

**Neighborhood racial composition and hypertension awareness, treatment, and control: An examination of direct, mediating and moderating effects of economic and social factors**

**by**

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## **DEDICATION**

This dissertation is dedicated to the loving memory of my beloved father, Lucious Hartfield.

I cannot express in words the extent of my love for you.

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## **LIST OF ACRONYMS**

BP	Blood pressure
CDC	Centers for Disease Control and Prevention
CVD	Cardiovascular disease
HBP	High blood pressure
HEP	Healthy Environments Partnership
NHANES	National Health and Nutrition Examination Survey
NHBs	Non-Hispanic Blacks
NHWs	Non-Hispanic Whites
RBRS	Race-based residential segregation
SPD	Social production of disease/political economy of health
SEM	Social Ecological Model
SEP	Social economic position
US	United States

## **ABSTRACT**

Non-Hispanic Blacks (NHBs) suffer disproportionate rates of hypertension. Although prevalence is frequently examined, racial/ethnic differences in hypertension awareness, treatment, and control are equally important, yet poorly understood. Compared with non-Hispanic Whites (NHWs) and Hispanics, NHBs are more likely to be aware of their hypertension, more likely to receive treatment, yet less likely to achieve control. Research has established that NHB neighborhood racial composition and poverty impact health; however, the mechanisms influencing hypertension awareness, treatment, and control are obscure.

This dissertation examines three main research questions. First, whether there is an association between NHB neighborhood racial composition and hypertension awareness, treatment and control, and, if so, the extent to which this association is explained by neighborhood socioeconomic composition. Next, whether social connectedness also explains this association. Finally, I examine perceived discrimination, in conjunction with NHB neighborhood racial composition, in shaping hypertension awareness, treatment and control.

To address these research questions, data were analyzed, from a sample of 377 hypertensive adults in Detroit, Michigan, using SAS 9.0 and two-level hierarchical regression models (HLM 7). NHB neighborhood racial composition was positively associated with awareness (OR = 1.01,  $p=0.05$ ). No association was found between NHB neighborhood racial composition and treatment among those who were aware (OR=1.01,  $p=0.33$ ), or of control among those who were treated (OR=1.00,  $p=0.73$ ).

Analyses reported here did not support the hypothesis that social connectedness was associated with hypertension awareness, treatment, and control. Social connectedness was not associated with awareness (OR=1.34, p=0.08) nor did it mediate associations between NHB neighborhood racial composition and awareness. Similarly, social connectedness was not associated with treatment (OR=1.12, p=0.69), or control (OR=1.00, p=1.00) among those currently treated for hypertension.

Individual acute unfair treatment modified associations between NHB neighborhood racial composition and hypertension awareness (OR=1.02, p=0.04), and individual acute unfair treatment positively correlated with being treated for hypertension (OR=9.13, p=0.001). Aggregate acute unfair treatment was not associated with achieving hypertension control (OR=0.22, p=0.10). Findings emphasize the importance of multilevel approaches examining social and economic factors in explaining racial /ethnic differences in hypertension awareness, treatment, and control. Policy solutions should focus on creating equitable neighborhoods for all races/ethnicities.

## CHAPTER 1

### **An overview of uncontrolled hypertension and neighborhoods with a high percentage of Non-Hispanic Blacks**

#### **Introduction**

Despite major improvements in hypertension awareness and treatment over the past three decades, persistent racial, ethnic, and socioeconomic disparities in hypertension control continue to be widely documented in the United States, but poorly understood (Yoon et al, 2010; Hertz & Unger, 2005). Hypertension is not only one of the most prevalent public health problems in the United States, affecting an estimated 77.9 million (1 out of every 3) adults aged 20 years and older, it is the single most important modifiable risk factor for cardiovascular disease (CVD) (AHA, 2013; Ostchega et al., 2008; DeNavas-Walt et al., 2009; Giles et al., 2005). Nationally, nearly 40 percent of the cardiovascular mortality differences between Blacks<sup>1</sup> and Whites are attributable to hypertension (Thorpe et al., 2007; Wong et al., 2002). Yet, hypertension control is achieved in merely one-third of all patients with high blood pressure (HBP) (Hertz & Unger, 2005; Nelson, 2003; Howard et al., 2006; Wong et al., 2002; Ong et al., 2007). Reduction in hypertension prevalence and increase in hypertension control are vital to improving the health of non-Hispanic Blacks (NHBs) and eliminating cardiovascular health disparities among NHBs.

