplied by -1. This allows for all values to be put on the same scale while also retaining the original notion that some household have no wealth or negative wealth (Haas & Rohlfsen, 2010).

Education. Educational attainment was self-reported in the HRS and as years of schooling (0-17 years) and highest degree of completion (Bugliari et al., 2018). Following the HRS, educational attainment has been operationalized as both a continuous measure of education in years and highest degree type. Lastly, three classifications for degree types were created: college or more (coded as 0); high school diploma or GED (coded as 1); and less than a high school degree (coded as 2).

Health characteristics

Health behaviors. Three health behavior variables were included from the HRS-RAND data file. First, respondents provided self-reports of alcohol drinking behavior per day. Never drinkers reported no alcoholic drinks (coded as 0 in the dissertation), moderate drinkers reported one or two drinks per day (coded as 1), and heavy drinking was operationalized as those drinking two or more drinks per day (coded as 2). Next, a measure of smoking behavior was created using respondents' past and present (i.e. at time of survey participation): never smokers (0); past smokers (1) and current smokers (2). Third, self-reports of moderate vigorous activity assessed the frequency of moderate physical activity at baseline. The following categories were created:

never engaged in moderate activity (0); sometimes engaged in moderate activity (1); and frequently engaged in moderate activity (2).

Depression. Lastly, a mental health variable taken from the HRS-RAND data file was also included as a covariate. Respondents self-reported depressive symptomology within the past week using the Center for Epidemiological Studies Depression (CES-D) 8-item short scale (Radloff, 1977).

Geographic characteristics

Region. The HRSxRegion file contains census region information based on where the respondent was contacted in each interviewing year. Census region and county-level information are based on the state where the respondent was interviewed; however, state, zip code and census-tract level geographic information are restricted to protect respondent identification. Using four census-derived geographic regions from the HRS, the following regions are used in the dissertation: 1) Northeast; 2) Midwest; 3) South; and 4) West.

Urban-rural typologies. The HRSxRegion file also contains county-level rural-urban classifications, or typologies, using the Beale Rural-Urban Continuum Codes (Butler & Beale, 1994), which have been updated every 10 years since 1983. These codes form a classification scheme to distinguish metropolitan counties by the population size of their metro area, and non-metropolitan counties by degree of urbanization and adjacency to a metropolitan area. Figure 4 displays metro county and non-metro county codes in 1993, 2003, and 2013.

The 2003 and 2013 Beale Rural-Urban codes were used to reflect the HRS 2006-2014 waves used in the dissertation. The following three urban-rural typologies (herein referred to as urban typologies) are provided by the HRS and included: 1) urban—counties in metro areas of 1 million population or more; 2) suburban—counties in metro areas of 250,000 to 1 million

population; and 3) ex-urban—counties in metro, metro adjacent, or rural areas of fewer 250,000 population).

1993	2003	2013	Description
		Metro counties:	
0, 1	1	1	Counties in metro areas of 1 million population or more
2	2	2	Counties in metro areas of 250,000 to 1 million population
3	3	3	Counties in metro areas of fewer than 250,000 population
		Non-metro counties:	
4	4	4	Urban population of 20,000 or more, adjacent to a metro area
5	5	5	Urban population of 20,000 or more, not adjacent to a metro area
7	6	6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	7	7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	8	8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	9	9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Figure 10. Beale Rural-Urban Continuum Codes from the HRSxRegion data file (1992-2016). *Note*: Image taken from https://ssl.isr.umich.edu/hrs/filedownload2.php?d=1439

Sample Selection

Data were pooled using the HRS 2006-2014 biomarker (i.e. CRP and HbA1c), leave-behind (i.e. neighborhood perceptions), and HRS cross-wave (i.e. RAND, Tracker, and Region) data files. Data were pooled rather than combined in order to acquire the maximum sample size, particularly for Latinos. Pooled data allows for a cross-sectional examination with one data value for each respondent, whereas combined panel data would include multiple data points per respondent (Servais, 2010). The sample selection and subsequent descriptive analysis involved the following data management steps: dataset merging, data cleaning, recoding and construction of variables, and finally a series of statistical analyses.

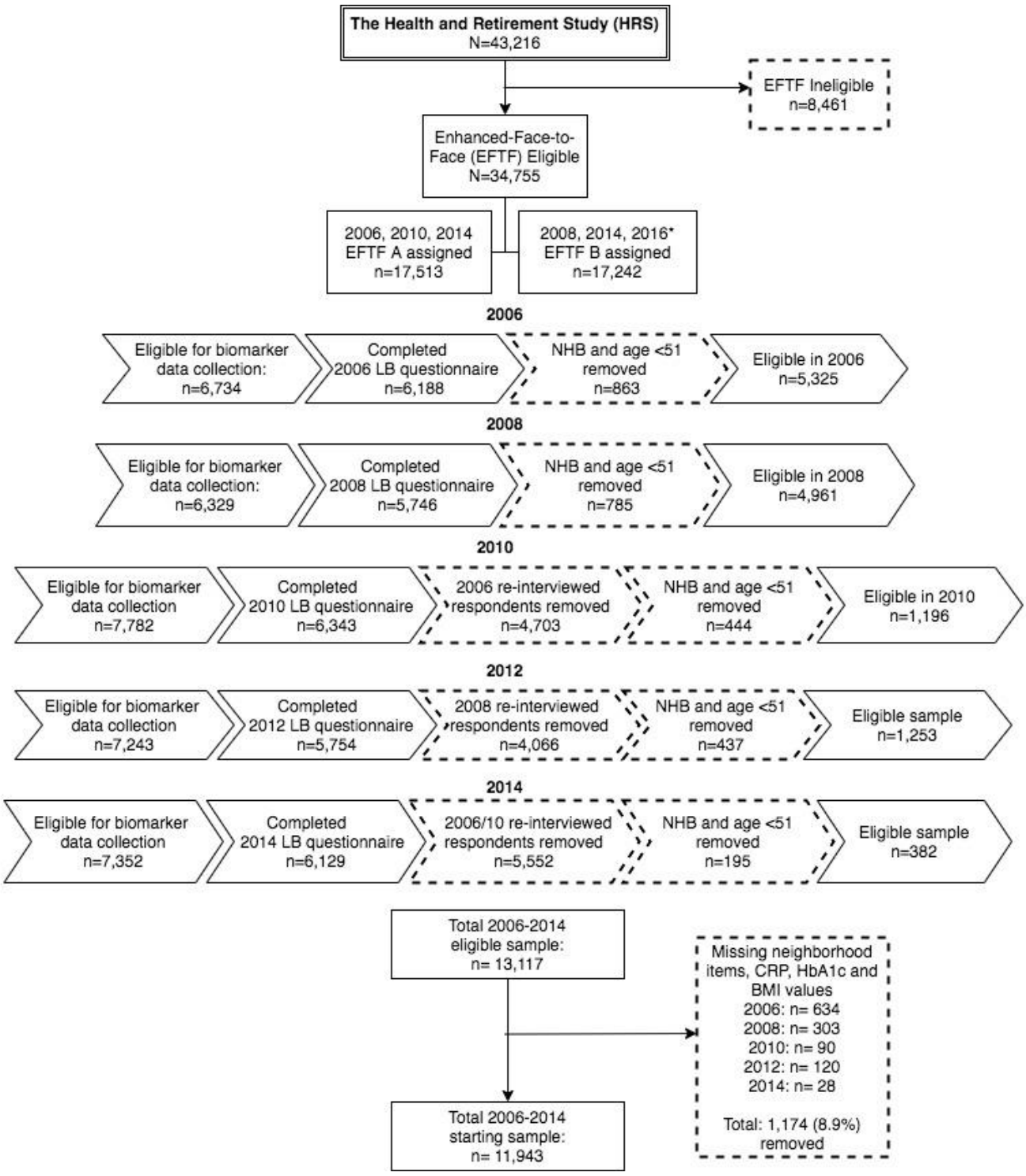

Figure 11. Flow chart depicting study sample selection process. HRS 2006-2014.

Note: Dashed boxes indicate ineligibility

Eligibility criteria

Figure 11 displays the participant flow chart for study eligibility and the analytic sample selection. The following eligibility criteria were applied for study inclusion: 1) eligible for EFTF in any wave between 2006 and 2014; 2) eligible for biomarker collection; 3) completed the LB questionnaire in their designated wave (not in a previous or subsequent wave); 4) restricted to NHW and Hispanic respondents; and 5) must be 51 years or older. Additionally, I note that the respondents eligible for biomarker collection are community-dwelling midlife and older adults; therefore, these samples do not include institutionalized individuals (i.e. nursing home residents). The HRS has biomarker information and leave-behind information for 13,117 NHW and Hispanic midlife and older adults.

Due to the rotating, random half sample design of EFTF interviews, it was possible for respondents to have multiple values for a given variable, or for respondents to have missing biomarker data at one wave yet have complete biomarker data in a subsequent wave. Therefore, to be included in the starting sample, respondents needed a value for both dimensions of neighborhood perceptions (i.e. physical disorder and negative social cohesion), as well as corresponding biomarker values in the same wave. For example, a respondent who entered the HRS study in 2006, completed the 2006 LB questionnaire (i.e. neighborhood perceptions), and had a corresponding CRP and HbA1c values in 2006 were considered eligible. Conversely, if a respondent entered the HRS study in 2006, completed the neighborhood items and did not have a CRP value in 2006 but had a CRP value in 2010, they were removed from the 2006 wave. A total of 12,093 respondents fits these criteria.

An analysis of missing values was conducted to examine whether race/ethnicity, sex/gender, income, or education were significant predictors of missing information. For

neighborhood variables, respondents were likely to be missing information if they were of lower socioeconomic status, such as in the lowest income quartile or had less than a college degree. Race/ethnicity nor gender were significant predictors. Next, Latino ethnicity and women were significant predictors of missing BMI; however, SES variables were not. For HbA1c, there were no significant predictors. Respondents with less than a high school degree were more likely to be missing CRP information.

Analytic sample

A complete case analysis was conducted. Because the dissertation examines these data cross-sectionally rather than longitudinally, a complete case analysis is a reasonable approach (Bennett, 2001). The starting analytic sample was 12,093 midlife and older adults, which included those with missing values for BMI. Thus, an additional 151 (1.2%) respondents were removed from the sample. After accounting for complete cases, the overall missingness across both key independent and outcome variables of interest (i.e. neighborhood, BMI, HbA1c, and CRP, and BMI) resulted in the removal of 1,174 respondents (8.9 %). Further, the aforementioned eligibility criteria resulted in a small amount of missingness (<10%), particularly for CRP (i.e. 4% across all waves), therefore, values were not imputed (García & Ailshire, 2019). Thus, the final analytic sample was comprised of 11,943 NHW and Latino midlife and older adults aged 51 years and older.

Analytic Strategy

HRS sampling weights

Data management and statistical analyses were conducted using Stata SE, version 16.1 (StataCorp., 2019). The HRS provides survey-specific procedures for statistical analysis to account for the complex design of the HRS. For example, the HRS provides two variables—

stratum and cluster variables—that must be used in conjunction with a given sampling weight. Additionally, wave-specific modules require separate respondent-level sample weights for statistical analyses. For example, biomarker sample weights were constructed in the HRS for the biomarker sub-sample in each wave and were post-stratified to closely match the HRS sample by age, gender and race (Crimmins et al., 2013). In turn, all analyses account for the complex design of the HRS and include the stratum, cluster, and biomarker sub-sample weights (i.e. 2006-2014 biomarker weight) using Stata's "*svy*" commands. Statistical analyses were weighted to account for differential probability of being selected into the sample. Thus, all analyses were adjusted for the complex survey design of the HRS. A description of the analytic plan is provided below.

Statistical Analyses

Preliminary analyses

Descriptive analyses were generated in the preliminary stages of the dissertation to evaluate sample characteristics, establish final variable selection, and determine model building for the regression analyses. It should be noted that Tables 1A and 2A in the Appendix display the preliminary sample characteristics for all variables that were utilized in the dissertation dataset; however, not all of the variables shown in these tables were included in the subsequent empirical studies. For example, I did not include self-reported diabetes in order to construct a "high risk" category for all respondents by using the continuous value of HbA1c. Also, during the preliminary phase I considered social cohesion, but focused on negative social cohesion as an indicator of stress-related exposure in the social environment. Next, I conducted a series of correlations and examined issues of multicollinearity determine whether the removal or construction of certain variables was justified. I found that the inclusion of individual items, particularly in the regression models, was not an issue because the variance inflation factor (VIF)

was below the recommended cut off of ten. Upon identifying the final variable selection, descriptive and regression analyses were conducted to address Aims 2 and 3.

Aim 2/Study 2

In Aim 2, I sought to explore between-group differences by race/ethnicity between NHW and Latinos. Using a series of bivariate analyses, including t-tests, chi-square, and adjusted Wald tests, as well as correlation matrices, significant differences for the stratified groups were evaluated at the .05 *p*-level. This included reporting weighted means and standard errors (SE) for continuous variables and frequencies (%) for categorical variables. Moreover, gender differences within NHW and within Latinos were examined using the aforementioned steps. Also, a series of bar graphs were generated to display select descriptive findings of important associations, net of other model variables. Lastly, multiple linear regression analyses were employed to examine the relationships between: 1) neighborhood perceptions a) obesity and b) diabetes; and 2) inflammation in midlife and older adults. Models were examined in subsequent steps. Model 1 included the non-adjusted association between race/ethnicity, neighborhood perceptions and each outcome. Model 2 adjusted for age, sex, and socioeconomic factors. Model 3 included health behaviors (smoking, drinking, and physical activity) and depression. Next, Model 4 was the fully adjusted model, which added geographic characteristics (i.e. region and urban typology).

Aim 3/Study 3

Similarly, Aim 3 aimed to explore group differences, specifically ethnic and nativity differences within the Latino subsample. Aim 3 followed a similar analytic plan as Aim 2, with the caveat that I examined the interaction effects of ethnicity (i.e. Mexican-origin vs. non-Mexican origin) and nativity status (i.e. U.S.-born vs. foreign-born). First, I conducted a series of bivariate nativity comparisons between ethnicity and within ethnicity for various

sociodemographic, perceived neighborhood characteristics, and health factors, as well as geographic characteristics. Thus, the results chapter includes visual descriptions of perceived neighborhood characteristics by ethnicity and by urban typology (i.e. urban, suburban, and ex-urban). Informed by the preliminary and descriptive results, I then assessed four perceived neighborhood characteristics as predictors of cardiometabolic and inflammatory risk. These included ratings to the following perceived neighborhood physical disorder and negative social cohesion items: 1) I do not feel safe walking alone; 2) This area has a lot of vandalism and graffiti; 3) I feel like I do not belong in the area; and 4) I do not trust people in the area. In turn, I employed regression analyses to test the association between ethnicity, nativity, and (four) perceived neighborhood characteristics in relation to 1) BMI, 2) HbA1c, and 3) CRP. Lastly, I examined the interaction effects of ethnicity in the association between perceived neighborhood characteristics and the three health outcomes.

Supplementary analysis. Lastly, because I used HbA1c values without confirming a self-reported diabetes diagnosis, I created a new diabetes-HbA1c variable using the following categories: 1) no diabetes + normal HbA1c; 2) diabetes + normal HbA1c; and 3) diabetes + elevated HbA1c. It should be noted that diagnosis was utilized rather than treatment because the HRS RAND file keeps respondents' information for number of self-reported chronic health conditions, not treatment responses. Thus, I examined this three-level variable as a potential covariate in the association between race/ethnicity, perceived neighborhood characteristics and HbA1c.

Conclusion

In sum, this chapter has described the primary data (HRS) source that were employed to address the empirical studies of this dissertation. Such information included sampling and

collection procedures of the HRS and the measures included from the HRS data files used to construct an analytic dataset. Second, this chapter described the key analytic variables and additional social, demographic, and geographic variables that were utilized in the empirical studies. Additionally, the sample selection process and an overview of the analytic strategy were provided. The subsequent chapters include the results for Aim 2 and Aim 3.

CHAPTER 5

RESULTS

This chapter presents results for Aims 2 and 3, which consist of a series of bivariate descriptive analyses and regression analyses to examine between-group and within-group differences in a sample of NHW and Latino midlife/older adults aged 51 and above in the HRS. A series of t-tests for continuous outcomes and chi-square (Wald's) tests for categorical outcomes were employed to determine statistically significant group differences between race/ethnicity as well as within-group ethnic differences. Next, multiple linear regression models were employed to test associations between perceived neighborhood characteristics and three cardiometabolic risk factors: 1) BMI, 2) HbA1c and 3) CRP. Subsequently, this chapter first presents findings for racial/ethnic differences between NHWs and Latinos followed by a similar description of Mexican-origin versus non-Mexican origin groups within the Latino sample.

AIM 2 RESULTS

Examine racial/ethnic differences between NHW and Latino midlife and older adults

The purpose of Aim 2 was to take a health disparities approach by identifying differential exposures to socioenvironmental conditions, specifically perceived neighborhood characteristics, which may be directly linked to individual-level socioeconomic status. Therefore, I acknowledge socioeconomic and health differences by offering NHW-Latino comparisons and also test whether perceptions of the physical and social neighborhood environment are associated with cardiometabolic and inflammatory risk.

AIM 2a: DESCRIPTIVE FINDINGS

Describe racial/ethnic differences for sociodemographic factors, perceived neighborhood characteristics, and cardiometabolic health risk among NHW and Latino midlife and older adults

Sample Characteristics

Table 4 presents descriptive characteristics for the total sample (n=11,943) and stratified by race/ethnicity (i.e. NHW and Latino) and by gender (i.e. men and women). Racial/ethnic differences are shown in the last column and reported as a *p*-value to indicate significant mean differences for continuous outcomes or frequencies (proportions). Gender differences are denoted with an asterisk (*) to reflect significance within each race/ethnic group at significance levels of $p<.05$. Overall, the total sample was comprised largely of NHW respondents and 9% of the sample was Latino. Women made up 53.7% of the total sample; and, on average, midlife/older Latino adults were younger (M=61.4, SE=0.63) compared to midlife/older NHW adults (M=63.1, SE=0.27). Additionally, significant differences between NHWs and Latinos were observed across a number of factors, including socioeconomic status, cardiometabolic health risk, as well as neighborhood perceptions. Lastly, although gender differences were observed within NHWs, less gender differences were observed within Latinos; therefore, gender was not assessed beyond its descriptive purposes since gender was explored as a potential moderator for the Latino population. Sample characteristics are detailed below; in addition, a visual description of geographic characteristics is provided for considering the potential influence of the geographic context on perceived neighborhood characteristics.

Table 4. Weighted means (SE) and proportions (%) of sample characteristics by race/ethnicity by gender. HRS 2006-2014 (n=11,943).