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<sup>1</sup> In the research literature, the terms Black, African American and Non-Hispanic Blacks (NHBs) are used interchangeably to denote the sample population of reference; the same is true for the terms White and Non-Hispanic Whites (NHWs) and Mexican, Mexican-American, and Hispanic. This terminology variation in this dissertation denotes the language used in the cited publications. When expressing my views, I will use NHBs, NHWs, and Hispanics.

Moreover, when compared with non-Hispanic Whites (NHWs) and Hispanics, NHBs are more likely to have hypertension; more likely to be aware of it; and more likely to be treated (Hertz & Unger, 2005; Hajjar & Kotchen, 2003). However, those who are treated are less likely to achieve blood pressure control (Hertz & Unger, 2005). Similarly, NHBs experience earlier onset of hypertension, higher systolic and diastolic blood pressures, and more secondary illnesses (kidney failure, stroke, etc.) as a result of hypertension compared with NHW and Hispanics (AHA, 2005). Efforts to explain the excess burden of hypertension among NHBs often cite several individual-risk factors such as diet, lack of physical activity, genetic factors, lack of access to health care, socioeconomic position (SEP) and medication compliance as possible explanations (Appel et al., 2006). However, while these factors may contribute to one's risk of increased hypertension and decreased hypertension control, they do not fully account for the elevated risk of hypertension and decreased rates of hypertension control observed among NHBs (Appel et al., 2006; White & Borrell, 2011). Even when such factors have been controlled for, racial and ethnic patterns still persist across hypertension awareness, treatment, and control (Appel et al., 2006). In this effort, it is important to examine not only individual-level risk factors but to concentrate on neighborhood effects (Osterling, 2007; Chaix et al., 2010). This concern, “neighborhood effects”, generally refers to the study of how local context influences the health and well-being of individuals in a way that cannot be reduced to the properties of the individuals themselves (Osterling, 2007; Sampson et al., 2002).

Race and ethnicity are strongly associated with both the physical and the social characteristics of the neighborhoods within which people reside (Braveman et al., 2005;

Williams & Jackson, 2005; Williams & Collins, 2001). Systematic differences in social and economic characteristics of neighborhoods have been associated with neighborhood racial composition (Schulz et al., 2008), and these, in turn, may have implications for not only the prevalence of hypertension, but also for hypertension awareness, treatment, and control. Limited research exist investigating associations between neighborhood racial composition, poverty, and hypertension awareness, treatment, and control (Morenoff et al., 2007). Few, if any, studies have examined specific pathways linking neighborhood characteristics to racial and ethnic variations in hypertension awareness, treatment, and control (Morenoff et al., 2007). Yet, both conceptual and empirical grounds exist for assuming race-based residential segregation (RBRS) may contribute to racial and ethnic differences in hypertension awareness, treatment, and control (Mujahid et al. 2008; Hunte et al., 2012; Hickson et al., 2012; Kramer et. al, 2004; Kershaw et al., 2011). This dissertation aims to contribute to addressing this gap in the literature.