	Total (n=11,943)	**Non-Hispanic Whites (n=10,447)**			**Latinos (n=1,496)**			
		Total	Men	Women	Total	Men	Women	*p-value*
Cardiometabolic risk	Mean (SE) or %	Mean (SE) or %			Mean (SE) or %			
Biological indicators (M)								
BMI kg/m^2	28.4 (0.08)	28.3 (0.08)	28.5 (0.08)	28.1 (0.12)*	29.6 (0.27)	29.3 (0.24)	29.8 (0.44)	<.001
HbA1c %	5.8 (0.01)	5.7 (0.01)	5.8 (0.02)	5.7 (0.01)*	6.2 (0.05)	6.2 (0.07)	6.2 (0.06)	<.001
CRP mg/L	3.8 (0.07)	3.8 (0.07)	3.4 (0.10)	4.3 (0.11)*	4.2 (0.19)	3.7 (0.32)	4.6 (0.28)*	n.s.
High risk cut-off points (%)								
Obese (≥30 kg/m^2)	33.1	32.1	32.0	32.1	43.2	42.7	43.5	<.001
Elevated HbA1c (≥ 6.5%)	11.0	10.0	11.5	8.7*	21.8	22.3	21.4	<.001
Elevated CRP (>3.0 mg/L)	34.3	33.8	28.6	38.6*	39.0	33.8	43.3*	<.01
Sociodemographic variables								
Age (in years)	63.9 (0.25)	64.1 (0.27)	63.4 (0.27)	64.8 (0.31)*	61.4 (0.63)	61.1 (0.62)	61.6 (0.695)	<.001
Female (%)	52.7	52.5	--	--	54.7	--	--	--
Married (%)	67.1	67.3	--	--	64.2	--	--	n.s.
Income quartiles (%)								
<$20,000	18.1	15.7	11.1	19.8*	43.2	35.8	49.4*	<.001
>$20,000 - <$40,000	21.5	21.4	19.1	23.5*	22.2	26.7	18.4*	n.s.
>$40,000 - <$75,000	25.8	26.2	27.4	25.1*	21.1	22.9	19.7	<.001
>$75,000 (reference)	34.6	36.6	42.3	31.5*	13.5	14.5	12.6	<.001
Income (logged)	10.7 (0.29)	10.8 (0.02)	10.9 (0.02)	10.7 (0.02)*	9.8 (0.09)	10.0 (0.09)	9.6 (0.13)*	<.001
Wealth quartiles (%)								
<$50,000	23.6	21.1	19.5	22.8*	51.2	22.1	28.9	<.001
>$50,000 - <$180,000	23.8	26.5	24.8	25.1	25.5	25.1	24.2	n.s.
>$180,000 - <$450,000	25.6	28.2	26.9	26.7	13.7	15.1	12.6	<.001
>$450,000 (reference)	25.5	24.3	28.9	25.4*	9.5	9.0	9.9	<.001
Wealth (logged)	4.6 (0.04)	4.7 (0.04)	4.8 (0.04)	4.7 (0.05)	3.2 (0.13)	3.4 (0.15)	3.0 (0.18)*	<.001
Below poverty threshold (%)	5.8	4.2	3.5	4.7	23.3	21.1	25.0	<.001
Education (in years)	13.2 (0.08)	13.5 (0.05)	13.7 (0.06)	13.3 (0.05)*	9.9 (0.26)	10.0(0.35)	9.8 (0.26)	<.001
Educational attainment (%)								

Less than HS	13.2	10.1	9.7	10.3*	46.6	44.3	48.5	<.001
HS diploma/GED	33.8	34.5	31.4	37.2	26.5	27.5	25.6	<.001
College + (reference)	53.0	55.4	58.8	52.3*	26.9	28.1	25.9	<.001
Uninsured (%)	7.4	6.1	6.9	5.3*	21.2	21.2	21.2	<.001
Neighborhood perceptions								
Physical disorder index (1-7)	1.4 (0.02)	1.3 (0.02)	1.3 (0.03)	1.3 (0.22)	2.0 (0.06)	1.9 (0.06)	2.1 (0.08)	<.001
Vandalism and graffiti	2.3 (0.03)	2.3 (0.02)	2.3 (0.03)	2.3 (0.03)	3.1 (0.07)	3.1 (0.09)	3.1 (0.09)	<.001
Afraid to walk alone	2.6 (0.03)	2.5 (0.02)	2.4 (0.04)	2.7 (0.02)*	3.4 (0.08)	3.3 (0.09)	3.5 (0.11)	<.001
Areas kept unclean	2.3 (0.02)	2.2 (0.02)	2.3 (0.03)	2.2 (0.03)*	2.8 (0.09)	2.8 (0.09)	2.9 (0.12)	<.001
Vacant and deserted areas	2.3 (0.03)	2.3 (0.03)	2.4 (0.04)	2.3 (0.03)*	2.7 (0.06)	2.6 (0.08)	2.8 (0.08)	<.001
Negative social cohesion index (1-7)	2.5 (0.02)	2.4 (0.02)	2.5 (0.02)	2.4 (0.03)*	3.0 (0.07)	2.9 (0.05)	3.1 (0.10)	<.001
Don't feel part of the area	2.6 (0.02)	2.5 (0.02)	2.6 (0.03)	2.5 (0.03)*	2.8 (0.06)	2.7 (0.07)	2.91 (0.10)	<.001
People cannot be trusted	2.4 (0.03)	2.4 (0.02)	2.4 (0.03)	2.3 (0.03)*	3.1 (0.10)	3.0 (0.10)	3.2 (0.12)	<.001
People are not friendly	2.2 (0.02)	2.2 (0.02)	2.2 (0.02)	2.1 (0.03)	2.8 (0.08)	2.7 (0.06)	3.0 (0.11)*	<.001
People do not help when in trouble	2.7 (0.03)	2.7 (0.02)	2.8 (0.02)	2.6 (0.03)*	3.2 (0.08)	3.3 (0.09)	3.2 (0.11)	<.001
Health characteristics								
Heavy drinker (%)	10.7	10.5	17.0	4.7*	12.4	20.8	5.5*	n.s.
Current smoker (%)	14.8	14.6	15.8	13.7*	16.7	21.4	12.8*	n.s.
No moderate activity (%)	15.7	15.6	13.2	17.7*	17.6	14.0	20.6*	<.05
Depression (CESD, 1-8)	1.4 (0.03)	1.3 (0.03)	1.2 (0.03)	1.4 (0.03)*	2.2 (0.10)	1.9 (0.11)	2.3 (0.14)*	<.001
Geographic characteristics								
Region (%)								
Northeast (reference)	16.3	16.9	16.1	17.5*	10.3	8.2	12.0	<.001
Midwest	27.2	29.4	30.4	28.4*	4.1	3.5	4.6	<.001
South	34.3	33.3	33.1	33.5	44.7	48.0	42.0*	n.s.
West	22.2	20.4	20.3	20.5	40.9	40.3	41.4	<.001
Urban Typology (%)								
Urban (>1,000,000) (reference)	46.2	45.6	46.4	45.0	53.1	51.0	54.8	n.s.
Suburban (250,000 to 1,000,000)	20.2	18.9	18.7	19.1	33.1	34.8	31.6	n.s.
Ex-urban (<250,000)	33.5	35.4	34.8	35.8	13.9	14.2	13.6	<.001

Notes: These data are adjusted for HRS complex survey design. Significance at $p \leq .05$ level. NHW = Non-Hispanic white
p-value represents statistical differences between NHW and Latino racial/ethnic subgroups.
n.s. indicates non-significance between NHW and Latino racial/ethnic subgroups.
***** significant difference by gender within each racial/ethnic subgroup. Men are the reference group.

Cardiometabolic risk

Obesity, diabetes, and inflammation. Weighted means are reported in continuous values for BMI, HbA1c and CRP as well as each high-risk category (BMI defined as ≥ 30 kg/m^2; HbA1c defined as ≥6.5%; and CRP defined as >3.0 mg/L). Continuous values of BMI and HbA1c were higher for Latinos compared to NHW, but mean differences for CRP were not statistically significant. Significant gender differences were observed within NHWs and Latinos for CRP, with women having higher values compared to men. Next, compared to NHW, Latinos were more likely to be represented in each high-risk category. In the total sample, 33.1% of respondents were obese—with a larger proportion of obese Latinos (43.2%) than obese NHWs (32.1%). For HbA1c, Latinos were two times (21.8%) more likely to be high-risk compared to NHWs (10.0%), even though only 11.0% of the total sample had HbA1c values of 6.5% or greater. For CRP, 33.8% of NHW respondents and 39.0% of Latinos were in the high-risk category. Whereas differences for continuous CRP values did not statistically differ by race/ethnicity, differences for high-risk CRP were observed but the strength of the association was weaker as compared to between-group differences for BMI.

Socioeconomic status (SES)

Income and wealth patterns. As expected, Latinos had significantly lower SES across all measures, including less income, less wealth, and lower educational attainment. For descriptive purposes, income and wealth quartiles are reported in U.S. dollars ($USD). Despite significant within-group differences by gender for NHWs, both NHW men and women had greater income (logged) and wealth (logged) compared to Latino men and women. This pattern was also observed for income and wealth quartiles. Latinos were more likely to be in the lowest income (43.2%) and wealth (51.2%) quartiles than in the highest quartiles. Further, NHWs,

particularly NHW men, were two times more likely to be represented in the larger income (36.6%) than Latino men and women (14.5% and 12.6%, respectively). Together, these findings suggest that Latinos are socioeconomically disadvantaged compared to NHW; however, Latina women face greater socioeconomic disparities. This is further shown by the disproportionate frequency of Latina women living below the poverty threshold (25.0% versus 5.8% for the total sample).

Education disparities. For years of education, Latinos had approximately 9.9 (0.26) years of education, while the average years of education for NHW was 13.5 (0.05) years. Furthermore, Latinos were four times more likely to have less than a high school (HS) diploma compared to NHW. For example, while only 10% of NHW had less than a HS diploma, 46.6% of Latinos had less than an HS diploma. Conversely, a greater proportion of NHWs, especially NHW men (58.8%) had attended some college or more as opposed Latinos (26.9%). Lastly, given the age of the sample, it is alarming that a significant proportion of Latinos did not have health insurance (21.2% versus 6.1%) compared to NHW. However, later we will see that insurance status does not have a significant effect in the tested associations. In turn, we can conclude that Latinos in the present sample had less education as measured by both years in education and degree attainment as well as were more likely to live in poverty and be uninsured compared to NHW.

Health characteristics

Health behaviors and depression. In general, NHW and Latinos had similar health behavior profiles, but racial/ethnic differences for physical activity and depression were observed, pointing to higher depression levels and lower physical activity among Latinos. For unhealthy behaviors, almost 18% of Latinos and 15.6% of NHW did not engage in any moderate

physical activity. Latinos also reported more depressive symptoms compared to NHW. Particularly, Latina women reported more depressive symptoms than Latino men and compared to NHW women. Next, gender differences within each racial (NHW) and ethnic group (Latinos) were significant across all health behaviors and depression. For instance, the proportion of Latino men who were heavy drinkers and current smokers was greater compared to Latina women but a greater proportion of Latina women engaged in no moderate physical activity compared to Latino men. Similar gender differences within NHWs were observed.

Geographic context

Geographic characteristics such as region and urban typologies were examined to provide insight regarding the geographic context in which respondents in this sample live. Overall, many respondents lived in regions of the South or Midwest (61.5%) region, with Latinos largely concentrated in the South or West (85.5%) compared to other regions. This is expected since Latinos are generally geographically dispersed throughout states such as California, Texas, Arizona, and New Mexico as well as Florida. However, given the data restrictions for state-level information, this information cannot be confirmed in the present study. Also expected, is the proportion of Latinos living in urban areas, but there is also a significant proportion of Latinos living in suburban areas, which warrants investigation. Subsequently, I aimed to examine whether neighborhood perceptions vary across urban, suburban, ex-urban settings between this sample of midlife/older NHW and Latino adults.

Region x urban typology. Figure 12 exhibits the proportion of respondents in urban, suburban, ex-urban settings within each region for the total sample. A larger proportion of those living in the Northeast and West live in urban counties compared to suburban or ex-urban counties. Conversely, those living in the Midwest and South are more likely to live in ex-urban

counties. I note that this categorization of ex-urban vastly includes counties that are in metropolitan areas of fewer than 250,000 residents, metropolitan adjacent areas (i.e. 20,000 or more), as well as non-metropolitan (i.e. rural) counties, and therefore cannot be stratified beyond this level of information. Therefore, the next section goes on to describe neighborhood perception findings, including a descriptive analysis of racial/ethnic differences between NHW and Latinos by urban typology.

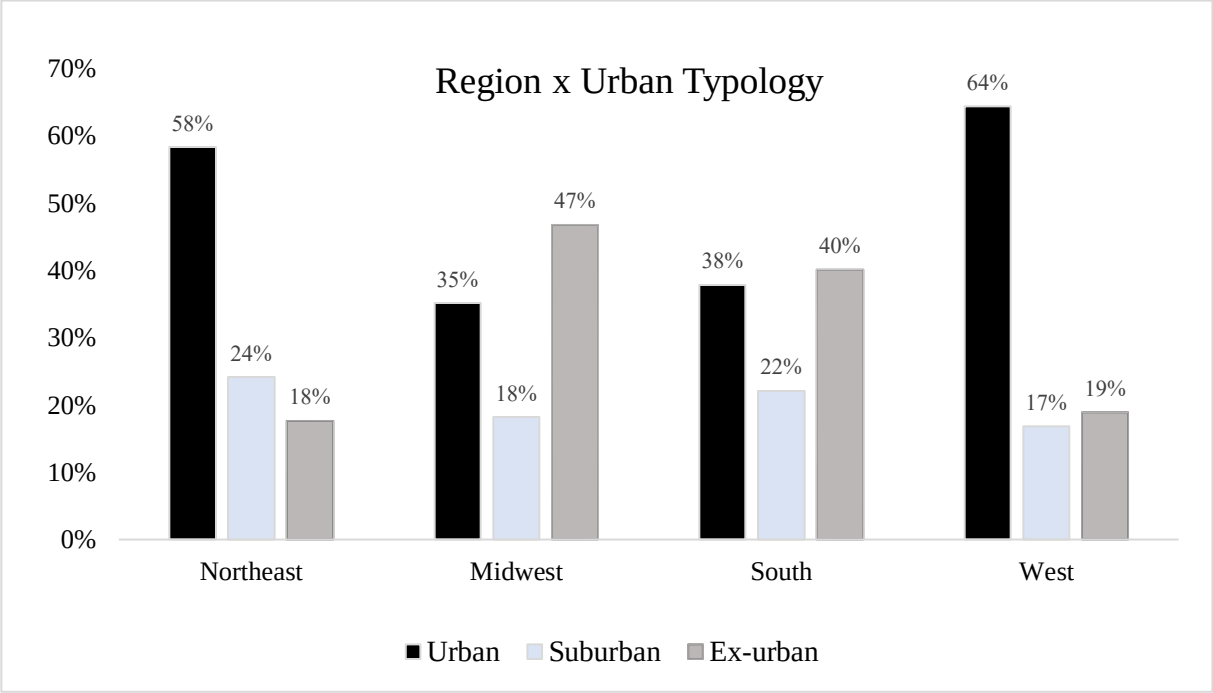

Figure 12. Geographic distribution of the HRS total sample (2006-2014). Region by urban typology.

Perceived neighborhood characteristics

Negative perceived neighborhood characteristics for both neighborhood physical disorder and negative social cohesion were greater for midlife/older adult Latinos compared to midlife/older NHW adults, as denoted in Table 1. On average, Latinos reported greater physical disorder and negative social cohesion compared to NHWs, suggesting that Latinos had worse perceptions of their social environment relative to NHWs. A closer examination of individual

neighborhood characteristics indicate that Latinos had worse perceptions of safety (i.e. afraid to walk alone), mistrust (i.e. people cannot be trusted), and lack of helpfulness (i.e. people do not help when in trouble) compared to NHW. Lastly, perceived physical disorder and negative social cohesion differences by race/ethnicity by typology were examined and are displayed below.

Visual Depictions of Perceived Neighborhood Characteristics by Race/Ethnicity by Geographic Context

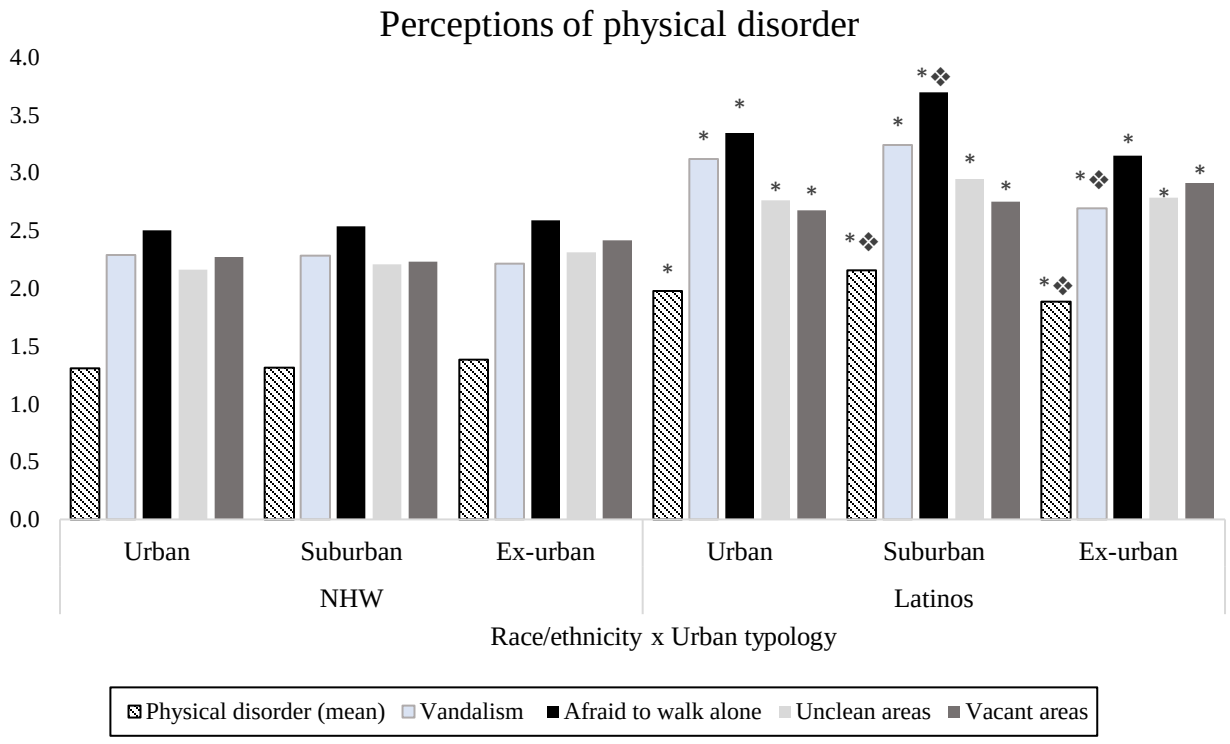

Figure 13. Perceived neighborhood physical disorder (range 1-7) stratified by race/ethnicity by urban typology.
Note: * indicates Latinos' perceptions statistically differ from NHW and ❖ indicates perceptions statistically differ within Latino population.

Perceived physical disorder x race/ethnicity x urban typology

Figure 13 exhibits NHW-Latino mean differences for the overall neighborhood disorder index and for each item within the physical disorder index by urban typology (urban, suburban, and ex-urban). On average, Latinos' perceptions of physical disorder were worse compared to NHWs in urban, suburban, and ex-urban areas. For example, Latinos reported greater overall physical disorder index and for all items, particularly negative feelings of perceived safety (i.e. afraid to walk alone) across each typology. Interestingly, a within-group examination among Latinos revealed that Latinos living in suburban areas reported worse perceptions of overall physical disorder, unsafety, and vandalism compared to those living in urban areas. Lastly, although Latinos in ex-urban areas, on average, perceived overall physical disorder to be lower, they were more likely to perceive more vandalism and graffiti.

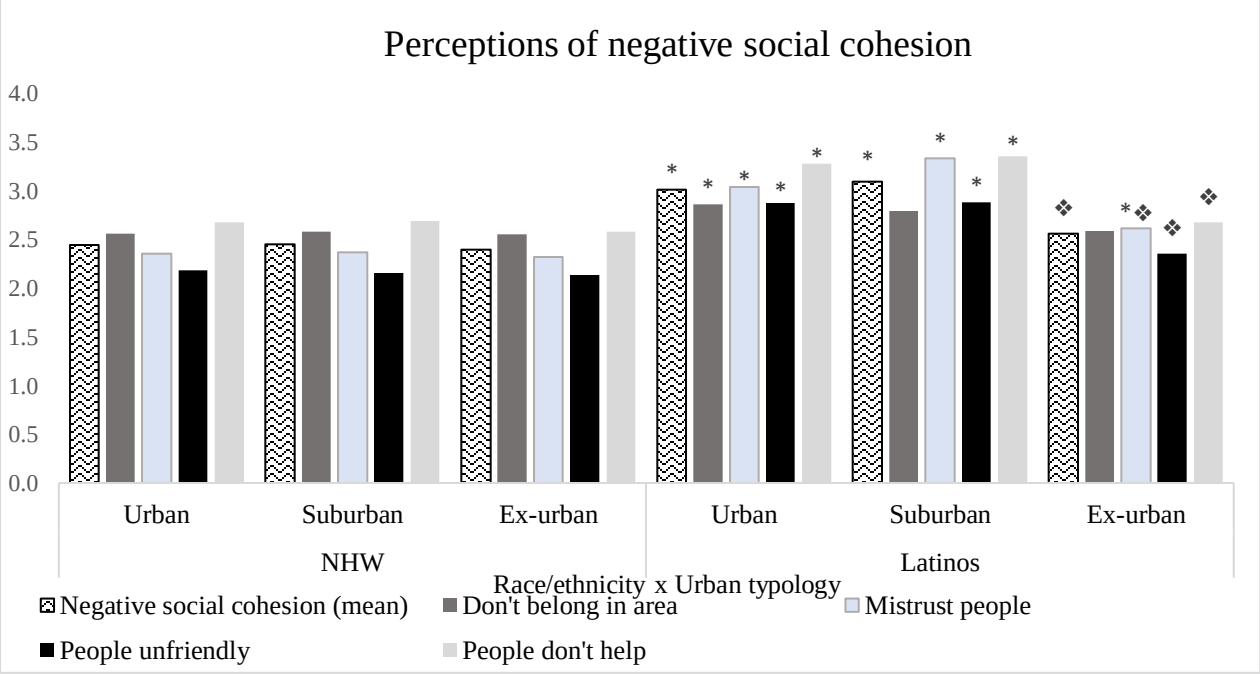

Figure 14. Perceived negative social cohesion (range 1-7) stratified by race/ethnicity and urban typology.