Given the role of RBRS in guiding the distribution of neighborhood resources and social conditions at both the individual- and neighborhood-level, neighborhoods with a high percentage of NHBs may experience reduced access of goods, services, and social and economic opportunities, with implications for health (White & Borrell., 2011). Paradoxically, research has demonstrated both protective and deleterious associations between RBRS and health (Williams, 1999; Bell et al., 2006). The process by which RBRS influences health, positively or negatively, appears to be highly correlated with features of the social environment. For example, in a study examining birth outcomes among African Americans, higher isolation (a measure of racial segregation that emphasizes “the extent to which minority members are exposed only to one another,” (Massey & Denton, 1988) and is computed as the minority-weighted average of the minority proportion in each area) was associated with lower birth weight, higher rates of

prematurity, and higher rates of fetal growth restriction (Bell et al., 2006). In contrast, in this same study, higher clustering (a measure of racial segregation that emphasizes the degree to which minority group members live disproportionately in contiguous areas) was associated with more optimal birth outcomes (Bell et al., 2006). In discussing these findings, Bell and colleagues posit that isolation reflects factors associated with RBRS that are deleterious to health including poor neighborhood quality, persistent discrimination, and the intra-group diffusion of harmful health behaviors, while associations with clustering may reflect factors associated with RBRS that are health-promoting such as African-American political empowerment, social support and cohesion (Bell et al., 2006). Ultimately, RBRS is a complex multidimensional construct, and there is growing evidence of both deleterious and protective influences on birth outcomes, depending on the dimensions under consideration. Patterns and pathways linking RBRS to hypertension awareness, treatment, and control are relatively unexplored. Further research to understand racial, ethnic, and economic health disparities across hypertension awareness, treatment, and control could benefit from a focus on the effects of neighborhood attributes associated with RBRS.

Thus, a closer look is warranted into the correlates, mediators, and moderators of racial and ethnic differences in hypertension awareness, treatment, and control in order to unravel the paradoxical relationship among higher rates of awareness, and equally high rates of treatment, but lower rates of control among NHBs in comparison with NHWs and Hispanics. *The purpose of this dissertation is to investigate the extent to which hypertension control is a function of the social environment. The paucity of studies examining the relationship between hypertension awareness, treatment, and control and NHB neighborhood racial composition serves as the basis*

*for this dissertation, which hopes to add to the body of knowledge related to the social processes associated with the patterning of hypertension awareness, treatment, and control.*

In the remainder of Chapter 1, I review current literature on social determinants of hypertension awareness, treatment, and control with identified links to NHB neighborhood racial composition. In Chapter 2, I examine whether race, NHB neighborhood racial composition, and neighborhood poverty correlates with hypertension awareness, treatment, and control in a multi-ethnic sample from Detroit, Michigan. Chapter 3 considers social connectedness as a potential pathway mediating the relationships between NHB neighborhood racial composition and hypertension awareness. Similarly, I test social connectedness as a main correlate of hypertension treatment and control, while controlling for NHB neighborhood racial composition in Chapter 3. It is also important to note that other social structural features of neighborhoods such as length of residence in the neighborhood may also affect the quality and quantity of social ties with possible implications for health outcomes (Keene et al., 2013; Sampson et al., 2002; Matheson et al., 2006; Sampson et al., 1999). For this reason, length of residence will be adjusted for in Chapter 3. Using a similar framework as Chapter 3, Chapter 4 will examine relationships among NHB neighborhood racial composition, perceived discrimination, and hypertension awareness, treatment, and control. In the final Chapter (5), I will synthesize the main findings from chapters 2-4, review the overall strengths and limitations of this study, and discuss the implications for future research and for public health policy and practice.

### **Specific Aims**

The goal of this dissertation is to evaluate the relationships between NHB neighborhood racial composition and hypertension awareness, treatment, and control and potential correlates, mediators, and predictors of these relationships. I examine these relationships using a multi-ethnic sample from Detroit, Michigan. Building on the argument that, in order to attain

hypertension control, individuals must first become aware of their hypertension, next must obtain treatment, and third that the treatment obtained must adequately address their high blood pressure (HBP), I will investigate three ways that NHB neighborhood racial composition may influence hypertension awareness, treatment, and control, as specified in the aims below. The Background section, which follows, develops the rationale for each of these questions in greater detail.

**SPECIFIC AIM 1:** Chapter 2 investigates four main research questions. First, whether race is associated with hypertension awareness, treatment, and control. Second, whether NHB neighborhood racial composition is associated with hypertension awareness, treatment, and control. Third, whether neighborhood poverty is associated with hypertension awareness, treatment, and control. Fourth, whether neighborhood poverty and NHB neighborhood racial composition, together, are associated with hypertension awareness, treatment, and control.

**SPECIFIC AIM 2:** Chapter 3 investigates three main research questions. First, whether social connectedness mediates the relationships between NHB neighborhood racial composition and hypertension awareness. Second, whether social connectedness correlates with hypertension treatment, controlling for NHB neighborhood racial composition. Third, whether social connectedness correlates with hypertension control, controlling for NHB neighborhood racial composition.

**SPECIFIC AIM 3:** Chapter 4 investigates three main research questions. First, whether perceived discrimination moderates the relationship between NHB neighborhood racial composition and hypertension awareness. Second, whether perceived discrimination correlates with hypertension treatment, controlling for NHB neighborhood racial composition. Third,

whether perceived discrimination correlates with hypertension control, controlling for NHB neighborhood racial composition.

**SPECIFIC AIM 4:** Chapter 5 synthesizes the significant results from Chapters 2-4 and identifies overall strengths and limitations of this study. Similarly, a comprehensive discussion of implications for future policy and research is presented.

## **Part I: Background**

### **Hypertension Prevalence in the United States**

CVD continues to be one of the leading causes of death in the United States (Riaz & Bautman, 2012; Chobanian et al., 2003; Hajjar & Kotchen, 2003). The risk for CVD mortality increases as blood pressure increases (CDC, 2013; Chobanian et al., 2003). The relationship between hypertension prevalence and risk of CVD events is continuous, consistent, and independent of other risk factors (Chobanian et al., 2003). Hypertension is also a major risk factor for kidney disease, and stroke (Hajjar & Kotchen, 2003). For this reason, it is critical to understand factors that influence the prevalence of hypertension. Literature shows that hypertension prevalence increases with age and is further modified by race, ethnicity, geographical location, and SEP (AHA, 2012; Ostchega et al., 2008; U.S. Census Bureau, 2010). As with hypertension prevalence, hypertension awareness, treatment, and control differ significantly among populations based on race, ethnicity, gender, age, SEP, and geographical locations (Lloyd-Jones et al., 2002; Hertz & Unger, 2005).

For instance, NHBs experience disproportionate burdens of hypertension prevalence compared with other racial and ethnic groups of all ages in the U.S. (AHA, 2011; Kramer et al., 2004). In the U.S., about 1 out of every 3, which is approximately 77.9 million adults have hypertension (AHA, 2014). Among adults age 20 and older in the U.S., 33.4 % of NHW men and 30.7% of NHW women; 42.6% of NHB men and 47.0% of NHB women; 30.1 % of

Mexican-American men and 28.8% of Mexican-American women are hypertensive (AHA, 2013). Furthermore, a higher percentage of men than women have hypertension until age 45 (AHA, 2013). From ages 45–54 and 55–64, the percentage of men and women is similar; after that a much higher percentage of women than men have hypertension (AHA, 2013). The reasons for these racial and gender differences remain uncertain.

### **Hypertension Awareness**

According to data from the National Health and Nutrition Examination Survey (NHANES) 2007-2010, roughly 81.5% of those with HBP in the total U.S. population are aware they have hypertension (AHA, 2014; AHA, 2011). Hypertension awareness has shown steady increases over the past decade or more (CDC, 2011; AHA, 2014; AHA, 2011), and it also varies by race/ethnicity, age, and gender (Ostchega et al., 2008). Older adults are more likely to be aware of their hypertension status as compared with adults ages 18 to 39 (AHA, 2014; AHA, 2011; CDC, 2011). Among hypertensives aged 18–59, 63% of men compared to 87% of women are aware of their hypertensive status, while no significant gender difference was found among adults aged 60 and older (men-84% , women-87%) (AHA, 2012). Compared with NHWs and Mexican Americans, NHBs are more likely to be aware of their hypertension status (AHA, 2012); Mexican Americans in particular have lagged in hypertension awareness for the past decade (AHA, 2014; AHA, 2011; CDC, 2011).