Note: * indicates Latinos' perceptions statistically differ from NHW and ❖ indicates perceptions statistically differ within the Latino population.

Perceived negative social cohesion x race/ethnicity x urban typology

Similarly, Figure 14 shows that negative perceptions of social cohesion among Latinos was higher compared to NHW; however, these differences were only observed in urban and suburban areas as opposed to ex-urban areas. Further, in urban areas, Latinos reported negative feelings towards belonging in the area, greater mistrust in people, unfriendliness, and lack of help from people when in trouble. Latinos living in suburban areas reported similar perceptions for these characteristics, except there was a significant difference between Latinos and NHW regarding belonging. That is, Latinos reported stronger feelings of not belonging in the area. Next, with the exception of Latinos reporting greater mistrust in people, perceived negative social cohesion was similar for Latinos living in ex-urban areas and NHWs living in ex-urban areas. Ex-urban areas did however differ within Latinos. For example, Latinos living in ex-urban areas reported lower negative social cohesion compared to Latinos in urban areas. Put differently, Latinos living in urban areas negatively perceived social neighborhood characteristics, particularly those that pertained to interactions with people.

AIM 2b: REGRESSION FINDINGS

Test the association between race/ethnicity, perceived neighborhood characteristics (i.e. physical disorder and negative social cohesion) and 1) BMI, 2) HbA1c, and 3) CRP

Description of regression models

Table 5 displays summary results for each association between race/ethnicity, perceived neighborhood characteristics, and the three outcomes of interest. Therefore, you will see that the three columns each represent the final regression model (i.e. Model 4) and the associated outcome of interest (i.e. BMI, HbA1c or CRP). Separate models were created for each

association and the tables can be found in the Appendix (Tables A3, A4 and A5). In each regression analysis, socioeconomic status (SES) variables (income, wealth, education, and health insurance) were added to Model 2, health characteristics (heavy drinking, current smoking, no moderate physical activity, and depression) were added to Model 3, and geographic characteristics (region and urban typologies) were included in Model 4. Thus, the final models controlled for age, gender, SES variables, health characteristics, and geographic characteristics. Lastly, I note that CRP was log-transformed to account for non-normality of the values. The main findings are described and organized by outcome in the subsequent text.

Table 5. Adjusted regression models testing the association between race/ethnicity, perceived neighborhood characteristics and 1) BMI, 2) HbA1c, and 3) CRP (n=11,943).

	BMI		**HbA1c**		**CRP**	
	b	(95% CI)	*b*	(95% CI)	*b*	(95% CI)
Key variables						
Latino ethnicity	**0.53***	(-0.03, 0.92)	**0.31****	(0.2, 0.41)	-0.002	(-0.13, 0.13)
Physical disorder	0.02	(-0.14, 0.19)	-0.004	(-0.02, 0.01)	0.01	(-0.01, 0.04)
Negative social cohesion	**0.15***	(0.02, 0.29)	**0.03****	(0.01, 0.05)	0.01	(-0.01, 0.03)
Socioeconomic variables						
Income (logged)	-0.01	(-0.12, 0.1)	-0.01	(-0.03, 0.01)	-0.03**	(-0.05, -0.01)
Wealth (logged)	-0.16***	(-0.23, -0.08)	-0.02*	(-0.04, -0.01)	-0.02*	(-0.03, 0)
Education						
Less than HS	0.62**	(0.26, 0.97)	0.10**	(0.06, 0.15)	0.10***	(0.04, 0.16)
HS diploma/GED	0.26	(-0.18, 0.7)	0.15**	(0.08, 0.23)	0.11**	(0.04, 0.18)
College + (reference)						
Insured	0.42	(-0.22, 1.05)	-0.02	(-0.13, 0.1)	-0.08	(-0.17, 0.02)
Health covariates						
Heavy drinker	0.55*	(0.05, 1.05)	-0.10*	(-0.17, -0.02)	0.09*	(0, 0.18)
Current smoker	-2.23***	(-2.66, -1.94)	-0.07*	(-0.15, 0)	0.28***	(0.22, 0.34)
No moderate activity	2.31***	(1.82, 2.81)	0.18**	(0.10, 0.25)	0.37***	(0.3, 0.44)
Depression (CESD, 1-8)	0.20***	(0.11, 0.29)	0.01	(0, 0.03)	0.03***	(0.01, 0.04)
Geographic covariates						
Region						
Northeast (reference)						
Midwest	0.69*	(0.15, 1.22)	-0.01	(-0.06, 0.08)	0.05	(-0.03, 0.14)
South	0.02	(-0.51, 0.54)	-0.01	(-0.08, 0.07)	0.06	(-0.02, 0.14)
West	-0.36	(-0.99, 0.26)	0.04	(-0.04, 0.11)	-0.05	(-0.20, 0.07)
Rural-urban continuum						
Urban (>1,000,000) (reference)						
Suburban	0.42*	(0.05, 0.79)	0.03	(-0.03, 0.10)	0.01	(-0.07, 0.10)
Ex-urban	0.39	(-0.04, 0.66)	0.01	(0.03, 0.06)	0.08**	(0.02, 0.14)
R-squared	0.12		0.07		0.07	

Note: The models shown are fully adjusted models and were adjusted for age and sex (coefficients not shown). CRP has been log-transformed to account for skewness. *p<.05; **p<.01; ***p<.001

Obesity

Race/ethnicity, neighborhood characteristics, and BMI. In the unadjusted model (Model 1), there was a positive association between being Latino and greater negative social cohesion. Latinos' BMI score was on average 1.10 k/m^2 higher than NHWs (95 % CI [0.56,

1.64]; $p<.01$). Upon adjusting for socioeconomic status (SES) and health covariates in Models 2 and 3, Latino ethnicity was no longer statistically significant but remained in the positive direction. Unexpectedly, when region and urban typology were introduced in Model 4, Latino ethnicity became significant again, suggesting that geographic characteristics may have a moderating effect in the independent association for Latinos. Furthermore, perceptions of physical disorder were not associated with BMI, yet greater negative social cohesion was positively associated with BMI across all four models. That is, negative perceived social cohesion was associated with a .35 k/m^2 increase in BMI (95 % CI [0.56, 1.64]; $p<.01$) in Model 1. Further, even though the strength of the association was reduced after adjusting for SES, health, and place-based characteristics, the positive direction of the association between greater negative social cohesion (i.e. worse perceptions) remained significant in Models 2-4. These findings suggest SES and health-related characteristics account for Latino's higher BMI scores but do not account for the association between negative social cohesion and higher BMI scores. Additional factors, particularly region and suburban typology, warrant investigation. For example, living in the Midwest ($b=0.69$, 95 % CI [0.15, 1.22]; $p<.05$) and living in a suburban county ($b=0.42$, 95 % CI [0.05, 0.66]; $p<.05$) both pointed to higher BMI compared to their respective reference categories.

Diabetes

Race/ethnicity, neighborhood characteristics, and HbA1c. Latinos had higher HbA1c levels than NHW in Models 1-4, even after controlling for SES, health characteristics, and geographic characteristics in the final model. Similarly, greater negative social cohesion was associated with higher HbA1c levels and the strength and direction of the association remained relatively unchanged after adjusting for SES, health risks, and geographic characteristics (Model

4: *b*=.03, 95 % CI [0.01, 0.05]; *p*<.01). Although greater perceived physical disorder pointed to higher HbA1c levels in Model 1 (*b*=.02, 95 % CI [0, 0.04]; *p*<.05), this relationship was attenuated once SES was accounted for. Individual-level SES may serve as an indicator of neighborhood SES; however, previous findings suggest that objective measures of neighborhood SES do not fully account for the association between perceived neighborhood characteristics and adverse physical health. Furthermore, unlike with BMI, SES nor risky health characteristics accounted for the NHW-Latino difference in HbA1c levels. These findings suggest that Latinos' elevated risk for adverse diabetes-related outcomes cannot be explained fully by the variables in the present model.

Inflammation

Race/ethnicity, neighborhood characteristics, and CRP. CRP did not significantly differ between NHW and Latinos. Further, the direction of the association changed from a positive association in Model 1 to negative in Models 2-4, indicating that Latinos' CRP values would be lower than NHW after accounting for SES, health, and geographic differences. A strong association between poor neighborhood physical disorder and higher CRP was observed in Model 1 (*b*=.05, 95 % CI [0.02, 0.07]; *p*<.001). However, the positive association between physical disorder and increased CRP was stronger than it was for the aforementioned association between greater perceived physical disorder and HbA1c. Consequently, negative perceptions of the neighborhood physical disorder point poor perceptions of the physical environments (i.e. vandalism), which leads to unfavorable health outcomes, including increased HbA1c and CRP. However, SES largely accounts for these independent associations. Finally, greater negative social cohesion slightly differed from the observed associations with BMI and HbA1c. Greater negative social cohesion was positively associated with higher CRP in Model 1 (*b*=.02, 95 % CI

[0, 0.04]; $p<.05$), but was weaker than it was for the other outcomes. Also, after accounting for risky health characteristics, the association was completely attenuated. Subsequently, heavy drinkers, current smokers, no moderate activity, and those with higher depression scores had higher CRP values.

Summary

In sum, there were marked differences between NHW and Latinos, especially as they relate to socioeconomic and perceived neighborhood characteristics. Latinos reported greater neighborhood physical disorder and reported greater negative social cohesion. Further, neighborhood physical disorder was positively associated with BMI and diabetes, even in the fully adjusted models. Also, physical disorder was independently associated with higher CRP levels in unadjusted models—yet, the strength of these association was weak and SES accounted for this association. Interestingly, SES explained the association between higher perceptions of physical disorder and higher CRP, yet SES did not explain the association between negative social cohesion and CRP. Rather, risky behaviors and depression explained away the adverse effects of greater negative social cohesion and higher CRP.

Supplementary Findings

Lastly, a separate regression analysis was conducted to examine the potential effect of diagnosis when coupled with HbA1c. Supplementary Table A4 in the Appendix, shows the regression results for Models 1-4. In Model 3, the new diabetes-HbA1c variable is included as a health characteristic covariate. Upon entering this into the model, negative neighborhood social cohesion is no longer significant. In turn, diabetic patients may be especially susceptible to aspects of the social neighborhood environment. Otherwise, results for Latino ethnicity and neighborhood physical disorder were similar to those in the original model.

AIM 3 RESULTS

Examine within-group ethnic differences among midlife and older adult Latinos

The purpose of Aim 3 was to provide an in-depth description of the Latino population in this sample of midlife/older adults using a nationally-representative sample from the HRS. Respondents in this Latino sample were analyzed by ethnicity and further stratified by nativity status (i.e. U.S. born or foreign-born). The descriptive portion of this section was intended to be largely exploratory; therefore, it describes ethnic differences between ethnicity, defined as Mexican-origin or non-Mexican origin, as well as nativity differences within each respective ethnic group. An example of nativity differences within each ethnic group would be U.S.-foreign born Mexican-origin Latinos compared to foreign-born Mexican-origin Latinos. Additionally, because we know that Latino groups have distinctive experiences within the U.S., I provide brief descriptions of findings for U.S.-born Mexican-origin Latinos compared to U.S.-born non-Mexican Latinos and similarly for foreign-born Mexican-origin and non-Mexican origin Latinos to inform potential future directions of my research agenda. Lastly, similar regression analyses conducted in Aim 2 were employed using this subsample of midlife/older Latinos.

AIM 3a: DESCRIPTIVE FINDINGS

Describe ethnic and nativity differences for sociodemographic factors, perceived neighborhood characteristics, and cardiometabolic health risk among Latino midlife and older adults

Latino sample characteristics

Sample characteristics for the Latino subsample (n=1,496) are presented in Table 6. Differences by ethnicity are shown in the last column and reported as a *p*-value to indicate whether responses or frequencies statistically differed. Nativity differences are denoted with an

asterisk (*) to reflect U.S.-born versus foreign-born differences within each ethnic group. Further, I conducted an examination of nativity differences between each ethnic group. For example, the diamond (♦) indicates a significant difference between U.S.-born non-Mexican-origin respondents versus U.S.-born Mexican-origin respondents and between foreign-born non-Mexican-origin respondents versus foreign-born Mexican-origin respondents.

Nearly 60% of the total Latino sample was of Mexican-origin and approximately half were born in a foreign country (herein referred to as foreign-born (FB)). Latinos were on average 61 years of age (0.63). Women made up 54.7% of the sample and 64.2% of the sample was married. Moreover, although Latinos' health status did not differ significantly for all conditions, marked differences for diabetes outcomes were more unfavorable for Mexican-origin respondents. Next, nativity differences were observed within- and between- ethnic groups. Particularly, nativity differences were evident across perceived neighborhood characteristics for FB Mexican-origin respondents compared to FB non-Mexican origin respondents. This section closely follows the structure of Aim 2; therefore, I provide descriptions of the bivariate findings, along with visual descriptions for neighborhood perceptions and geographic characteristics below.

Table 6. Weighted means (SE) and proportions (%) of Latino sample characteristics stratified by ethnicity by nativity status. HRS 2006-2014 (n=1,496).

	Total (n=1,496)	**Mexican-origin (n=888)**			**non-Mexican origin (n=608)**			*p-value*
		Total	U.S. born	Foreign-born	Total	U.S. born	Foreign-born	
Cardiometabolic risk	Mean (SE) or %	Mean (SE) or %			Mean (SE) or %			
Biological indicators (M)								
BMI kg/m^2	29.6 (0.27)	30.0 (0.37)	30.5 (0.50)	29.4 (0.37)*****	28.9 (0.33)	29.8 (0.89)	28.5 (0.45)	≤.05
HbA1c %	6.2 (0.05)	6.3 (0.06)	6.3 (0.08)♦	6.3 (0.10) ♦	5.9 (0.07)	5.9 (0.11)	6.0 (0.08)	<.001
CRP mg/L	4.2 (0.19)	3.8 (0.21)	3.8 (0.22)	3.9 (0.35)	4.8 (0.44)	4.9 (0.83)	4.8 (0.58)	<.10
High risk cut-off points (%)								
Obese (≥30 kg/m^2)	43.2	44.8	46.2	43.2	40.4	42.7	39.3	n.s.
Elevated HbA1c (≥ 6.5%)	21.8	24.7	24.3	25.3♦	16.9	14.8	18.0	<.01
Elevated CRP (>3.0 mg/L)	38.9	38.1	38.0	38.2	40.5	45.2	38.2	n.s.
Sociodemographic variables								
Age	61.4 (0.63)	60.8 (0.78)	60.8 (0.97)	60.9 (0.78)♦	62.3 (0.53)	61.1 (0.96)	62.9 (0.60)	<.10
Female	54.7	58.6	--	--	52.4	--	--	
Married	64.2	68.3	66.4♦	70.1♦	57.2	55.3	58.1	<.05
Foreign-born	53.5	45.1 (0.02)	--	--	67.9 (0.04)	--	--	<.001
Income (logged)	9.8 (0.09)	9.8 (0.12)	10.2 (0.13)	9.3 (0.23)*****	9.8 (0.12)	10.1 (0.12)	9.6 (0.17)*****	n.s.
Income quartiles (%)								
<$20,000	43.2	43.8	35.6	54.0*****	42.2	35.9	45.2	n.s.
>$20,000 - <$40,000	22.2	23.4	21.0	26.4	21.0	19.7	20.2	n.s.
>$40,000 - <$75,000	21.1	20.0	26.2	12.3*****	22.9	31.2	19.0	n.s.
>$75,000 (reference)	13.5	12.7	17.2	7.3	14.8	13.2	15.6	n.s.
Wealth (logged)	3.2 (0.13)	3.5 (0.14)	3.6 (0.18)	3.3 (0.18)♦	2.7 (0.24)	3.1 (0.29)	2.5 (0.25)*****	<.01
Wealth quartiles (%)								
<$50,000	23.6	50.6	48.2	52.5	53.8	49.9	54.9	n.s.
>$50,000 - <$180,000	23.8	29.6	16.1	33.8	18.3	24.9	15.2	n.s.
>$180,000 - <$450,000	25.6	11.4	14.6	7.6	17.7	15.0	19.1	<.01
>$450,000 (reference)	25.5	8.9	11.1	6.1*****	10.6	10.3	10.8	<.05
Below poverty threshold	23.3	26.3	21.2	32.6	18.1	17.1	18.5	<.10
Education (in years)	9.9 (0.26)	9.1 (0.26)	11.6 (0.34)♦	6.6 (0.39)*****♦	11.3 (0.26)	12.4 (0.35)	10.7 (0.28)*****	<.001
Education (categories, %)								
Less than HS	46.6	52.8	34.7+	74.8*+	36.0	24.2	41.4*****	<.001

HS diploma/GED	26.5	26.2	34.3	16.4*	27.0	30.8	25.2	n.s.
College + (reference)	26.9	21.0	31.0+	8.9**♦**	37.0	44.9	33.3	<.001
Uninsured	21.6	24.7	16.2	35.0**♦**	15.2	16.1	14.8	≤.05
Neighborhood perceptions								
Physical disorder (1-7)	2.0 (0.06)	2.1 (0.08)	2.0 (0.14)	2.2 (0.08) ♦	1.8 (0.06)	1.9 (0.13)	1.8 (0.08)	<.05
Vandalism and graffiti	3.1 (0.07)	3.2 (0.08)	3.2 (0.17)	3.3 (0.12) ♦	2.9 (0.11)	2.8 (0.20)	2.9 (0.13)	<.05
Afraid to walk alone	3.4 (0.08)	3.5 (0.12)	3.4 (0.21)	3.6 (0.14)	3.3 (0.12)	3.3 (0.20)	3.4 (0.13)	n.s.
Areas kept unclean	2.8 (0.09)	2.9 (0.11)	2.8 (0.14)	3.0 (0.10) ♦	2.6 (0.12)	2.6 (0.14)	2.6 (0.16)	<.10
Vacant and deserted areas	2.7 (0.06)	2.7 (0.07)	2.7 (0.11)	2.8 (0.10)	2.6 (0.09)	2.8 (0.16)	2.5 (0.11)	n.s.
Negative social cohesion (1-7)	3.0 (0.07)	3.0 (0.071)	2.8 (0.15)	3.2 (0.08)*	2.9 (0.10)	2.8 (0.10)	3.0 (0.10)	n.s.
Don't feel part of the area	2.8 (0.06)	2.8 (0.10)	2.5 (0.08)♦	3.1 (0.09****	2.9 (0.07)	2.9 (0.15)	2.8 (0.13)	n.s.
People cannot be trusted	3.1 (0.10)	3.2 (0.13)	3.2 (0.22)	3.2 (0.12)	2.9 (0.08)	2.8 (0.15)	2.9 (0.11)	<.10
People are not friendly	2.8 (0.08)	2.9 (0.12)	2.7 (0.15)	3.1 (0.13)****	2.7 (0.75)	2.5 (0.10)	2.9 (0.09)****	n.s.
People do not help when in trouble	3.2 (0.08)	3.3 (0.20)	3.0 (0.21)	3.5 (0.10)****	3.2 (0.12)	2.9 (0.15)	3.3 (0.18)	ns
Health characteristics								
Heavy drinker	12.4	12.4	15.6	8.5****	12.4	16.5	10.5	n.s.
Current smoker	16.7	17.3	18.3	16.0	15.7	23.5	12.0****	n.s.
No moderate activity	17.6	18.2	18.7	17.8	16.6	15.0	17.3	n.s.
Depression (CESD, 1-8)	2.2 (0.10)	2.2 (0.13)	2.0 (0.16)	2.4 (0.14)****	2.1 (0.11)	2.2 (0.18)	2.1 (0.14)	n.s.
Geographic characteristics								
Geographic region								
Northeast (reference)	10.3	<1	<1+	<1♦	27.5	15.9	33.1****	<.001
Midwest	4.1	4.5	5.8	2.8	3.4	5.0	2.7	n.s.
South	44.7	47.1	45.2	49.3	40.4	34.0	43.4	n.s.
West	40.9	48.1	49.0	47.1♦	28.5	45.1	20.8****	≤.05
Urban-rural typologies								
Urban (>1,000,000 pop.)	53.1	41.7	35.6	49.2**♦**	72.7	47.0	84.8****	<.001*
Suburban (>250,000 to 1,000,000)	33.1	44.5	45.6+	43.3♦	13.3	21.8	9.3	<.001*
Ex-urban (<250,000) (reference)	13.8	13.7	18.9+	7.5****	14.0	31.2	5.9****	n.s.