One plausible explanation for differences in hypertension awareness based on age, gender, race, and ethnicity may be the result of socioeconomic and environmental differences across these subgroups. For instance, younger individuals and men are less likely to have health insurance and are less likely to utilize health care consistently (DHHS, 2011). Moreover, factors contributing to racial and ethnic differences in hypertension awareness may not be identical to factors that contribute to racial and ethnic difference in hypertension treatment and control.

What is known is that awareness of one's hypertensive status is a prerequisite for seeking and receiving adequate medical treatment, achieving control of the disease, and reducing the risk of future CVD related health problems (CDC, 2011).

### **Hypertension Treatment**

National data from 2007-2010 NHANES show 74.9% of those with high blood pressure were receiving treatment (AHA, 2014; AHA, 2011). As with hypertension awareness, hypertension treatment patterns are unevenly distributed by population subgroups. For instance, treatment among hypertensive adults was greater for those aged 60 years and older (77%) compared with those aged 18–59 (59%) and more common among women (74%) than men (47%) aged 18-59 (Ostchega et al., 2008). Among hypertensive individuals in this study, a smaller proportion of Mexican-Americans (50%) take antihypertensive medication compared with NHWs (69%) and NHBs (72%) (Ostchega et al., 2008). In a more recent study, among those with uncontrolled hypertension, hypertension awareness and treatment were greater for Blacks (66.3% and 50.7%, respectively) compared with Whites (aware: 59.4%, treated: 44.0%) and Mexican-Americans (aware: 51.4%, treated: 35.9%) (Valderrama et al., 2012). While most studies suggest that hypertension treatment rates are the highest among NHBs (Valderrama et al., 2012; CDC, 2011; Gu et al., 2012), one study suggested NHB males are less likely to be treated for hypertension than NHB women (Burt et al., 1995). This finding is consistent with national trends indicating that women are more likely than men to be treated for hypertension (Ostchega et al., 2008).

It is plausible that treatment is greater for NHBs because of higher awareness, perhaps due to national public health campaigns and efforts (Ostchega et al., 2008; Morenoff et al., 2007) that specifically target hypertension prevalence among NHBs. As with hypertension awareness, the association between social contexts and hypertension treatment has not been widely

examined. I was unable to identify any studies that link racial and ethnic difference in hypertension treatment to features of the social environment. Most studies simply report the prevalence of hypertension treatment without relating racial and ethnic patterns to broader social processes and spatial inequalities.

### **Hypertension Control**

Although therapy has been available for more than 50 years, most individuals with hypertension do not have their blood pressure under control (CDC, 2005). For example, in 2013, of those with hypertension, up to 47.5% did not achieve BP control to less than 140/90 mm Hg, which is the recommended standard by Joint National Convention 7 (JNC7) (AHA, 2012). Treated hypertensives aged 18–59 were more likely to have controlled their blood pressure (72%) than those aged 60 and older (58%) (Ostchega et al., 2008). Hypertension control among hypertensives was significantly higher for men aged 60 years and older (64%) compared with women (53%) in the same age group (Ostchega et al., 2008). In a recent study, among those with hypertension, hypertension control was 43.0% for Blacks compared to 48.6% for Whites (Valderrama et al., 2012).

Like hypertension awareness and treatment, similar concerns persist as to the nature of racial and ethnic differences in hypertension control. Most striking is the finding that NHBs are more likely to be aware of their hypertension status and more likely to be treated, but they remain less likely to achieve BP control while receiving treatment, when compared to NHWs and Hispanics (Hertz & Unger, 2005). The paradoxical relationship between hypertension awareness and control suggests NHBs have an advantage in hypertension awareness; this advantage yields them more likely to be treated for hypertension compared to NHWs and Hispanics, but the advantage is lost when trying to achieve hypertension control among those who are treated. Thus, further investigation is needed to understand racial and ethnic differences

across hypertension awareness, treatment, and control. Moreover, it is crucial to understand factors that contribute to racial and ethnic difference in uncontrolled hypertension, which leads to severe complications such as heart disease, stroke and renal failure (Hertz & Unger, 2005; Hajjar et al., 2006). Addressing this critical gap in the literature is the goal of this dissertation.