Notes: These data are adjusted for HRS complex survey design. Significance at $p \leq .05$ level.
p-value represents statistical differences between ethnic subgroups: Mexican-origin vs. non-Mexican origin (reference).
n.s. indicates non-significance between Mexican-origin and non-Mexican origin ethnic subgroups.
***** significant difference within ethnicity by nativity status. U.S- born = reference: U.S.-born Mexican-origin vs. FB Mexican-origin AND U.S. non-Mexican origin vs. FB non-Mexican.
♦ significant difference within nativity by ethnicity. U.S- born = reference: U.S.-born Mexican-origin vs. U.S.-born non-Mexican AND FB Mexican-origin vs. FB non-Mexican.

Ethnicity-nativity differences for cardiometabolic and inflammatory risk

Obesity, diabetes, and inflammation. For diabetes, Mexican-origin Latinos, on average, had poorer outcomes for HbA1c compared to non-Mexican Latinos. For example, both U.S.-born and FB Mexican-origin midlife/older adults had higher HbA1c levels compared to U.S-born and FB non-Mexican midlife/older adults. Furthermore, FB Mexican-origin Latinos were more likely to have elevated HbA1c (25.3%), particularly when compared to FB non-Mexican (18.0%) Latinos. Altogether, diabetes, as measured by HbA1c warrants further investigation since HbA1c can be indicative of unknown diagnosis or uncontrolled diabetes for those with a diagnosis.

Next, nativity differences between ethnicity and within ethnicity were observed for continuous BMI, with U.S.-born Mexican-origin respondents having the highest BMI levels compared to their Mexican-origin and non-Mexican origin counterparts. However, the proportion of obese respondents did not statistically differ across any groups. In fact, 43.1% of respondents in this Latino sample were obese. Furthermore, for continuous values of CRP, marginal differences between ethnic groups were observed ($p<.10$); however, the proportion of Latinos in the high-risk category also did not differ across groups. Indeed, 39.0% of Latinos in the sample had elevated CRP, which could be indicative of cardiovascular risk among this aging population.

Socioeconomic status (SES)

Shared SES patterns among Latinos. Unlike with NHW-Latino differences across all SES measures, SES within Latinos did not differ significantly across all wealth and income measures. Instead, these findings point to noteworthy similarities in SES for midlife/older Latino adults. For example, approximately 43% of Latinos' income was less than $20,000, with nearly half of the FB Latino population disproportionately represented in this low-income quartile. That is, nearly 54.0% of the FB Mexican-origin and 45.2% of the FB non-Mexican origin population

had income levels below $20,000. Similarly, approximately half of the Mexican-origin (50.6%) as well as the non-Mexican origin (53.8%) population was in the lowest wealth quartile (<$50,000). Nevertheless, log-wealth values were higher for Mexican-origin midlife/older adults compared to non-Mexican origin midlife/older adults. Particularly, U.S.-born Mexican-origin Latinos, were more likely to be in the highest wealth quartiles than their FB Mexican-origin ethnic counterparts (11% vs 6.1%, respectively); yet, these overall findings suggest that income and wealth are limited among Latinos, especially in later ages.

Disproportionate education disparities. Further, stark education disparities were observed for FB Mexican-origin respondents compared to both their U.S.-born Mexican-origin and FB non-Mexican counterparts. Approximately 75% if the FB Mexican-origin population had less than a H.S. degree and reported an average of 6.6 (0.26) years of education. Conversely, U.S.-born Latinos from both ethnic groups had close to 12 years of education; however, Mexican-origin respondents (21%) did not attend college compared to non-Mexican origin respondents (37%). In addition to marked income and wealth differences, as well as education disparities, FB Mexican-origin midlife/older adults were two times more likely to be uninsured. For example, 35% of the FB Mexican-origin population was uninsured, while 16.2% of the U.S.-born Mexican-origin and 14.2% of the FB non-Mexican origin populations, respectively, were uninsured. These findings are not novel to the documented disadvantaged profile of FB populations; nevertheless, it is imperative to highlight these inequalities among this multi-disadvantaged group of aging midlife and older adults.

Health characteristics

Greater depressive symptoms. Ethnic differences between Mexican-origin and non-Mexican origin Latinos were not observed across any health characteristics. To echo previous

paradoxical findings about FB Latinos, foreign-born respondents reported better health behaviors compared to U.S.-born Latino respondents. For example, foreign-born Mexican-origin midlife/older adults were less likely to be heavy drinkers and foreign-born non-Mexican midlife/older adults were less likely to be current smokers compared to their respective ethnic counterparts. Although foreign-born respondents reported better health behaviors, foreign-born Mexican-origin midlife/older adults reported greater depressive symptoms compared to their U.S.-born Mexican-origin counterparts.

Ethnicity-nativity differences in perceived neighborhood characteristics

Significant nativity differences within ethnic groups. Perceived neighborhood characteristics between Mexican-origin and non-Mexican origin Latinos differed only for total perceived physical disorder (mean index score) and perceptions of vandalism. Nevertheless, significant nativity differences were observed within ethnicity and within the FB population across various perceived neighborhood characteristics. Compared to U.S.-born Mexican-origin respondents, FB Mexican-origin respondents had worse perceptions of social cohesion (mean index score), but also for specific items such as not belonging, people not being friendly, and people not being helpful when in trouble. Additionally, FB Mexican-origin Latinos, perceived greater neighborhood physical disorder compared to FB non-Mexican Latinos. Altogether, these findings suggest that FB Mexican-origin midlife/older adults perceive their social environment more negatively than their U.S.-born Mexican-origin counterparts as well as compared to FB non-Mexican origin midlife/older adults.

Visual Depictions of Perceived Neighborhood Characteristics by Latino Ethnicity by Urban Typology

As was the case for Aim 2, I analyzed geographic characteristics; however, I was especially interested in documenting the potential influence of urban, suburban, and ex-urban settings on perceived neighborhood characteristics within the Latino subsample. In this section I present the overall ethnic differences between Mexican-origin Latinos' and non-Mexican Latinos' perceptions of neighborhood characteristics by urban, suburban, and ex-urban settings. Results pertaining to differences in perceived physical disorder and negative social cohesion by urban typology are presented in Figures 15 and 16.

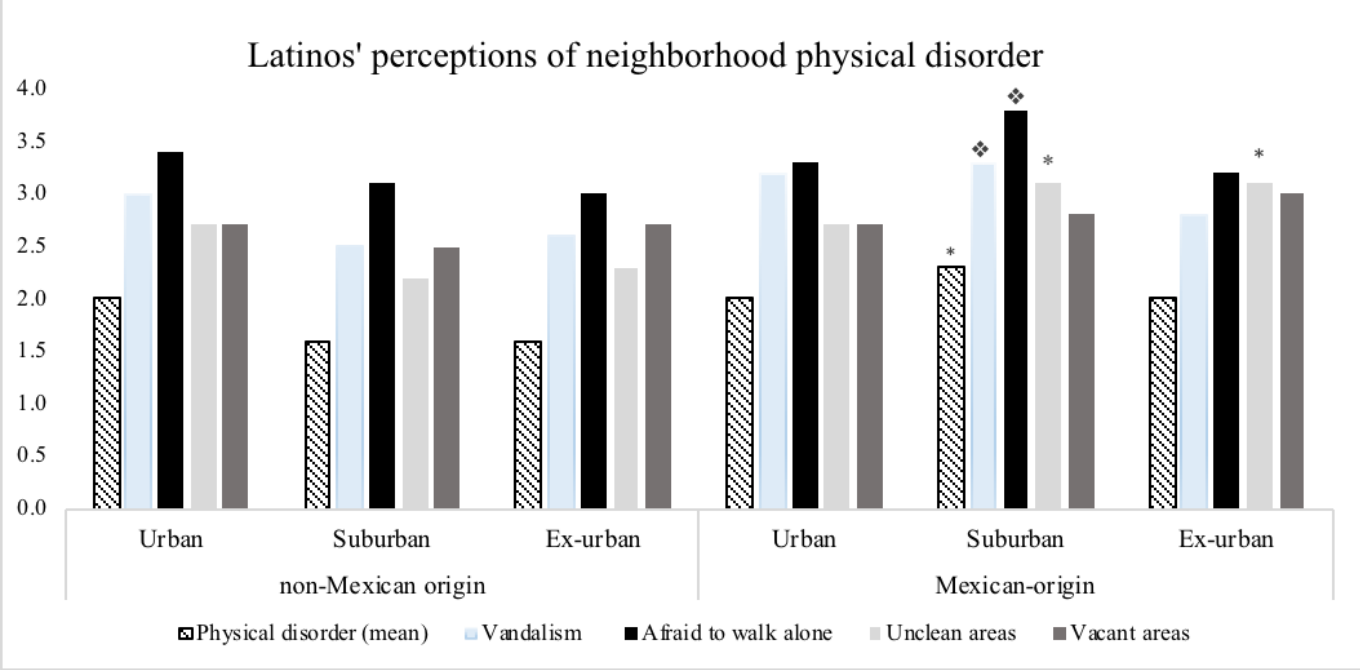

Figure 15. Perceived physical disorder (range 1-7) stratified by Latino ethnicity by urban typology.

Notes: 1) * indicates that perceptions statistically differ between each urban, suburban or ex-urban typology for Mexican-origin Latinos when compared to non-Mexican origin adults (ref)

2) ❖ indicates perceptions statistically differ within Mexican-origin group living in urban or suburban areas when compared to ex-urban areas (ref).

3) There were no statistical differences within non-Mexican origin Latinos.

Perceived physical disorder x ethnicity x typology

Between ethnic group differences by typology. For perceived physical disorder, there were significant differences between Mexican-origin and non-Mexican Latinos, particularly in suburban areas. Figure 15 shows that the total physical disorder index was higher for Mexican-origin Latinos living in suburban areas (2.3) compared to non-Mexican Latinos also living in suburban areas (1.6). Also, in suburban areas, Mexican-origin Latinos rated uncleanliness (3.1) nearly one point greater than non-Mexican Latinos in suburban areas (2.2). Similarly, greater perceptions of uncleanliness were observed for Mexican-origin Latinos in ex-urban areas (3.1) compared to non-Mexican Latinos in ex-urban areas (3.1).

Within ethnic group differences by typology. Further, within group differences among Mexican-origin Latinos were observed in suburban areas. For example, Mexican-origin Latinos living in suburban areas rated vandalism and graffiti (3.3) and unsafety (i.e. afraid to walk alone) (3.8) greater than Mexican-origin Latinos living in ex-urban areas (2.5 and 3.1, respectively). This was not observed for urban Mexican-origin Latinos compared to ex-urban Mexicans. Lastly, although perceived neighborhood unsafety did not statistically differ between ethnic groups, it was consistently higher than all other items of perceived physical disorder. These findings pertaining to worse perceptions of physical disorder in the suburban context merit attention in the discussion.

Perceived negative social cohesion x ethnicity x urban typology

Between and within ethnic group differences by typology. A number of between group ethnic group differences and significant within groups were observed for perceived negative social cohesion. As shown in Figure 5, overall (mean) index scores of negative social cohesion were greater for Mexican-origin Latinos in suburban areas (3.2 vs 2.6) compared to

non-Mexican Latinos living in suburban areas. Additionally, average ratings of mistrust for suburban Mexican-origin adults was one point higher than suburban non-Mexican Latinos (3.5 vs. 2.5), on average. Mistrust also differed within Mexican-origin Latinos in suburban areas compared to those in ex-urban areas. Lastly, non-Mexican Latinos living in urban areas reported greater negative social across all measures when compared to their non-Mexican counterparts living in ex-urban areas. In the subsequent section, I use these exploratory findings to examine potential associations.

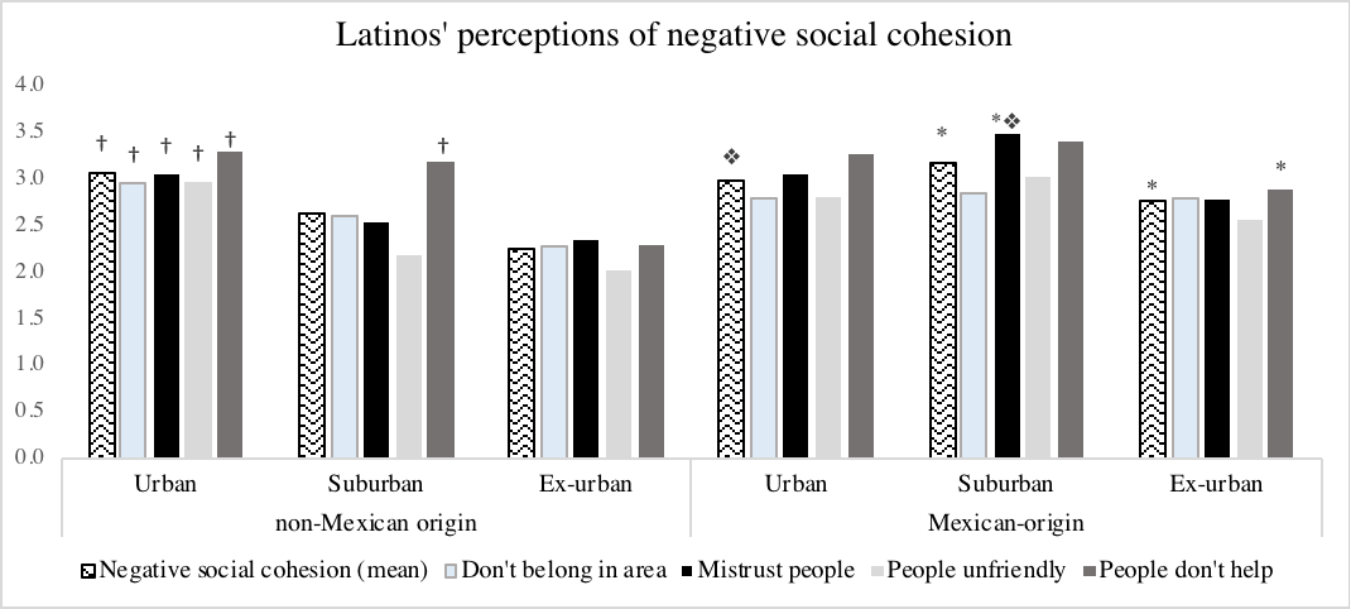

Figure 16. Perceived negative social cohesion (range 1-7) stratified by Latino ethnicity by urban typology.

Notes: 1) * indicates that perceptions statistically differed between Mexican-origin Latinos when compared to non-Mexican origin adults (ref) by each urban, suburban or ex-urban typology.

2) ❖ indicates that perceptions statistically differed within Mexican-origin group living in urban or suburban areas when compared to ex-urban areas (ref).

3) + indicates that perceptions statistically differed within non-Mexican Latinos living in urban or suburban areas when compared to ex-urban typology (ref).

AIM 3b: REGRESSION FINDINGS

Test the association between ethnicity, perceived neighborhood characteristics and 1) BMI, 2) hemoglobin A1C (HbA1c), and CRP. Examine potential moderators.

Description of regression models

The analyses performed in this section were informed by the descriptive findings from Aim 3a as well as a series of correlation matrices (not shown) to identify salient neighborhood characteristics relevant to Latinos. I followed up with models using individual neighborhood items that were consistently significant in the univariate and bivariate analyses. In turn, the regression findings in this section primarily focus on the following four neighborhood characteristics: 1) afraid to walk alone, also referred to as unsafe, 2) vandalism and graffiti (vandalism), 3) don't belong in the area, herein referred to as social isolation, and 4) people cannot be trusted, herein referred to as mistrust. Subsequently, I checked for issues of multicollinearity. The variance inflation factor (VIF) was below 10, indicating that these variables do not present issues of multicollinearity in a given model. Lastly, I employed similar steps from the previous multiple regression analyses; however, in these models I analyzed both ethnicity and nativity, separately, as potential moderators.

Regression results: Obesity, diabetes, and inflammation

Vandalism an independent predictor of HbA1c. First, the independent associations between ethnicity, nativity, perceived neighborhood characteristics and 1) BMI, 2) HbA1c, and 3) CRP were examined. These three unadjusted models included ethnicity, nativity and the four perceived neighborhood characteristics: unsafe, vandalism, social isolation, and mistrust. For BMI, foreign-born was associated with lower BMI compared to U.S.-born (b= -1.13, 95 % CI [-2.2, -0.17]; p<.05), however, no other variables in this model were associated with BMI. For

HbA1c, Mexican-origin ethnicity was strongly and positively associated with higher HbA1c compared to non-Mexican origin ethnicity (b= 0.35, 95 % CI [-0.18, 0.51]; p<.001). Additionally, higher perceived vandalism associated with increased HbA1c (b= 0.05, 5 % CI [0, 0.09]; p<.05). Lastly, there were no independent associations between ethnicity, nativity, perceived neighborhood characteristics, and CRP.

INTERACTION EFFECTS

Second, I tested for the interaction between each neighborhood characteristic by both ethnicity and nativity. However, there were little to no significant findings for foreign-born; therefore, I proceed with a discussion of ethnicity as the moderator of interest. Subsequently, the interaction between unsafe, vandalism, social isolation, and mistrust by ethnicity (i.e. mistrust x ethnicity) was analyzed for each outcome. The interaction between social isolation by ethnicity was the only significant interaction; and this was true for both BMI and CRP. In turn, I discuss these findings and present results in the next section.

Interactions by ethnicity

Table 7 reports the significant interaction effects in the association between perceived neighborhood characteristics and BMI as well as CRP among Latinos. The results presented controlled for the same covariates of the previous regression analyses, including age, sex, health characteristics, and geographic characteristics. The findings suggest that among Latinos, Mexican-origin Latinos who perceived greater social isolation in their neighborhoods had poorer BMI outcomes compared to non-Mexican Latinos. That is, for every additional point on feelings of social isolation (i.e. don't belong in the area), BMI was .55 kg/m^2 higher compared to their non-Mexican counterparts, as shown in Figure 7. Additionally, a significant main effect for social isolation was observed in the negative direction among Latinos. However, the interaction

effects shown in Figure 8 indicate that Mexican-origin Latinos had a less steep decline compared to non-Mexican Latinos, suggesting CRP levels were poorer for Mexican-origin Latinos who perceived greater social isolation compared to non-Mexican Latinos (*b*=0.09, 95% CI [-0.17, -0.28]). Subsequently, Figures 17 and 18 are provided to illustrate these findings.

Table 7. Adjusted linear regression models indicating the significant interaction effects between perceived neighborhood characteristics and 1) BMI and 2) CRP among Latinos (n=1,496).

	BMI		**CRP**	
	b	(95% CI)	*b*	(95% CI)
Key Variables				
Mexican-origin (ethnicity)	-0.88	-2.6, 0.78	**-0.28***	**-0.51, - 0.05**
Foreign-born (nativity)	**-1.53***	**-2.2, -0.22**	-0.09	-0.26, -0.22
Neighborhood perceptions				
Afraid to walk alone (unsafe)	-0.08	-0.27, 0.11	0.01	-0.39, 0.07
Vandalism & graffiti (vandalism)	-0.11	-0.44, 0.21	0.001	-0.37, 0.04
Don't belong in area (social isolation)	***0.24+***	**-0.49, 0.26**	**-0.13*****	**-0.49, 0.23**
People can't be trusted (mistrust)	-0.02	-0.27, 0.23	-0.009	-0.51, 0.03
Neighborhood perceptions x Latino ethnicity (Interaction effects)				
Unsafe x ethnicity	0.03	-0.41, 0.24	0.04	-0.05, 0.13
Vandalism x ethnicity	-0.17	-0.64, 0.31	-0.02	-0.39, 0.08
Mistrust x ethnicity	0.08	-0.36, 0.52	-0.02	-0.09, 0.06
Social isolation x ethnicity	**0.55***	**0.04, 1.05**	**0.09****	**-0.17, -0.28**
R-squared	11.7%		7.4%	

Note: Results presented are from the final adjusted model, which controlled for age, sex, health characteristics, and geographic characteristics. *<.05; ***<.001, + <.10

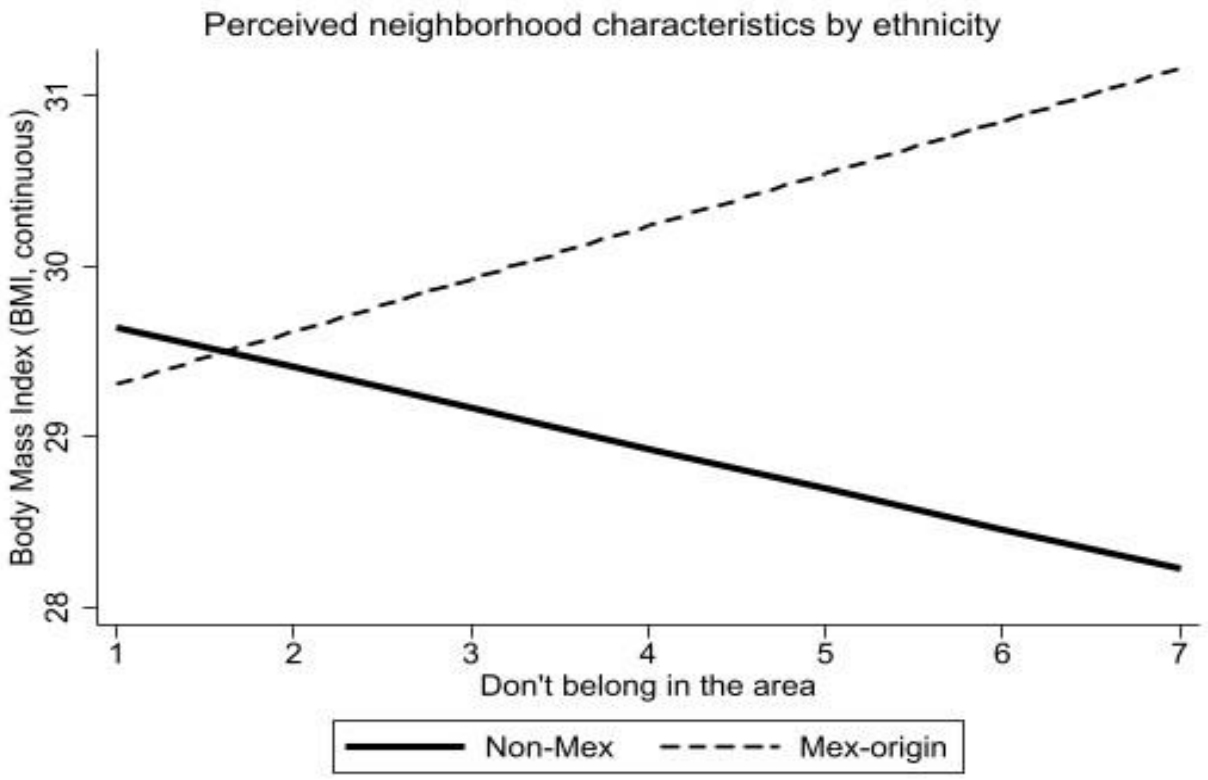

Figure 17. Interaction effects by Latino ethnicity in the association between perceived social isolation (don't belong in the area) and BMI among midlife/older Latinos.

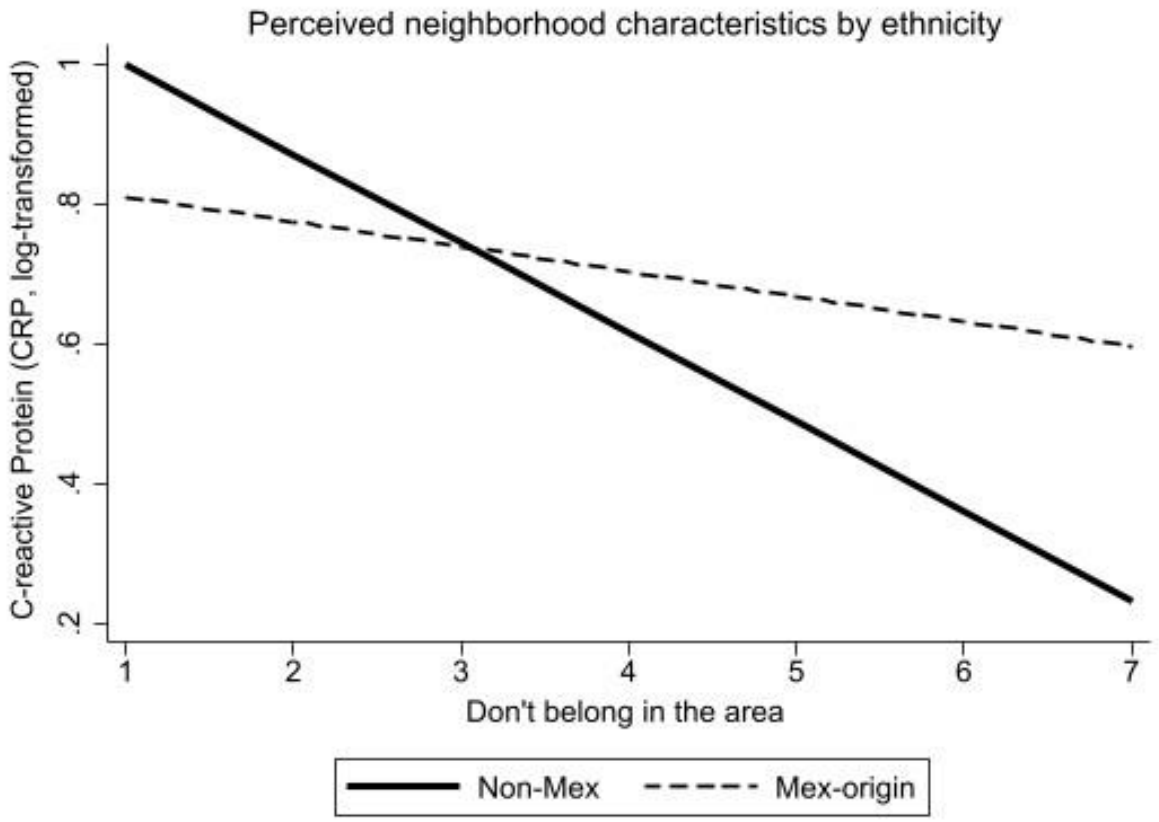

Figure 18. Interaction effects by Latino ethnicity in the association between perceived social isolation (don't belong in the area) and CRP among midlife/older Latinos.

Concluding Summary

To conclude, the main goals of Aims 2 and 3 are to examine both racial/ethnic group differences as well as within-group differences in a sample of midlife/older adults aged 51 and above. The objective of Aim 2 was to document NHW-Latino differences in midlife/older adults for a number of factors, including sociodemographic factors, the residential environment, as well as physical health outcomes. Indeed, disparities for socioeconomic, socioenvironmental, and health outcomes were observed. Particularly, independent associations between Latino ethnicity, perceived neighborhood social cohesion, and to a lesser degree perceived physical disorder were associated with high cardiometabolic or inflammatory risk. Further, the objective of Aim 3 was to provide an in-depth analysis to explore the health effects of the perceived neighborhood

environment among Latinos. The limited number of associations make it difficult to confirm adverse experiences of the social and environmental neighborhood context lead to poor cardiometabolic and inflammatory risk in Latino populations. Nevertheless, the results in Aim 2 present preliminary evidence that health effects may differ by Latino ethnicity. The following chapter provides an elaborated discussion of the findings and their implications.

CHAPTER 6

DISCUSSION

The overarching goal of the dissertation was to explore potential social and environmental factors related to physical health outcomes among U.S. Latinos, with attention to the residential environment, cardiometabolic conditions, and inflammatory risk. Taken together, this dissertation is comprised of three studies and the development of a conceptual framework. First, I conducted a scoping review to explore a narrow area of place-based studies. I was particularly interested in examining inflammatory risk as a potential stress-related outcome in relation to place/neighborhood environments among U.S. Latinos. Second, I conceptualized why and how place matters for racial/ethnic health disparities by noting various structural, social, environmental, and psychosocial exposures related to physical health outcomes. Third, using a nationally representative sample of midlife/older adults from the HRS, I conducted two empirical examinations to test associations between race/ethnicity, perceived neighborhood characteristics, and three health outcomes—obesity, diabetes, and inflammation. More specifically, I analyzed both racial/ethnic differences between non-Hispanic whites (NHW) and Latinos as well as ethnic groups differences within Latinos to reveal racial and ethnic patterns of perceived neighborhood characteristics; and in turn, determine whether negative perceptions of the physical and social neighborhood environment adversely impact these three health outcomes.

This chapter begins with an overview of the findings from the scoping review followed by a discussion of the two empirical studies. I then summarize the main findings along with their broader relevance and implications. Next, this chapter covers the studies' strengths and limitations, future directions, and closes with a call for research.

REVIEW OF FINDINGS

STUDY 1: SCOPING REVIEW

The purpose of the scoping review was to review the breadth of the place-health literature to identify studies that have examined the biological consequences associated with aspects of place or health, with attention to the Latino population and inflammatory risk. This scoping review served as an initial step for guiding the direction of the present dissertation, beginning with identifying gaps in knowledge that later served to inform the conceptualization of the two empirical studies. To guide my search and study eligibility, I posed the following research question: *What is known about the association between residential environments (i.e. neighborhoods/place-based characteristics) and inflammation in U.S. Latinos?* Since a detailed review of the findings is covered in Chapter 2, I provide a summary discussion of the findings in the following section.

Does the Residential Environment Get "Under the Skin"? A Focus on U.S. Latinos

A total of twelve studies met the eligibility criteria and were included for review, pointing to a dearth of knowledge that remains unexplored in place-health studies. The overall findings for the association between place/neighborhoods and inflammatory risk among U.S. Latino were mixed; thus, I am unable to confidently answer whether the residential environment "gets under the skin" for U.S. Latinos. First, I point to one aspect of the residential context that was not reviewed: housing conditions. People generally desire favorable housing conditions; yet, due to lack of income, legal status, and/or housing discrimination, Latinos, such as recent immigrants and their children, are more likely to live in poorer quality housing conditions relative to their NHW counterparts (Friedman & Rosenbaum, 2004). Poor quality housing, including household crowding, presence of lead, asbestos, rodents, and cockroaches lead to

negative health outcomes (Troche-Rodriguez, 2009). For example, lead exposure can result in significant health consequences including digestive and cardiovascular diseases as well as increased inflammatory outcomes (Boskabady et al., 2018). Examining these environmental exposures at both the neighborhood- and household- levels has important implications for environmental/public health researchers, prevention scientists, and policy-makers seeking to improve the residential conditions that impact individuals and communities differently.

Next, the scoping review revealed that few empirical studies have examined the association between neighborhood and/or place in relation to inflammation, and to a lesser extent studies have examined within-group differences among Latinos. For example, there were a total of seven studies that utilized an all-Latino sample—mainly either Mexican or Puerto Rican samples, while the others grouped Latinos as one group. This observation has implications for population studies seeking to advance research efforts towards the disaggregation of Latino subgroups, when possible. In the U.S., a majority of research on Latinos often focuses on Mexicans, which are the most populous group; however, scholars argue there is great heterogeneity across groups' racial/ethnic identity, socioeconomic integration, and differing health profiles among the various Latino subgroups (Lopéz, 2014; Rodriguez et al., 2017). Ultimately, this served to inform my own work where I sought to utilize a national survey to examine within-group differences among a midlife/older Latino population.

Lastly, there was marked heterogeneity in the assessment of neighborhood/place measures. This is consistent with existing critiques in the place-health literature suggesting that there is currently no consensus on the operationalization of neighborhoods (Duncan & Kawachi, 2018). Neighborhood studies often focus on census-derived neighborhood measures, such as neighborhood socioeconomic status to operationalize characteristics like neighborhood

deprivation. However, this may be problematic since this measure is assigned to all residents in a given census area, with little regard for individual-level experiences. Additionally, I point to methodological issues with utilizing such data. One, the modifiable area unit problem (MAUP), defined as the sensitivity of analytic results to the definition of units for which data are collected (Fotheringham & Wong, 1991) may be problematic when interpreting the findings pertaining to multivariate analyses of aggregated data. Another fundamental issue in spatial studies is the uncertain geographic context problem (UGCoP) (Matthews, 2016) which refers to problems analytical results due to spatial uncertainty in the actual area-based characteristics that exert contextual influences on the residents—as well as the temporal uncertainty in the timing and duration in which residents were exposed to such contextual influences.

As a result, future studies should incorporate perceived neighborhood characteristics in conjunction with objective measures in order to tap into the individual-level psychosocial experiences for residents living in similar challenging environments. Previous work using both census-level data and neighborhood perceptions suggests individuals are more sensitive to their surroundings, or perceptions may be more influenced by objective neighborhood conditions (Roosa, White, Zeiders, & Tein, 2009). For example, using a sample of Mexican-American adults, Roosa et al., (2009) found the association between objective indicators of neighborhood disadvantage, such as poverty rates, unemployment rates and perceived danger, was stronger among those with less education than those with more education. Thus, if coupled with objective measures, neighborhood perceptions could reveal individual differences (i.e. perceived threat) in response to contextual neighborhood conditions (i.e. poverty). Further, examinations of perceived neighborhood characteristics in relation to dysregulation remains a gap in knowledge;

thus, the implications of these findings served to inform the subsequent studies in the present dissertation.

STUDY 2: RACIAL/ETHNIC DIFFERENCES BETWEEN NHWs AND LATINOS

Next, the purpose of Aim 2 was to examine racial/ethnic differences for a number of factors that could be related to unfavorable health outcomes. In doing so, I aimed to emphasize existing disparities between NHW and Latinos, including socioeconomic and health disparities among a sample of midlife/older adults. Subsequently, a goal of this study was to identify differential exposures to socioenvironmental conditions, specifically perceived neighborhood characteristics, which may be indicative of socioeconomic status, stress exposure and ensuing health status. Therefore, I acknowledge socioeconomic and health differences by offering NHW-Latino comparisons, yet ultimately look to investigate whether perceptions of the physical and social neighborhood environment are associated with cardiometabolic and inflammatory risk.

NHW-Latino SES and Health Inequality

Marked SES disparities between Latinos and NHWs were observed in the present study, echoing existing evidence regarding Latinos' socioeconomic disadvantage across income, wealth and education measures. In the present study, significant differences in education were observed, with Latinos reporting only an average of approximately 10 years of education compared to an average of 13.5 years for NHWs. To drive this point further, more than half (55.4%) of NHWs had attended some college or more, whereas nearly half of the Latino sample (46.6%) had less than a H.S. diploma. Also, the proportion of Latinos in the lowest income and wealth quartiles was significantly higher than NHWs. In fact, the present findings indicate that 23.3% of Latinos, on average, lived below the poverty threshold compared to only 4.2% of NHWs. For context, in 2006 the threshold for a two-person household was $13,200 and in 2014 it was $15,730 (HHS

poverty guidelines). This is supported by previous findings that report Latinos' median net household income is $13,700 vs. $141,900 for NHWs, and that Latinos have a poverty rate that is two times greater than NHWs (21.4% vs 9.1%) (Parker, Horowitz, & Mahl, 2016). These findings are important because social and economic resources, especially income and education, are key for obtaining and maintaining resources to achieve good health.

Furthermore, substantial evidence points to a broad range of health advantages for Latinos, especially mortality advantages for foreign-born Mexicans (Palloni & Arias, 2004; Velasco-Mondragon et al., 2016); however, the current findings suggest cardiometabolic conditions remain a concern for midlife/older Latinos. For example, Latinos in the present sample were more likely to be obese and were two times more likely to have elevated HbA1c levels (21.8% vs. 10%) compared to NHWs. Similarly, prior HRS evidence has found that both U.S. born and foreign-born older Latinos exhibit greater risk for high blood pressure and diabetes, despite other findings pointing to older foreign-born Latinos having lower or comparable rates of high blood pressure, heart disease, cancer, arthritis, chronic lung disease, as well as inflammatory biomarkers (Zhang et al., 2012). It should be noted that in this analysis I did not examine health differences by nativity status, however, I examine both ethnicity and nativity differences in the subsequent section (Study 3). Thus, it is plausible that health outcomes vary by foreign-born versus U.S. born status within the Latino subsample or by ethnicity (i.e. Mexican-origin versus non-Mexican). As the U.S. demographic profile shifts to more U.S.-born and aging Latinos, researchers should give attention to the "longer and linger" phenomenon by considering how older adults may be vulnerable to longer exposures to adverse chronic stressors. Indeed, chronic psychological stress is said to influence metabolic functioning and contribute to insulin resistance (McCurley et al., 2015).

Next, Latinos were more likely to have elevated CRP than NHWs, even though significant differences in continuous CRP values were not observed. CRP is one hypothesized pathway chronic stress is linked to negative health consequences. High-risk (or elevated) CRP, as defined by <3.0 mg/L, is a stronger predictor of adverse outcomes, including diabetes and cardiovascular disease. Consistent with prior HRS evidence, while Latinos in the present study had greater metabolic risk than NHWs, significant differences for CRP by race/ethnicity were only partially supported (Boen & Hummer, 2019; García & Ailshire, 2019).

Differences by gender within race (NHW) and ethnicity (Latino) were examined. Latina women were more likely to have elevated CRP compared to Latino men, underscoring the importance of considering the role of gender to examine stress-CVD risk relationships. Previous studies have found chronic stressors including chronic work stress, financial strain, and caregiving stress have been linked to dysregulation for women, including higher CRP (Gallo, Jiménez, Shivpuri, Espinosa de los Monteros, & Mills, 2011; Shivpuri, Gallo, Crouse, & Allison, 2012). Together these findings highlight the relevance of chronic stress in relation to high-risk CRP, though point to important household-related chronic stressors. In the subsequent sections, I bring attention to potential social environmental exposures, such as perceived neighborhood characteristics, that may elucidate the present findings on obesity, diabetes, and inflammation.

Perceived Neighborhood Characteristics by Race/ethnicity

In the U.S., immigrants and racial/ethnic minorities, including Latinos, often report unfavorable neighborhood environments relative to NHWs (Perez, Ruiz, & Berrigan, 2019). Consistent with these findings, the current findings revealed that Latinos perceived their residential environments more poorly than NHWs. For example, Latinos reported worse overall neighborhood physical disorder (i.e. vandalism, safety, cleanliness, and vacancies) as well as

poorer negative social cohesion (i.e. belonging, trust, friendliness, help from others) than NHWs. Particularly, perceptions of safety conditions were worse (unsafe) among midlife/older Latinos relative to NHWs' perceptions of neighborhood safety. One explanation for these findings points the influence of objective neighborhood measures that I was unable to examine in the current study. Objective neighborhood characteristics, such as poverty, education, and crime rates may provide additional context to understanding why this measure of neighborhood physical disorder was salient among older Latinos. Specific to this age-group, older adults may have a distinctive lens through which they perceive the context and quality of their neighborhood. Indeed, recent research on perceived neighborhood characteristics among Latinos suggests perceptions are shaped by the complex interplay of structural (i.e. education) and contextual (i.e. age) factors (Perez et al., 2019).

Moreover, the visual descriptions of perceived neighborhood characteristics by race/ethnicity and by urban typology yielded preliminary results that warrant continued investigation. In the present study, Latinos living in suburban areas reported worse perceived physical disorder, safety, and problems with vandalism compared to those living in urban areas. Additionally, compared to NHW living in suburban areas, Latinos who lived in suburban areas had worse perceptions of "belonging in the area." Although we must take caution in how these findings are interpreted, the descriptive tables showed 33.1% of Latinos resided in suburban areas, suggesting that Latinos may be dispersed beyond urban communities. These findings are interesting considering previous research pointing to strong social networks of traditional destinations, such as ethnic/immigrant enclaves, which are often characterized by urban environments; however, Latinos in non-traditional or non-urban areas may not have access to the same socially organized communities. For example, (Lichter, 2012) points to increased migration

to non-established areas, such as rural parts of America, may contribute to community challenges as it also comes with increasing racial/ethnic change and diversity. Additionally, the expansion of service industries and suburban job growth in the 1990s increased the minority labor force, and especially for Latino, into suburban settings (Troche-Rodriguez, 2009). Thus, as the geographic dispersion of Latinos' migration continues to shift, noteworthy research is needed in non-urban settings, where recently arrived Latinos may face unique obstacles to social integration due to legal status, language barriers, or economic instability.