### **Racial Differences in Social Context and Hypertension**

NHBs and Hispanics compared with NHWs are more likely to live in racially segregated neighborhoods with high concentrations of poverty. Heightened risk factors for hypertension are linked to neighborhood characteristics (Mujahid et al., 2008); some studies have even established an inverse relationship between neighborhood poverty and hypertension control (Morenoff et al., 2007; Mujahid et al., 2008). However, these studies lacked identification of specific features of the social environment as plausible explanatory factors for this inverse relationship. Rather, a combination of indirect and direct social factors, such as access to healthy lifestyle options and frequent health care visits, were offered as potential correlates that are known to positively affect hypertension-related outcomes (Morenoff et al., 2007). Before proceeding, a brief description of social environment and its potential links to health outcomes is warranted.

*Social Context.* The social environment is often defined as structures of income inequality, which may be measured as socioeconomic position, economic isolation, racism, segregation by race and ethnicity, discrimination by sex, and lack of neighborhood resources, all of which are firmly linked with health outcomes (Hynes & Lopez, 2009). Potentially, these same factors are interconnected to uncontrolled hypertension as well.

Among the probable pathways linking structural inequities to racial and ethnic disparities in hypertension control are the combined effects of differential access to social, political, and economic resources and differential exposures to adverse social and physical environments. (Sampson et al., 2002; Schulz et al., 2008). The inequitable distribution of social, political, and

economic resources across racially segregated neighborhoods dictates opportunity structures, mediates access to quality job opportunities, and influences the distribution of access to healthy lifestyle choices (Dickerson, 2005). The combination of poverty, adverse neighborhood conditions, and isolation from mainstream society makes it difficult for residents of such neighborhoods to overcome increased risks for negative health outcomes. For instance, Diez-Roux and Mair (2010) have established neighborhood of residence is strongly patterned by individual SEP, race, and ethnicity, which suggests NHBs are more likely to live (jointly) in neighborhoods with high percentages of other NHBs and high concentrations of poverty. Similarly, LaVeist and colleagues (2007) have suggested that neighborhood structures, such as NHB neighborhood racial composition, are vital, yet understudied social determinant of health inequities. LaVeist and colleagues (2007) argue that if NHB neighborhood racial composition is not accounted for, the oversight may lead to false conclusions about racial differences in risk exposures. Neighborhood poverty and neighborhoods with high percentages of NHBs are extremely difficult to disentangle (Seitles, 1996) and share a common underlying factor -- institutional racism (discussed in more depth below) -- that must be taken into account when understanding how neighborhoods with a high percentage of NHBs contribute to racial and ethnic health disparities (Osypuk & Acevedo-Garcia, 2010). Thus, failure to examine the role and influence of NHB neighborhood racial composition may contribute to widely held beliefs about biological explanations for racial and ethnic differences across hypertension awareness, treatment, and control and may possibly overemphasize cultural difference as an underlying cause of racial and ethnic differences in health behaviors (Thorpe, Jr. et al., 2008). The theoretical framework in Part III below outlines pathways through which neighborhood effects may contribute to hypertension awareness, treatment, and control.

## **Part II: NHB Neighborhood Racial Composition**

### **Race-Based Residential Segregation (RBRS)**

Racial separation in place of residence is an engrained institutionalized feature of urban life in the United States (Squires & Kubrin, 2005; Squires et al., 2002). Residential segregation is defined as the extent to which, within a given geographical area (e.g., a city), individuals belonging to different social groups live in neighborhoods characterized by different social compositions (Reardon & O'Sullivan 2004). Schulz and colleagues (2002) further emphasize that RBRS is the spatial manifestation of macrolevel social processes and racial ideologies that keep African Americans from needed resources to maintain health. Social, cultural, and economic policies and practices characterize dissimilarities in neighborhood environments, which further create and maintain racial separation (Williams & Collins, 2001). More pointedly, racial segregation refers to the degree to which two or more groups live separately from one another in a geographical area (Massey & Denton, 1988), and it is often measured with indices of *evenness* (involves the differential distribution of the subject population), *exposure* (measures potential contact), *concentration* (refers to the relative amount of physical space occupied), *centralization* (indicates the degree to which a group is located near the center of an urban area), and *clustering* (measures the degree to which minority group members live disproportionately in contiguous areas) (Massey & Denton, 1988).