Race/ethnicity, Perceived Neighborhood Characteristics, and Health

Put altogether, one aim of the present study was to test independent associations between race/ethnicity, perceptions of neighborhood physical disorder, perceptions of negative social cohesion and the three outcomes: 1) BMI, 2) HbA1c, and 3) CRP. As expected, Latino ethnicity was positively associated with both BMI and HbA1c, controlling for all covariates including demographic, socioeconomic, health, and geographic characteristics. These associations support the descriptive findings; although, the persisting associations even after controlling for various variables suggest there are additional factors at play that shape poor cardiometabolic conditions, such as obesity and diabetes for Latinos.

Next, a positive association was observed between negative social cohesion and both BMI and HbA1c and persisted after adjusting for covariates. Latham and Clarke (2018) explored similar physical and social characteristics of the neighborhood environment among a nationally representative adult sample aged 65 and older from the National Health & Aging Trend Study. Although they did not examine the health effects of these associations, they found low social cohesion reduced social participation, including visiting friends and family and participation in community organizations like attending religious services. Their findings inform the current

findings, pointing to the possibility that as older adults become less socially active, they could be leading more sedentary lifestyles. In turn, the present findings imply the social neighborhood environment is salient to healthy aging; thus, improving the social neighborhood environment for midlife/older adults has implications for promoting greater physical activity through social engagement.

Lastly, despite existing literature pointing to the direct or indirect influence of the physical neighborhood environment (i.e. safety, walkability) for physical health, physical disorder did not predict cardiometabolic health outcomes (McCurley et al., 2019). Nevertheless, greater perceptions of physical disorder were associated with higher CRP in the unadjusted models. After adjusting for socioeconomic factors and other covariates, this association did not remain. As noted, socioeconomic status is key for obtaining and maintaining good health and well-being, these findings suggest socioeconomic status may also be a key driver in determining the link between disorder and adverse health. Put differently, socioeconomic levels not only directly affect stress-related outcomes like CRP; but also, indirectly affect health through poorly perceived stressful neighborhood conditions like physical disorder.

Summary and Conclusion

Midlife/older Latinos' lived experiences are characterized by greater socioeconomic disadvantage, stress, and health risks relative to NHWs (Boen & Hummer, 2019; Brown et al., 2018). In addition to significant SES disparities, the current findings showed cardiometabolic risk, as measured by BMI and HbA1c, was consistently poorer for midlife/older Latinos compared to NHWs; however, there were mixed findings for inflammation—as measured by CRP, a stress-related biological outcome. For example, continuous values of CRP did not differ by race/ethnicity but high-risk CRP (defined as >3.0 mg/L) was higher among Latinos relative to

NHWs. This is especially concerning since high-risk CRP is a significant predictor of diabetes and cardiovascular disease. Furthermore, the associations between perceived neighborhood characteristics and obesity, diabetes, and inflammation indicate the following: 1) perceived negative social cohesion seemed to be salient for increased cardiometabolic risk and to a lesser degree for inflammatory risk; and 2) perceived physical disorder was only associated with CRP in unadjusted models.

Taken together, it is possible that the mixed findings for inflammation could be understood better through explanations of the stress process or modified cultural frameworks. For example, perceptions or stress appraisals of a stressful event/condition are important to the affective and physiological cascade known to be deleterious to health (Ruiz et al., 2018). It has been theorized that Latinos experience relatively less stress, physiologically, than other groups. For this reason, health advantages are sometimes observed among Latinos, despite SES disadvantages that contribute to greater socioenvironmental stress exposure (Ruiz et al., 2018). Thus, a strength of the present study was to examine perceived (unfavorable) neighborhood characteristics as a way to assess socioenvironmental stress in relation to obesity, diabetes, and inflammation.

Next, the Latino health paradox offers a cultural framework to for theorizing positive health outcomes among Latinos, including lower cardiovascular disease and mortality—particularly when compared to Black Americans; however, I caution the inferences made in relation to the current study findings for the following reasons. First, increased longevity does not equate to better quality of life, especially when Latinos' lives are characterized by disadvantage. Second, as researchers increasingly look to move beyond explanations of acculturation, I point to the promising implications in Ruiz's (2018) culturally-tailored stress

theory model to elucidate stress psychophysiology among Latino populations. For example, the model illustrates how sociocultural factors, such as resilience, may moderate experiences of stress through appraisal—which could be effective in understanding the mixed findings related to inflammation. Third, I echo several population studies that note the need for research to disaggregate Latinos to uncover their heterogeneity. Although I was unable to disaggregate beyond two Latino ethnic subgroups, the subsequent study is one of the first population studies to use a stratified sample of midlife/older Latinos in the context of neighborhoods and health.

STUDY 3: ETHNIC AND NATIVITY DIFFERENCES AMONG LATINOS

Grouping Latinos into a single category masks potential heterogeneity. Therefore, the purpose of Aim 3 was to acknowledge Latinos' ethnic heterogeneity as well as differences by nativity. That is, to avoid treating Latinos as a homogenous group, I examine within-group differences by ethnicity and nativity status for socioeconomic factors, physical health outcomes, and perceived neighborhood characteristics. Using the subsample of midlife/older Latinos, I stratified the sample by Mexican-origin and those of non-Mexican origin backgrounds as well as by nativity status (i.e. foreign-born vs. U.S.-born). For the purpose of this discussion, I briefly cover socioeconomic and health differences within these subgroups of Latinos, but focus mainly on the results related to perceived neighborhood characteristics. In doing so, I was able to describe whether socioenvironmental exposures impact these groups similarly or differently.

Subsequently, I examined associations between specific perceived neighborhood characteristic and health in an exclusively Latino subsample. The key predictors in the regression models were ethnicity, nativity status, and four perceived neighborhood characteristics (safety, vandalism, mistrust and social isolation). The outcomes of interest remained the same: BMI (obesity), HbA1c (diabetes) and CRP (inflammation).

Latino Ethnicity-Nativity SES and Health Patterns

As mentioned, Latinos in this sample were socioeconomically disadvantaged. Even so, the findings in this study point to staggering socioeconomic disadvantages particularly for FB Mexican-origin midlife/older adults when compared to Mexican-origin and FB non-Mexican Latinos. For instance, 75% of FB Mexican-origin Latinos had less than a H.S. degree nor had reached H.S. level education, as indicated by an average of 6.6 years of education. FB origin were also two times more likely not to have health insurance compared to both their Mexican-origin and FB counterparts. Further, within-group ethnic differences indicated both FB Mexican-origin and non-Mexican Latinos had less education and wealth than their U.S.-born Latino counterparts. These findings are consistent with previous work suggesting that FB Latinos have little socioeconomic resources, thereby affecting their economic and social integration into the U.S. (Tienda & Fuentes, 2014; Viruell-Fuentes et al., 2012). Particularly, a clearer understanding of the structural factors such as immigration policies, labor practices, and racialization processes are necessary as scholars attempt to dispel the distinct contributions of Latinos on the U.S. economic and health profile (Castañeda et al., 2015; Viruell-Fuentes et al., 2012).

For health outcomes, BMI (continuous, kg/m^2) statistically differed by ethnicity, with Mexican-origin Latinos showing higher BMI scores compared to non-Mexican Latinos. Additionally, BMI scores were lower for FB Mexican-origin relative to U.S. born Mexican-origin; there were no observed differences by nativity among non-Mexican Latinos. Furthermore, poorer outcomes for diabetes were observed for Mexican-origin Latinos compared to non-Mexicans, with Mexican-origin Latinos having higher HbA1c irrespective of nativity status. Previous studies using national survey data rarely assess within-group ethnic differences by nativity status among Latino populations. Hence, I note U.S-born as well as FB Mexican-

origin Latinos have poorer cardiometabolic outcomes for both BMI and diabetes compared to non-Mexican midlife/older Latinos.

Using a national and diverse sample of Hispanic/Latinos (aged 18-74), Isasi et al. (2015) examined acculturation and other immigrant-related factors (i.e. place of birth, length of residence, and age at immigration) in relation to obesity outcomes among a national and diverse sample of Hispanic/Latinos aged 18-74. They found that one of the strongest predictors of obesity was longer length of residence in the U.S. across Latino subgroups, whereas acculturation (i.e. language preference, media preference, ethnic social relations) was not associated with obesity. Consequently, prolonged exposure among socially disadvantaged older adults who have lived and worked in the U.S. context for a long time may help explain adverse cardiometabolic conditions like obesity and diabetes, driving the point that researchers should consider how structural factors shape acculturation factors, including language preference and social integration.

Moreover, marginal differences were observed for inflammatory outcomes. Non-Mexican origin Latinos had higher CRP levels, when measured continuously, compared to Mexican-origin adults. Similar patterns were observed for differences in high risk CRP by ethnicity. Elevated CRP is a significant risk factor for chronic conditions, including obesity, diabetes, cardiovascular disease (CVD), with CVD being a leading cause of mortality among Latinos; despite noted mortality advantages. In a population-based study describing the prevalence of major CVD risk factors across Cubans, Dominicans, Mexicans, Puerto Ricans Central and South Americans found prevalence of adverse CVD risk profiles was highest among Puerto Ricans (Rodriguez et al., 2017). These nationally-representative findings offer support for the non-Mexican Latino group having higher CVD risk, as measured by CRP. It should be noted, however, that I was

unable to further disaggregate the current sample of non-Mexican Latinos due to sample size, but Puerto Rican, Cuban, along with other Latinos comprise this categorization. Furthermore, the current findings suggest psychophysiological responses to stressors may differ among Latinos, with ethnicity having a potential moderating role in pathways that link stress and health. In other words, does stress-related health effects differ across Latinos and which ethnic subgroups are at greatest risk?

Perceived Neighborhood Characteristics by Ethnicity and Nativity

Next, the findings indicate perceptions of unfavorable neighborhood characteristics differed by both ethnicity and nativity. First, overall perceived physical disorder was greater for Mexican-origin Latinos than non-Mexican Latinos; however, perceived negative social cohesion did not differ by ethnicity. Second, ethnic-nativity differences within each Latino subgroup revealed that compared to non-Mexican FB Latinos, Mexican-origin FB Latinos had worse perceptions of physical disorder, including problems with vandalism and cleanliness (i.e. litter). Third, compared to their U.S.-born Mexican-origin counterparts, FB Mexican-origin Latinos perceived greater overall negative social cohesion, including feelings of not belonging (social isolation), mistrust in people, and that people do not help when in trouble.

A plausible explanation for older adults having greater perceived disorder and negative social cohesion is they may be more critical of their environment, particularly as they become less mobile and are limited to the spaces they once frequented. A study using nationally representative data from the 2015 National Health and Interview Survey showed older individuals had worse neighborhood environment perceptions and reported fewer destinations (Whitfield et al., 2018). Specific to Latinos, the present findings add to existing neighborhood studies that have examined individual perceptions by nativity. For instance, Roosa and

colleagues (2009) found Mexico-born women reported a stronger association between objective indicators of neighborhood disadvantage and worse perceptions of danger. Hence, addressing social isolation and neighborhood cleanliness may be a critical aspect in order for older, immigrant adults to age in place.

Further, I analyzed both ethnic and nativity differences by urban/non-urban typologies to identify the potential influence of urban, suburban, and ex-urban settings on perceived neighborhood characteristics within the Latino subsample. Here, I briefly mention differences for Mexican-origin and non-Mexican Latinos (ethnicity). First, Mexican-origin Latinos living in suburban areas had worse overall perceptions of both physical disorder and negative social cohesion compared to non-Mexican origin Latinos living in suburban areas. Within Mexican-origin Latinos, perceptions of physical disorder (i.e. safety and cleanliness) were poorer compared to Mexican-origin Latinos living in ex-urban areas. Thus, it could be that poor perceptions of the Mexican-origin subsample are driving the earlier NHW-Latino differences in perceived neighborhood characteristics. Further, for non-Mexican Latinos, perceived social cohesion was poorer in urban areas across all measures when compared to non-Mexicans living in ex-urban areas.

It should be noted that the descriptive findings presented above were intended to provide preliminary results related to the geographic context; therefore, they require additional analytic testing and conceptual speculation. Indeed, geography is important to consider for several reasons. First, evidence suggests obesity and diabetes are spatially clustered in areas of the South and Southwest and vary by race/ethnicity. For example, Latinos are also largely represented for diabetes prevalence in states that are located in the Southwest and Midwest regions of the U.S. (Singh et al., 2017). Second, the dynamic geographic scattering of Latinos' across urban,

suburban, and rural settings in search of better job opportunities, lower housing costs, and safer communities has changed the metropolitan landscape of the U.S. (Tienda & Fuentes, 2014). Third, I note the vast heterogeneity that exists in these geographic patterns. For example, while the arrival of new immigrants has increased dispersal beyond traditional destinations (i.e. Southern California) to non-traditional destinations (i.e. Georgia), U.S. born Latinos' patterns may fuel patterns of internal migration. In future studies I propose conducting examinations of the geographical context to explore potential moderating effects of urbanicity and region.

Ethnicity, Nativity, and Perceived Neighborhood Characteristics

Next, I examined the independent associations between ethnicity, nativity, and perceived neighborhood characteristics and BMI, HbA1c, and CRP, exclusively among the Latino subsample. Moreover, I tested the independent and interacting effects of ethnicity and nativity in this association. Unlike the findings in the NHW-Latino total sample, overall perceived physical disorder and negative social cohesion indices were not associated with BMI, HbA1c or CRP. Therefore, the following neighborhood characteristics were selected for the models: 1) unsafe, 2) vandalism, 3) mistrust, and 4) don't belong (social isolation). Further, since I covered ethnicity and nativity differences in health in the sections above, I do not elaborate further in this section. Instead I focus on a discussion of the findings in relation to perceived neighborhood characteristics and health outcomes; and present the significant interactions.

For perceived neighborhood characteristics, vandalism was the only characteristic significantly associated with cardiometabolic risk. Specifically, higher perceptions of vandalism were associated with an increase in HbA1c, albeit weak associations. Studies with large sample sizes are needed to determine whether power changes the direction or strength of the association. Nevertheless, a plausible explanation for this finding is that vandalism, such as graffiti, could be

a sign of threat or danger, particularly in disadvantaged neighborhoods. Although not significant, the present findings also indicated perceived unsafe conditions were in the positive direction for higher BMI and HbA1c, which is in line with studies suggesting perceived threat may be a pathway linking harmful conditions to poor cardiometabolic outcomes. In the case of Latinos, "inner city" or "barrios" have been used to describe disadvantaged neighborhoods where traffic, gangs, graffiti or crime are present, which in turn could signal danger for some groups/individuals. Subsequently, previous studies suggest perceived threat is associated with unhealthy eating as a result of psychological coping to stressful events (Laraia et al., 2012). Further, poorly perceived neighborhood safety has been linked to decreased physical activity among Latinos, particularly Latina women (Perez et al., 2018). Taken together, stress, unhealthy eating and decreased physical activity may negatively influence healthy blood glucose levels, especially among older adults.

Similarly, unsafety, vandalism, and mistrust all pointed towards a positive direction with increasing CRP; however, they did not reach statistical significance. Additionally, there was an unexpected inverse association between responses to "don't belong in the area" and CRP but this association also was not statistically significant; that is, higher ratings to "don't belong" were associated with lower CRP. As noted, non-significant findings could be due to an insufficient sample size once stratified, which may not be large enough to verify this trend and larger sample sizes are needed in future studies to replicate the findings. Nevertheless, the current findings provide a closer examination of significant socioenvironmental stressors (i.e. vandalism and safety) impacting health among a nationally-representative group of midlife/older Latinos. Future population studies should consider the imprint these potentially stressful neighborhood conditions have within other Latino samples, including younger and/or larger samples.

Interactions: Perceived Neighborhood Characteristics x Ethnicity

Upon examining independent associations between perceived neighborhood characteristics and health outcomes, I then tested for the interaction effect of ethnicity to identify whether these associations varied between Mexican-origin Latinos and non-Mexican Latinos. The current findings suggest the relationship between perceptions of "don't belong in the area" (herein referred to as social isolation) and both BMI and CRP varied by ethnicity. For each additional point on perceived feelings of social isolation, the coefficient for BMI was higher among Mexican-origin Latinos compared to their non-Mexican counterparts. Similarly, higher social isolation was associated with higher CRP among Mexican-origin Latinos compared to non-Mexicans, despite the initial inverse association between social isolation and CRP. One potential explanation for this finding could be nativity status within Mexican-origin Latinos. As a reminder, the descriptive tables indicated FB Mexican-origin Latinos had worse perceptions of social cohesion compared to U.S. born Mexicans. A three-way interaction testing the multiplicative effects of negative social cohesion, FB status, and Mexican-origin among a larger sample size may reveal potentially masked effects. Moreover, the present interaction findings challenge existing work that points to social cohesion as a cultural benefit for Latino mortality advantages (Eschbach et al., 2004), particularly since Mexican-origin midlife/older who reported increased social isolation as measured by perceptions to "don't belong in the area" had poorer outcomes for obesity and chronic inflammation than non-Mexicans.

Summary and conclusion

To conclude this section, I point to the novelty of this work which examined various social, environmental, and psychosocial factors within an ethnically stratified Latino sample of midlife/older adults. The majority of research on "Latinos," especially in national survey data,

focuses primarily on Mexicans, arguably because they represent the largest proportion of Latinos in the U.S. and many survey studies often do not collect self-identification beyond "Latino/Hispanic" (Isasi et al., 2015). Taking this into account, the present study was limited to stratifying only by Mexican-origin versus non-Mexican Latinos. Nevertheless, the present study sheds light on socioenvironmental exposures for this population by examining perceived neighborhood characteristics in relation to biomarkers of health, including diabetes (HbA1c) and inflammation (CRP), an emergent area of study.

By examining perceived neighborhood characteristics specific to this subsample of Latinos, the present study aimed to ascertain which neighborhood characteristics were most salient to adverse health and for whom. Thus, I point to three key findings from this study. First, physical disorder (i.e. vandalism) was associated with higher HbA1c in this Latino subsample. Second, the preliminary analysis of ethnicity by urban typology on perceived neighborhood characteristics revealed that Mexican-origin Latinos living in suburban areas reported more unfavorable perceived physical and social neighborhood characteristics. Third, perceptions of the social environment seemed to have a unique effect on cardiometabolic (BMI) and inflammatory (CRP) risk for Mexican-origin Latinos, which may be attributed to foreign-born immigrants' negative perceptions of perceived social cohesion.

Much of the work on neighborhood effects on health and Latinos has attributed good health to the protective effects of social cohesion, especially for Mexican communities living in ethnic enclaves (Durazo et al., 2016; Eschbach et al., 2004). Conversely, others argue that residential context, particularly high co-ethnic density may be less beneficial, especially to immigrants. However, evidence suggests Latinos live amongst non-Latino or diverse neighborhoods. Yet, there is little focus on the underlying social processes that occur in these

environments, such as racialization (i.e. assignment of racial/ethnic identity), downward assimilation (immigrants and later generations experience economic stagnation), or discrimination in relation to health. Moreover, although majority-Latino neighborhoods are large and growing, those neighborhoods contain a mix of both native-born and foreign-born Latinos, Spanish and English speakers, and a mix of poor and middle-class residents (Suro & Tafoya, 2004). Existing evidence on the health-promoting outcomes of ethnic enclaves are noteworthy; however, increasing ethnic/racial diversity has implications for conceptualizing how social processes are shaped by neighborhood conditions or vice versa.

Previous studies have found U.S. born minority populations experience higher levels of perceived discrimination compared to their immigrant/foreign-born counterparts, which could reflect earlier and longer exposure to the racialized structure of the U.S. Thus, older foreign-born Latinos, similar to U.S. born Latino of all ages, may experience similar levels of adverse discriminatory events, especially in geographic areas where anti-immigration sentiment is high (i.e. U.S.-Mexico Border States). Additionally, we know racial identification of Latinos varies across subgroups, with Mexican-American likely to racially identify as White or "Other/Unknown"; and Puerto Ricans, Cubans, Dominicans who racially identify as either White or Black (Sáenz & Morales, 2015). In turn, Black (or Afro) Latinos are more likely to experience the unfair treatment or "othering" that Black Americans face in daily life. With the exception of segmented assimilation, sociological perspectives are largely absent from neighborhood-health studies among Latinos. Although mostly used to describe white-black inequalities, Geronimus' (1992) work on "weathering process" could shed light on both the social and biological consequences associated with a discrimination and health among more marginalized groups, such as Afro-Latinos or immigrants (Wildsmith, 2002). Altogether, to begin moving the needle

beyond cultural traits, I bring attention to the utilization of intersectionality to understand how Latinos' lived environments are shaped by race, gender, nativity, and class.

MAIN FINDINGS AND FUTURE IMPLICATIONS

The pathways connecting stressful exposures to physical health risks are complex and encompass biological, behavioral, cultural and psychosocial factors (Gallo et al., 2014), yet the synergy between these factors remains unclear (Myers, 2009). Nevertheless, one of the main objectives of this dissertation was to embark on this challenge by exploring biopsychosocial pathways that link race/ethnicity, the residential environment, stress and physical health, particularly for a growing and aging population: midlife/older Latinos. Grounded in health disparities research, I addressed racial/ethnic socioeconomic disparities, perceived neighborhood characteristics, and potentially associated cardiometabolic and inflammatory risks. Accordingly, the present dissertation makes contributions the body of work examining social determinants of health disparities and provides emergent evidence surrounding place, health, and aging Latinos. In this section I summarize the implications of the main findings.

1. Dearth of knowledge on downstream neighborhood effects for Latino

First, the systematic scoping review demonstrated there is limited evidence that the neighborhood context is a primary influence on Latinos' physiological health. The results also highlight that there is much to be learned about the residential environment and Latino populations, particularly studies seeking to incorporate biological indicators of health to reveal how the disease process is linked to the social and environmental neighborhood environments. This has important implications for informing studies using a social determinants of health framework because beyond individual-level factors, health is also determined by where populations live, work, play, and age.

Further, more research is needed to unpack the potential biological consequences play in the disease-process. For example, relevant housing exposures or other environmental toxins should be incorporated to reveal disparities in health and place. Rioux et al., (2010) found cardiovascular risk factors such as CRP and pulse pressure were positively associated with traffic density among a sample of Puerto Ricans. These effects were stronger for residents living near two or more roadways and among those with higher BMI indices as well as diabetes. These findings suggest that individuals with elevated inflammatory risk may be particularly susceptible to the adverse effects among populations living in close proximity to harmful environmental conditions.

2. NHW-Latino disparities in midlife/older adulthood

Second, NHW-Latino disparities in midlife/older adults were highlighted for various socioeconomic factors, perceived characteristics, and cardiometabolic risk. This is consistent with previous work suggesting that Latinos live longer—but harder lives as characterized by socially disadvantaged circumstances, as we well as increased cardiometabolic and inflammatory risk. For example, the current findings indicated Mexican-origin Latinos had greater cardiometabolic risk, as measured by BMI and HbA1c, while non-Mexican Latinos were at increased risk for elevated CRP, a predictor of future cardiovascular events. Substantial evidence suggests Latinos experience better than expected mortality outcomes, despite facing taxing circumstances in daily life, including ethnic discrimination, socioeconomic barriers, as well as limited access to health and healthcare resources—presenting challenges with understanding how these determinants differentially affect the health and well-being among Latino subgroups.

Scholars have argued that unequal social and economic opportunities as well as racial/ethnic health disparities are rooted in a legacy of unfair structural and institutional

practices, laws, and policies that disproportionately affect racial and ethnic minority groups. Consequently, Black and Latino lives are often characterized by chronically precarious and challenging environments (Jackson, Knight, & Rafferty, 2010), influenced by various socio-structural determinants, including the hierarchy of social status (i.e. race/ethnicity, class, and gender), historical context, and the political economy (Krieger, 2011). Yet, the unjust and unrelenting poor treatment of Black people in America, marked by a legacy of systemic racism, racial discrimination, and racial segregation, for example, leaves Black Americans disproportionately vulnerable to their consequences—including mortality disadvantages. Drawing from the ecosocial theory, hierarchies of social status, including race/ethnicity are entrenched in maintaining "whiteness," may leave some Latino groups at an advantage, especially for those who racially identify racially as White. Thus, mortality advantages, especially compared to Black Americans may, in part, be enlightened by theories of racial cueing (Adida, Davenport, & McClendon, 2016). Nevertheless, health challenges vary for certain Latino groups, such as increased cardiovascular risk for Puerto Ricans—who have racial origins in both White and Black racial identities.

At the core of health disparities are differential exposures to ethnicity-related and socioeconomic-related stressors, which are moderated by inadequate access and control over material, psychological, social and healthcare resources overtime (Myers, 2009). The current findings have implications for identifying unique ethnicity- and socioeconomic- related stressors that apply to Latinos. For example, fear of deportation for mixed status families, Puerto Ricans' exclusion as U.S. citizens, or easier social and economic integration for South Americans settling into affluence—to name a few. Altogether, this highlights the importance of examining the demographic heterogeneity marked by country of origin (ethnicity) and nativity.

3. Negative perceived neighborhood characteristics associated with higher cardiometabolic risk, particularly among midlife Mexican-origin Latinos

Third, the current findings showed Latinos had worse perceptions of both overall neighborhood physical disorder and negative social cohesion (i.e. low social cohesion). More specifically, the examination of within-group ethnic differences among the Latino subsample, indicated Mexican-origin Latinos, especially FB Mexican, had poorer perceptions of social cohesion compared to non-Mexican Latinos. Furthermore, perceived vandalism was a key predictor of higher HbA1c, while social isolation was a key determinant among Mexican-origin midlife/older Latino relative to non-Mexicans. Such findings document the importance of ensuring both the physical and social neighborhood conditions are hospitable spaces for adults to age healthfully.

Furthermore, there is much to be said about how race and class shape neighborhood disorder, particularly how cultural stereotypes or implicit biases shape individuals' perceptions of disorder. Sampson and Raudenbush (2004) suggest residents use prior beliefs or biases informed by racial stigmatization of urban areas or ghettos to form perceptions of disorder. For example, evidence suggests the percentage of Black residents in a block group was more closely linked to perceived disorder for Latinos than for other ethnic groups (Sampson & Raudenbush, 2004). Latinos changing geographic patterns into urban, suburban, and rural has implications for contextualizing frameworks that incorporate measures of intra- and inter- group biases shaped by processes of racialization and other social hierarchies. Furthermore, community social processes may be key determinants in shaping perceptions of neighborhood quality, which in turn are important for residents' motivation to engage in neighborhood-based activities, including exercise and maintaining social connections.

STRENGTHS AND LIMITATIONS

Strengths

The present dissertation addressed a major gap in knowledge population health examining neighborhood-health effects in Latino populations. For example, emerging studies have considered both nativity and neighborhood characteristics as individual predictors of health in Latino populations but have neglected to stratify by ethnic background (Durazo, Haan, Dang, Aiello, & Torres, 2020; McCurley et al., 2019). To my knowledge, prior population health studies have not utilized a nationally-representative sample to test for the association between perceived neighborhood characteristics in relation to physical and physiological health outcomes exclusively among Latinos. To be precise, the current work distinguished between ethnicity within a Latino population of midlife/older adults, which revealed that Mexican-origin Latinos may be at increased risk for negative socioenvironmental exposures; and in turn, may fare worse in cardiometabolic risk later in life. Third, I critically conceptualized links between populations, place, and health grounded in theoretically-informed concepts.

Limitations

The empirical studies in the dissertation are limited in important ways that should be acknowledged. First, I point to issues related to the sample size and subsequent generalizability. Although I utilized a nationally-representative sample of Latinos, the Latino subsample was substantially smaller (n=1,946) than the NHW population (10,447), despite efforts to oversample racial/ethnic minority populations. Moreover, because I obtained biomarker information, the sample is further limited to community-dwelling midlife and older adults and a random half-sample of respondents who had complete biomarker information in the 2006-2014 waves. Therefore, a substantial portion of the population may have been eliminated due to the HRS

study design and sample selection, thereby limiting the generalizability of the findings due to the restrictive nature of the eligibility criteria. Lastly, findings may not be representative of younger Latino populations' perceived experiences.

Furthermore, I point to limitations with the study design. Admittedly, a strength of the HRS is its rich, longitudinal data. However, I applied a pooled cross-sectional examination of respondents across five study waves from 2006-2014 rather than conducting a longitudinal study. In doing so, I was unable to make causal interpretations of the present findings as they relate to health effects of perceived neighborhood characteristics. Additionally, a longitudinal design would allow for assessing temporal changes in neighborhood characteristics as well as potential residential changes for the individual. In the future I propose conducting a longitudinal examination of respondents' health changes across study waves.

Moreover, I acknowledge that between 2007-2009, the U.S. experienced one of the longest economic recessions, which impacted unemployment rates, the housing market, and the income/wealth of U.S. households (Rich, 2013). While the potential influence of cohort effects and the socio-historical contexts may be pertinent to this population, I note that findings should not differ drastically since deflation remained subdued during this period and a number of policies were put in place to reduce broader financial conditions (Rich, 2013). Nevertheless, this remains a limitation of the present work because Latinos compared to NHWs likely faced worse economic hardship during the housing market and labor market crashes caused by the recession (Calnan & Painter, 2017).

Next, I address limitations with neighborhood measures—both those that were included and those that were not included in the dissertation studies. First, it is possible that perceived neighborhood characteristics do not capture health effects for this subsample of Latinos,

especially in relation biomarker health. Future research is needed to disentangle the contextual neighborhood conditions by including both individual perceptions and measures of objective neighborhood characteristics, such as neighborhood-level SES, ethnic/immigrant concentration, and availability of both health-aversive and health-promoting resources. Using ethnographic street-level coding of built neighborhood characteristics, Martins and colleagues (2016) examined whether two predominantly Dominican neighborhoods New York City (one ethnic enclave vs comparison) predicted risks (i.e. empty lots, fast food restaurant), structural resources (i.e. banks, churches, schools) and cultural resources (i.e. Hispanic food restaurant, hair salon/barbershop). Although enclave status did not predict risks or the presence of cultural resources, their findings suggest enclave status predicted structural resources, which could serve as "resource brokers" that empower residents by offering greater structural support through greater opportunities (Martins, Diaz, Valiño, Kwate, & Abraido-Lanza, 2014). Since the researchers did not examine residents' health as an outcome, their study offers a novel way to examine neighborhood risks and resources beyond census-level data. Thus, future studies may consider utilizing objective measures beyond census data along with residents' perceptions to identify health risks and/or benefits associated with living in these spaces.

Second, the neighborhood measures utilized in the present studies may not be sensitive enough to ascertain geographic differences across populations. Thus, a limitation of this work is the lack of geocoded data for linking respondents to their corresponding census-tract. Given the timeline constraints along with the challenges conducting a study using detailed geocoded data (restricted data) during the COVID-19 pandemic, I utilized the publicly available geographic information provided by the HRS. For example, the present examination of urban/non-urban typologies was restricted to aggregated data at the county-level, where the ex-urban category

(defined as populations of <250, 000) broadly captured metro, metro-adjacent, and rural counties. However, the HRS' categorization of ex-urban may have masked the vast heterogeneity that exists within these spatial units, which present potential issues when interpreting the findings.

Lastly, the present analysis did not assess household-level measures such as homeownership nor individual-level measures such as length of residence in the U.S. for foreign-born populations. These are areas for future examinations.

FUTURE DIRECTIONS

Despite a growing interest in examining the downstream health effects of neighborhoods among Latino populations (Jiménez et al., 2015; McClure et al., 2015), knowledge that demonstrates whether the residential environment gets under the skin for Latino and immigrant populations remains elusive. Further, it is known that the social and environmental context is important for producing racial/ethnic health inequalities; yet, population health scholars are often challenged in adequately addressing these contexts for several reasons: the heterogeneity of lived experiences, limited availability of longitudinal place-based and health data, and dynamic spatiotemporal changes—to name a few. Nevertheless, I propose the following three recommendations based on lessons learned and remaining gaps in knowledge: 1) leveraging theoretical perspectives; 2) examining the effects of residential segregation with the added notion of examining residential racial/ethnic diversity for Latinos; and 3) leveraging methodologies in spatial, quantitative, and qualitative studies.

First, I propose leveraging theoretical perspectives across disciplines. A multilevel approach may be necessary to adequately identify key social determinants of health and the leading mechanisms that explain how people embody their social and environmental context

(Krieger & Davey, 2004). I expound on this by suggesting that future studies seeking to eliminate health disparities within the context of lived experiences, must frame racial/ethnic minorities within a broader socio-structural context. Emerging work among Latino groups has explored how institutional barriers, such as anti-immigration enforcement laws, contribute to chronic stress for this population (Martinez et al., 2018; Riley, 2018). For example, Martinez et al. (2018) applied a biopsychosocial and socioecological framework to examine the fear of deportation in relation to chronic stressors and proinflammatory cytokines for mixed-status Mexican-origin families, which indeed were adversely associated. Although this is indirectly associated with place-health studies, the findings are in line with the notion that institutional racism can be embodied, especially for vulnerable populations (Petteway, Mujahid, & Allen, 2019). Thus, I offer the subsequent recommendation that pertains to other forms for structural racism in relation to place and neighborhoods.

Place matters *because* of structural racism, as expressed by Riley (2018), suggesting that place-based inequity is rooted in unfair policies targeted at racial/ethnic minorities. However, there is a significant gap in knowledge regarding the effects of residential segregation on Latino populations that warrant continued attention. For example, substantial evidence points to the structural and institutional discriminatory laws and policies that produce the segregation of racial/ethnic minority groups into disadvantaged neighborhood, leaving Black and Latinos particularly vulnerable to being rejected for housing loans (Acevedo-Garcia et al., 2003). Indeed, a marked history of racism has resulted in a legacy of white-black residential segregation and subsequent health inequities. Yet, paradoxical findings suggest that despite similar socioenvironmental stress exposures, Latinos experience better health and liver long lives. Therefore, substantial work is needed to conceptualize, measure, and design studies that examine

negative socioenvironmental exposures in relation to health declines, especially the psychophysiological processes that occur for Latino populations over the life course (Ruiz et al., 2018). A potential study could be to examine effects of the psychological (i.e. mental distress) and physiological (i.e. stress-related biomarkers) using objective indicators of racial/ethnic and immigrant concentration as well perceived discrimination to examine whether neighborhood social processes act as mechanisms to link structural factors to individual-level outcomes. Particularly, intra- and inter-group racial/ethnic discrimination may be of interest where there is high racial/ethnic diversity.

Third, I recommend leveraging methodologies, including the incorporation of spatial thinking when appropriate. One example I offer if to conduct case studies of Latino populations across different geographic regions. For example, a mixed method approach that leverages both spatial and qualitative data could be an area of future research. A large body of research points to the spatial patterning of life expectancy, mortality and chronic health outcomes (Tabb, McClure, Quick, Purtle, & Roux, 2018); however, we know less about the populations that make up these spatial patterns of health. Moreover, the present findings point to some preliminary results indicative of regional differences between urban, suburban, and ex-urban counties as they relate to perceived neighborhood characteristics. Therefore, future studies may utilize such preliminary knowledge to conduct focus groups or qualitative interviews to further explore the contribution of place and health, especially in the context building healthy communities for aging populations. Alternatively, studies that include both objective and subjective measures of neighborhood characteristics provide means for drawing the geographical context and individual-level perspectives in place-health research.

Concluding Remarks

Currently, Latinos account for 18.5% of the U.S. population. Moreover, the U.S. is expecting a rapid growth in Latinos aged 65 and older by 2050, with projections of the older Hispanic population to increase from 8.6% in 2020 to 18.4% by 2050 (Ortman, Velkoff, & Hogan, 2014). Furthermore, a large body of literature posits that Latinos experience similar or better morbidity and mortality outcomes comparable to non-Hispanic whites, despite well-documented socioeconomic disadvantages—this phenomenon is known as the Latino health paradox (Markides & Coreil, 1986; Markides & Eschbach, 2011). However, Boen and Hummer (2019) challenge previous paradoxical explanations, particularly for midlife/older Latinos suggesting that Latinos live longer—but harder lives as characterized by socioeconomic disadvantage, as well as increased cardiometabolic and inflammatory risk. Subsequently, I argue that the "longer and linger" phenomenon warrants greater attention, particularly as Latinos aged 65 and above shift the existing demographic profile of the U.S. Research, interventions, and healthcare efforts are needed to improve metabolic and cardiovascular risk factors through better surveillance of morbidity and disease management in aging Latino populations (Ruiz, Campos, et al., 2016).

There is preliminary evidence to suggest social, environmental, and psychological, factors may distinctively contribute to biological burden of cardiometabolic and inflammatory risk in Latino populations. In turn, the present dissertation makes a noteworthy contribution to the body of literature seeking to improve social and health inequalities experienced by Latinos—more specifically, aging Latinos. I was able to ascertain certain social, environmental and physical health inequalities experienced by Latinos when compared to NHWs as well as within the Latino population by ethnic background and by nativity status. Furthermore, the expected rise of Latinos

in the U.S. and their heterogeneous geographic patterns across the U.S. landscape merit attention, particularly in population health studies. Thus, I conclude by calling for research that carefully considers structural, socioenvironmental, and ethnic factors to adequately address the root causes of health disparities.

APPENDIX

Appendix A

PubMed Search Strategy

Latinos & inflammation: 3,015 as of 12/18
3,365 as of 12/19

(((("Hispanic Americans"[MeSH] OR "Hispanic Americans"[TIAB] OR "Latino"[TIAB] OR "Latinos"[TIAB] OR "Hispanic American"[TIAB] OR "Spanish American"[TIAB] OR "Spanish Americans"[TIAB] OR "Puerto Ricans"[TIAB] OR "Puerto Rican"[TIAB] OR "Cuban Americans"[TIAB] OR "Cuban American"[TIAB] OR "Latinas"[TIAB] OR "Latina Americans"[TIAB] OR "Latin American"[TIAB] OR "Latina"[TIAB] OR "Mexican Americans"[MeSH] OR "Mexican Americans"[TIAB] AND "Mexican"[TIAB] OR "Mexicans"[TIAB] OR "Mexican American"[TIAB] OR "Chicana"[TIAB] OR "Chicanas"[TIAB] OR "Chicano"[TIAB] OR "Chicanos"[TIAB] OR "Mexican origin"[TIAB] OR "Latino immigrant"[TIAB] OR "Latino immigrants"[TIAB] OR "Hispanic immigrant"[TIAB] OR "Hispanic immigrants"[TIAB] OR "Cuban immigrants"[TIAB] OR "Mexican immigrant"[TIAB] OR "Mexican immigrants"[TIAB] OR "foreign born"[TIAB] OR "foreign-born"[TIAB] OR "nativity"[TIAB] OR "Latinx"[TIAB] OR "Hispanic"[TIAB] OR "Hispanics" [TIAB]) AND ("cumulative biological risk"[TIAB] OR "cumulative stress"[TIAB] OR "stress, physiological"[MeSH] OR "physiological stress"[TIAB] OR "physiological stresses"[TIAB] OR "metabolic stress"[TIAB] OR "metabolic stresses"[TIAB] OR "physiological stress response"[TIAB] OR "physiological stress responses"[TIAB] OR "physiological stress reactivity"[TIAB] OR "biological stress"[TIAB] OR "biological stresses"[TIAB] OR "metabolic stress response"[TIAB] OR "metabolic stress responses"[TIAB] OR "chronic inflammation"[TIAB] OR "systemic inflammation"[TIAB] OR "inflammation"[MeSH] OR "inflammation"[TIAB] OR "inflammations"[TIAB] OR "c reactive protein"[MeSH] OR "c reactive protein"[TIAB] OR "c reactive proteins"[TIAB] OR "c-reactive protein"[TIAB] OR "c-reactive proteins"[TIAB] OR "CRP"[TIAB] OR "chronic stress"[TIAB] OR "biological phenomena"[MeSH] OR "biological phenomena"[TIAB] OR "biological phenomenon"[TIAB] OR "biological processes"[TIAB] OR "biological process"[TIAB] OR "biomarkers"[MeSH] OR "biomarkers"[TIAB] OR "biomarker"[TIAB] OR "biological markers"[TIAB] OR "biologic marker"[TIAB] OR "laboratory markers"[TIAB] OR "laboratory marker"[TIAB] OR "serum markers"[TIAB] OR "serum marker"[TIAB] OR "surrogate endpoints"[TIAB] OR "surrogate endpoint"[TIAB] OR "clinical markers"[TIAB] OR "clinical marker"[TIAB] OR "viral markers"[TIAB] OR "viral marker"[TIAB] OR "biochemical marker"[TIAB] OR "biochemical markers"[TIAB] OR "immune markers"[TIAB] OR "immune marker"[TIAB] OR "immunologic marker"[TIAB] OR "immunologic markers"[TIAB] OR "interleukin-6"[MeSH] OR "interleukin-6"[TIAB] OR "interleukin 6"[TIAB] OR "IL6"[TIAB] OR "b-cell stimulatory factor 2"[TIAB] OR "b cell stimulatory factor 2"[TIAB] OR "b cell differentiation factor 2"[TIAB] OR "b cell differentiation factor-2"[TIAB] OR "b-cell differentiation factor 2"[TIAB] OR "b-cell differentiation factor 2"[TIAB] OR "BSF-2"[All Fields] OR "hybridoma growth factor"[TIAB] OR "IFN-beta 2"[TIAB] OR "plasmacytoma growth factor"[TIAB] OR "MGI-2"[TIAB] OR "IL-6"[TIAB] OR "interferon beta-2"[TIAB] OR "interferon beta 2"[TIAB] OR "tumor necrosis factor-alpha"[MeSH] OR "tumor necrosis factor-alpha"[TIAB] OR "tumor necrosis factor alpha"[TIAB] OR "cachectin"[TIAB] OR "cachectin-tumor necrosis factor"[TIAB] OR "cachectin tumor necrosis factor"[TIAB] OR "tumor necrosis factor"[TIAB] OR "TNFalpha"[TIAB] OR "TNF-alpha"[TIAB] OR "inflammatory markers"[TIAB] OR "inflammatory marker"[TIAB])) NOT ("animals"[MeSH] NOT ("humans"[MeSH] AND "animals"[MeSH])))