The origin of RBRS in the United States dates back several hundred years when Whites resided separately from African Americans because of racialized ideologies that perpetuated the idea that African Americans were inferior to Whites (Griffith et al., 2010; White, 1986). RBRS emerges from a long history based in these ideologies that supported racism, and were instantiated in legal, lending and other codes. While no longer legal, the legacies, such as institutional racism, remain, as do the racialized ideologies (Williams & Collins, 2001). The

Civil Rights Act of 1964 deemed such actions as unconstitutional and illegal, but RBRS is a system that socially, economically, and politically continues to marginalize African Americans (Bell, 2004; Griffith, et al., 2010). According to the 2010 Census, Black-White RBRS is stagnant with little change reported from 2000 and 2005-2009 (Lichter, et al., 2012; Logan & Stults, 2011). For example, Whites, on average, live in neighborhoods that are nearly 83% White, Blacks live in neighborhoods that are approximately 56% Black, while Hispanics, on average, reside in communities that are 42% Hispanic (Lichter, et al., 2012; Logan & Stults, 2011). Detroit, Michigan continues as the most segregated city in the United States, which in part was exacerbated by the recent recession and home foreclosure crises that started in 2007 (Logan & Stults, 2011). Detroit's high rates of RBRS have implications for the health status and health outcomes but more specifically, hypertension awareness, treatment, and control.

### **NHB Neighborhood Racial Composition**

Even though NHB neighborhood racial composition has often been conceptualized as RBRS, they are not the same; rather, NHB neighborhood racial composition is defined as “percent Black” at the census block group in 2000 Census data (Schulz et al., 2002; White & Borrell., 2011). Thus, NHB neighborhood racial composition is a proxy for correlated nonracial neighborhood conditions (such as poverty and crime) (Sampson et al., 2002; Do et al., 2008) as well as perceptions that may or may not be associated with actual conditions to which Whites respond (Taub et al. 1984; Quillan & Pager, 2001) and is postulated to be related to prejudice, interracial conflict and discrimination (Blanchard et al., 2004). NHB neighborhood racial composition has been interpreted as a measure of neighborhood racial context (White and Borrell, 2011; Zenk et al., 2005), and racial composition has been postulated to be related to lower exposure to discrimination, enhanced social cohesion, mutual social support, and a sense of community (Bécares et al., 2009; Hunte et al., 2012). Paradoxically, the racial composition

measure often serves as an indicator for a relatively large NHB population with high concentrations of economic and social challenges and provides insight into the social context of the neighborhoods where residents live, such as crime, deteriorating buildings, ineffective public schools, and other social ills (Massey, 2004; Massey 1995; Massey & Denton 1993). Where residential segregation studies traditionally include neighborhood or metropolitan-level variables as predictors such as *evenness*, *exposure*, *concentration*, *centralization*, and *clustering* of residents (Massey & Denton, 1988), neighborhood racial composition is simply a measure of the percent of residents who are of a given race, without indicators of their distribution within an area.

However, using NHB neighborhood racial composition is consistent with previous research designs used to explore the determinants of residential segregation at the individual level; prior studies typically use cross-sectional data to examine the association between individual-level characteristics and racial and ethnic composition of individual's neighborhoods (South et al., 2011; Oliver & Wong; 2003; Emerson et al., 2001). The use of NHB neighborhood racial composition also allows for the analysis of both individual and combined effects of NHB neighborhood racial composition and neighborhood poverty. For this research, NHB neighborhood racial composition provides insight into the extent to which NHB individuals are ostracized by other groups (Brondolo et al., 2011) and provides insight into to the greatest determinant, of health, between NHB neighborhood racial composition and neighborhood poverty.