APPENDIX

Appendix B

Table A1. Preliminary descriptive characteristics of complete cases of midlife and older adults (n=11,943) (HRS 2006-2014). *

Variables of interest	**Total (n=11,943)**	**NHW (n=10,447)**	**Latinos (n=1,497)**
	Mean or % (SE)	Mean or % (SE)	Mean or % (SE)
Sociodemographic			
Age (mean)	63.9 (0.249)	64.1 (0.279)	61.4 (0.628)
Female (%)	52.7 (0.005)	52.6 (0.005)	54.7 (0.016)
Married (%)	67.1 (0.006)	67.3 (0.007)	64.2 (0.018)
Foreign-born (%)			
Income (mean)	81,092.3 (2166.9)	84,679.2 (2199.3)	42,817.5 (3240.2)
Log-income (mean)	10.7 (0.027)	10.8 (0.023)	9.8 (0.087)
Income quartiles (mean)			
<=20,000	34.6 (0.011)	15.7 (0.004)	43.2 (0.021)
>20,000 - <=40,000	18.1 (0.006)	21.4 (0.004)	22.2 (0.014)
>40,000 - <=75,000	21.5 (0.007)	26.2 (0.005)	21.1 (0.016)
>75,000	25.8 (0.005)	36.6 (0.01)	13.5 (0.021)
Wealth (mean)	438,871.5 (16809.4)	463,117.3 (17060.9)	180,148.4 (26467.3)
Poverty (%)	5.8 (0.005)	4.2 (0.003)	23.3 (0.027)
Education (in years)	13.2 (0.082)	13.5 (0.052)	9.9 (0.26)
Level of education (%)			
Less than HS	13.2 (0.007)	10.1 (0.004)	46.6 (0.024)
HS diploma/GED	33.8 (0.007)	34.5 (0.007)	26.5 (0.014)
College +	52.9 (0.011)	55.4 (0.01)	26.9 (0.025)
Insured	92.6 (0.005)	93.9 (0.004)	78.8 (0.026)
Cardiometabolic risk			
Biological indicators (M)			
BMI	28.4 (0.084)	28.3 (0.079)	29.6 (0.275)
HbA1C	5.7 (0.013)	5.7 (0.009)	6.2 (0.052)
CRP	3.9 (0.07)	3.9 (0.076)	4.2 (0.189)
High risk cut-off points (%)			
Obese	33.1 (0.006)	32.1 (0.006)	43.2 (0.019)
Elevated HbA1C	11 (0.004)	10 (0.003)	21.8 (0.016)
Elevated CRP	34.3 (0.007)	33.8 (0.007)	38.9 (0.016)
Self-reported diagnosis (%)			
Diabetes	17.6 (0.004)	16.5 (0.004)	29.7 (0.016)

High BP	50.7 (0.007)	50.4 (0.007)	54.3 (0.019)
Health characteristics			
Heavy drinker (%)	10.7 (0.004)	10.5 (0.005)	12.4 (0.012)
Current smoker (%)	14.8 (0.006)	14.6 (0.006)	16.7 (0.019)
No moderate activity (%)	15.8 (0.005)	15.6 (0.005)	17.6 (0.013)
Depression (CESD, 1-8) (mean)	1.4 (0.029)	1.3 (0.027)	2.2 (0.096)
Place-based characteristics			
Neighborhood disorder	1.39 (0.024)	1.3 (0.021)	2 (0.060)
Vandalism and graffiti	2.3 (0.028)	2.3 (0.024)	3.1 (0.071)
Afraid to walk alone	2.6 (0.029)	2.5 (0.025)	3.4 (0.084)
Areas kept unclean	2.3 (0.024)	2.2 (0.023)	2.8 (0.088)
Vacant and deserted areas	2.4 (0.029)	2.3 (0.029)	2.7 (0.063)
Neighborhood cohesion	4.5 (0.023)	4.6 (0.021)	4 (0.059)
Feel part of the area	2.5 (0.024)	2.6 (0.024)	2.8 (0.057)
People can be trusted	2.4 (0.027)	2.3 (0.023)	3 (0.099)
People are friendly	2.2 (0.024)	2.2 (0.02)	2.8 (0.076)
People help when in trouble	2.7 (0.027)	2.6 (0.024)	3.2 (0.085)
Region			
Northeast	16.3 (0.012)	16.9 (0.013)	10.3 (0.021)
Midwest	27.1 (0.016)	29.4 (0.017)	4.1 (0.009)
South	34.3 (0.015)	33.3 (0.014)	44.6 (0.083)
West	22.2 (0.017)	20.4 (0.017)	40.9 (0.067)
Rural-urban continuum	0 (0)		
Urban (>1,000,000)	46.3 (0.027)	45.6 (0.028)	53.1 (0.087)
Suburban (250,000 to 1,000,000)	20.2 (0.029)	18.9 (0.027)	33.1 (0.107)
Ex-urban (<250,000)	33.5 (0.023)	35.4 (0.023)	13.8 (0.037)

*These data are adjusted for HRS complex survey design. NHW=Non-Hispanic Whites

Table A2. Correlation matrix for outcomes of interest (BMI, HbA1c, and CRP) , neighborhood physical disorder, and negative social cohesion among the Latino sample only (n=1,496).

Variables of interest	BMI (cont.)	BMI (%)	HbA1c (cont.)	Elevated HbA1c (%)	Logged CRP (cont.)	Elevated CRP (%)	Neighborhood disorder	Vandalism and graffiti
BMI (cont.)	1							
BMI (%)	0.7481*	1						
HbA1c (cont.)	0.2054*	0.1878*	1					
Elevated HbA1c (%)	0.1871*	0.1728*	0.7744*	1				
Logged CRP (cont.)	0.3134*	0.2169*	0.1210*	0.1217*	1			
Elevated CRP (%)	0.2796*	0.1932*	0.0881*	0.0872*	0.7779*	1		
Neighborhood disorder	n.s.	0.0702*	0.1015*	0.0879*	n.s.		1	
Vandalism and graffiti	n.s.	0.0659*	0.0985*	0.0708*	n.s.	-0.0529*	0.8240*	
Afraid to walk alone	n.s.	0.0573*	0.0847*	0.0870*	n.s.	n.s.	0.7585*	0.5447*
Areas kept unclean	n.s.	0.0758*	0.0695*	0.0580*	n.s.	n.s.	0.7595*	0.5044*
Vacant and deserted areas	n.s.	n.s.	0.0581*	0.0546*	n.s.	n.s.	0.7066*	0.4336*
Neighborhood discohesion	n.s.	0.0687*	0.0858*	0.0821*	n.s.	n.s.	0.6711*	0.5132*
Don't feel part of the area	n.s.	0.0593*	0.0701*	0.0710*	-0.0667*	n.s.	0.4562*	0.3410*
People can't be trusted	n.s.	0.0567*	0.0653*	0.0705*	n.s.	n.s.	0.6529*	0.5101*
People are not friendly	n.s.	0.0721*	0.0898*	0.0674*	n.s.	n.s.	0.6158*	0.4623*
People don't help when in trouble	n.s.	n.s.	0.0569*	0.0564*	n.s.	n.s.	0.5008*	0.3906*

(continued)	Afraid to walk alone	Areas kept unclean	Vacant areas	Neighborhood discohesion	Don't feel part of the area	People can't be trusted	People are not friendly	People don't help
Afraid to walk alone	1							
Areas kept unclean	0.4278*	1						
Vacant and deserted areas	0.3086*	0.4288*	1					
Neighborhood discohesion	0.4749*	0.6631*	0.4187*	1				
Don't feel part of the area	0.2998*	0.4473*	0.3191*	0.7751*	1			
People can't be trusted	0.4910*	0.6163*	0.3856*	0.8348*	0.4841*	1		
People are not friendly	0.4455*	0.6221*	0.3650*	0.8761*	0.5856*	0.6923*	1	
People don't help when in trouble	0.3405*	0.5081*	0.3071*	0.8001*	0.4589*	0.5695*	0.6111*	1

Table A3. Linear regression models testing the independent association between race/ethnicity, neighborhood perceptions and BMI (n=11,943).

	Model 1		Model 2		Model 3		Model 4	
	b	(95% CI)	*b*	(95% CI)	*b*	(95% CI)	*b*	(95% CI)
Key variables								
Latino ethnicity	1.10**	(0.56, 1.64)	0.41	(-0.11, 0.93)	0.25	(-0.27, 0.78)	0.44	(-0.03, 0.92)
Neighborhood disorder	0.07	(-0.10, 0.23)	0.03	(-0.14, 0.2)	0.02	(-0.15, 0.18)	0.02	(-0.14, 0.19)
Neighborhood discohesion	0.35**	(0.20, 0.5)	0.24**	(0.09, 0.38)	0.15*	(0.01, 0.29)	0.15*	(0.02, 0.29)
Socioeconomic variables								
Income (logged)			-0.09	(-0.21, 0.03)	-0.02	(-0.13, 0.1)	-0.01	(-0.12, 0.1)
Wealth (logged)			-0.19**	(-0.26, -0.12)	-0.16**	(-0.23, -0.08)	-0.16**	(-0.23, -0.08)
Education								
Less than HS			0.92**	(0.57, 1.27)	0.71**	(0.37, 1.06)	0.62**	(0.26, 0.97)
HS diploma/GED			0.84**	(0.38, 1.3)	0.38	(-0.07, 0.83)	0.26	(-0.18, 0.7)
College + (reference)								
Insured			0.76*	(0.08, 1.44)	0.41	(-0.23, 1.04)	0.42	(-0.22, 1.05)
Health covariates								
Heavy drinker					0.57*	(0.08, 1.07)	0.55*	(0.05, 1.05)
Current smoker					-2.26	(-2.64, -1.89)	-2.3	(-2.66, -1.94)
No moderate activity					2.34**	(1.85, 2.83)	2.31**	(1.82, 2.8)
Depression (CESD, 1-8)					0.20**	(0.11, 0.28)	0.20**	(0.11, 0.29)
Place-based covariates								
Region								
West							-0.58*	(-0.96, -0.2)
Rural-urban continuum								
Urban (>1,000,000)							0.4	(0.08, 0.72)

Note: The models have been adjusted for age and sex (coefficients not shown). CRP has been log-transformed to account for skewness. *p<.05; **p<.01

Table A4. Linear regression models testing the independent association between race/ethnicity, neighborhood perceptions and HbA1 (n=11,943).

	Model 1		Model 2		Model 3		Model 4	
	b	(95% CI)	*b*	(95% CI)	*b*	(95% CI)	*b*	(95% CI)
Key variables								
Latino ethnicity	0.42***	(0.32, 0.52)	0.32***	(0.21, 0.43)	0.31**	(0.21, 0.42)	0.31**	(0.2, 0.41)
Neighborhood disorder	0.02*	(0, 0.04)	0.001	(-0.01, 0.02)	-0.003	(-0.02, 0.01)	-0.004	(-0.02, 0.01)
Neighborhood discohesion	0.04***	(0.02, 0.06)	0.04***	(0.02, 0.06)	0.03**	(0.01, 0.05)	0.03**	(0.01, 0.05)
Socioeconomic variables								
Income (logged)			-0.02*	(-0.04, 0)	0.01	(0.03, 0.01)	-0.01	(-0.03, 0.01)
Wealth (logged)			-0.03**	(-0.04, -0.01)	0.02*	(0.04, 0.01)	-0.02*	(-0.04, -0.01)
Education								
Less than HS			0.12***	(0.08, 0.17)	0.10**	(0.06, 0.14)	0.10**	(0.06, 0.15)
HS diploma/GED			0.21***	(0.13, 0.29)	0.15**	(0.07, 0.23)	0.15**	(0.08, 0.23)
College + (reference)								
Insured			0.01	(-0.11, 0.12)	-0.02	(-0.13, 0.1)	-0.02	(-0.13, 0.1)
Health covariates								
Heavy drinker					-0.10**	(-0.17, -0.03)	-0.10*	(-0.17, -0.02)
Current smoker					-0.07*	(-0.15, 0)	-0.07*	(-0.15, 0)
No moderate activity					0.18***	(0.10, 0.25)	0.18**	(0.10, 0.25)
Depression (CESD, 1-8)					0.01	(0, 0.03)	0.01	(0, 0.03)
Place-based covariates								
Region								
Northeast (reference)								
Midwest							-0.01	(-0.06, 0.08)
South							-0.01	(-0.08, 0.07)
West							0.04	(-0.04, 0.11)
Rural-urban continuum								
Urban (>1,000,000) (reference)							0.02	(-0.02, 0.06)
Suburban							0.03	(-0.03, 0.10)
Ex-urban							0.01	(0.03, 0.06)

Note: The models shown are fully adjusted models, including adjustment for age and sex (coefficients not shown). CRP has been log-transformed to account for skewness. *p<.05; **p<.01; ***p<.001

Supplementary Table A4. Adjusted regression models testing the association between race/ethnicity, perceived neighborhood characteristics and HbA1c, while controlling for diabetes diagnosis (n=11,943).

	Model 1		Model 2		Model 3		Model 4	
	b	(95% CI)	*b*	(95% CI)	*b*	(95% CI)	*b*	(95% CI)
Key variables								
Latino ethnicity	0.42***	(0.32, 0.52)	0.32***	(0.21, 0.43)	0.23***	(0.03, 0.17)	0.11***	(0.04, 0.18)
Neighborhood disorder	0.02*	(0, 0.04)	0.001	(-0.01, 0.02)	-0.001	(-0.01, 0.01)	-0.001	(-0.01, 0.01)
Neighborhood discohesion	0.04***	(0.02, 0.06)	0.04***	(0.02, 0.06)	0.01	(0, 0.01)	0.01	(0, 0.02)
Socioeconomic variables								
Income (logged)			-0.02*	(-0.04, 0)	-0.01	(0, 0.02)	-0.01	(0, 0.02)
Wealth (logged)			-0.03**	(-0.04, -0.01)	-0.001	(0, 0.01)	-0.001	(0, 0.01)
Education								
Less than HS			0.12***	(0.08, 0.17)	0.07***	(0.03, 0.10)	0.06***	(0.03, 0.10)
HS diploma/GED			0.21***	(0.13, 0.29)	0.09***	(0.04, 0.14)	0.09***	(0.04, 0.14)
College + (reference)								
Insured			0.01	(-0.11, 0.12)	-0.10	(-0.11, 0.02)	-0.05	(-0.12, 0.02)
Health covariates								
Diabetes + normal HbA1c					0.34***	(0.31, 0.37)	0.34***	(0.31, 0.37)
Diabetes + elevated HbA1c					2.33***	(2.22, 2.43)	2.33***	(2.22, 2.43)
Heavy drinker					-0.03	(-0.08, 0.16)	-0.02*	(-0.08, 0.17)
Current smoker					-0.03	(-0.06, 0.01)	-0.03*	(-0.06, 0.01)
No moderate activity					0.04**	(0, 0.10)	0.04**	(0, 0.10)
Depression (CESD, 1-8)					0.002	(0, 0.01)	0.002	(0, 0.01)
Place-based covariates								
Region								
Northeast (reference)								
Midwest							0.02	(-0.02, 0.06
South							-0.003	(-0.04, 0.03)
West							0.16	(-0.02, 0.06)
Rural-urban continuum								
Urban (>1,000,000) (reference)								
Suburban							-0.01	(-0.05, 0.04)
Ex-urban							0.01	(-0.05, 0.06)

Table A5. Linear regression models testing the independent association between race/ethnicity, neighborhood perceptions and CRP (n=11,943).

	Model 1		Model 2		Model 3		Model 4	
	b	(95% CI)	*b*	(95% CI)	*b*	(95% CI)	*b*	(95% CI)
Key variables								
Latino ethnicity	0.10	(-0.01, 0.21)	-0.07	(-0.19, 0.05)	-0.03	(-0.15, 0.08)	-0.002	(-0.13, 0.13)
Neighborhood disorder	0.05***	(0.02, 0.07)	0.02	(-0.01, 0.04)	0.01	(-0.01, 0.04)	0.01	(-0.01, 0.04)
Neighborhood discohesion	0.03*	(0, 0.05)	0.03*	(0.01, 0.05)	0.01	(-0.01, 0.03)	0.01	(-0.01, 0.03)
Socioeconomic variables								
Income (logged)			-0.06***	(-0.08, -0.03)	-0.03**	(-0.05, -0.01)	-0.03**	(-0.05, -0.01)
Wealth (logged)			-0.03***	(-0.04, -0.01)	-0.02*	(-0.03, 0)	-0.02*	(-0.03, 0)
Education								
Less than HS			0.18***	(0.12, 0.23)	0.12***	(0.06, 0.17)	0.10***	(0.04, 0.16)
HS diploma/GED			0.26***	(0.18, 0.33)	0.13***	(0.05, 0.2)	0.11**	(0.04, 0.18)
College + (ref)								
Insured			-0.08	(-0.18, 0.02)	-0.08	(-0.18, 0.02)	-0.08	(-0.17, 0.02)
Health covariates								
Heavy drinker					0.09*	(0.01, 0.18)	0.09*	(0, 0.18)
Current smoker					0.28***	(0.22, 0.35)	0.28***	(0.22, 0.34)
No moderate activity					0.38***	(0.31, 0.45)	0.37***	(0.3, 0.44)
Depression (CESD, 1-8)					0.03***	(0.01, 0.04)	0.03***	(0.01, 0.04)
Place-based covariates								
Region								
Northeast (ref)								
Midwest							0.05	(-0.03, 0.14)
South							0.06	(-0.02, 0.14)
West							-0.05	(-0.20, 0.07)
Rural-urban continuum								
Urban (>1,000,000) (ref)								
Suburban							0.01	(-0.07, 0.10)
Ex-urban							0.08**	(0.02, 0.14)

Note: The models shown are fully adjusted models, including adjustment for age and sex (coefficients not shown). CRP has been log-transformed to account for skewness. *p<.05; **p<.01; ***p<.001

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VITA
MARINA ARMENDARIZ

EDUCATION

The Pennsylvania State University
Ph.D., Biobehavioral Health — Anticipated 2020
Minor: Demography

The Pennsylvania State University
M.S. in Biobehavioral Health — Fall 2018

California State University, Dominguez Hills (CSUDH)
B.A. in Psychology — May 2015
Minor: Health Science

HONORS AND AWARDS

Virginia S. Shirley Memorial Graduate Scholarship	2019-2020
GATHER Doctoral Fellow (NIMHD # 1T37MD014251)	2019-2020
Alfred P. Sloan Scholarship (G-2016-20166039)	2017-2020
Yale Ciencia Academy Fellow (1R25GM1140002017-2018)	2018-2019
Sally Casanova Pre-Doctoral Scholarship	2014-2015
Ronald E. McNair Scholar	2013-2015

PEER REVIEWED PUBLICATIONS

Yang, T. C. Matthews, S.A., Sun, F., & **Armendariz, M**. (2019). Modeling the importance of within-and between-county effects in an ecological study of the association between social capital and mental distress. *Preventing Chronic Disease*, *16*.

Santos, S. J., Hurtado-Ortiz, M. T., **Armendariz, M.**, vanTwist, V., & Castillo, Y. (2017). Obesity-related dietary patterns and health status of diabetes among at-risk Latino college students. *Journal of Hispanic Higher Education*, *16*(4), 291-313.

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