### **NHB Neighborhood Racial Composition and Hypertension**

Studying NHB neighborhood racial composition allows for the compilation of information about the ways in which individual-level and neighborhood-level characteristics shape racial and ethnic differences in hypertension awareness, treatment, and control. Few

empirical studies have examined these factors together, but some evidence suggests that racial and ethnic disparities in hypertension depend on the combined effects of the socio-environmental context (Thorpe et al., 2008). Thorpe, Jr. and colleagues (2008) conducted a comparative analysis of racial disparities in hypertension among NHANES participants and Exploring Health Disparities in Integrated Communities (EHDIC). Researchers found that after adjusting for age, gender, household income, marital status, education level, and insurance status, Blacks in both studies had significantly higher odds of hypertension than Whites (Thorpe, Jr. et al, 2008). Another study by LaVeist and colleagues (2007) showed similar findings that racial and ethnic differences in social and environmental exposure partially accounted for racial and ethnic differences in hypertension.

Collectively, these differences may be attributable to the fact that NHBs, NHWs, and Hispanics tend to live in segregated neighborhoods where the social and political contexts are different and therefore have differential exposures and risks. It appears that the findings by LaVeist and colleagues (2007) are associated with premises embedded in the *social production of disease/political economy of health (SPD)* theory, which suggests structural, social, and economic forces perpetuate forms of institutional racism through differential access to goods, services and opportunities, resulting in differential health outcomes. The findings of Thorpe Jr, and colleagues (2008) and LaVeist and colleagues (2007) imply that inequities in hypertension and potentially racial and ethnic differences in hypertension awareness are associated with environmental factors. Their conclusions suggest racial and ethnic differences in hypertension can no longer be attributed only to biological differences among racial and ethnic groups, as has been suggested, but racial and ethnic differences in hypertension must account for social and environmental differences (Bamshad, 2005).

## **Part III: Theoretical Framework and Conceptual Model**

### **Introduction**

This dissertation draws on two theoretical frameworks: *the Social Ecological Model of Health and the Social Production of Disease/ Political Economy of Health*. These theories conceptualize NHB neighborhood racial composition as a complex and dynamic process in which social environmental conditions are associated with inequitable resources, life opportunities, and frequency of health care. Together these theories explain how structures such as institutional racism sustain neighborhood-level factors (like NHB neighborhood racial composition) that can be both positive and contribute to social connectedness among neighborhood residents, as well as negative and create disadvantaged resource availability, reduced frequency of health care, and increased likelihood of high concentrations of poverty. Below, I use these two overarching frameworks to provide a general overview of how hypertension awareness, treatment, and control vary according to the social and economic environments in which they occur.

### **Social Ecological Model (SEM) of Health**

Determinants of hypertension awareness, treatment, and control span multiple levels of the *Social Ecological Model (SEM)* of health. Its underlying hypothesis suggests that dynamic relationships exist among individuals and between people and their environments. Specifically, SEM addresses problems across several diverse levels: intrapersonal (individual)<sup>2</sup>, interpersonal, organizational, community, and public policy (McLeroy et al., 1988). Each of the five levels exerts a different degree of influence, and the interpersonal, organizational, and community levels have slightly different meanings depending on the author (McLeroy et al., 1988). Similarly, it is unclear where culture, social class, racism, gender, economics/employment

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<sup>2</sup> Other Ecological Models use differing nomenclature to refer to the same concepts: relationship, community, institutional, and societal

are best suited or if they fit anywhere (McLeroy et al., 1988). To depict my conceptual model, I will use the SEM framework of McLeroy and colleagues (1988).

I will continue with a brief discussion of each level of the SEM, and I will highlight the manner in which each level is associated with hypertension awareness, treatment, and control, as identified in Figure 1.1. It is also important to note in Figure 1.1 that fundamental, intermediate, and proximate levels are used to further illustrate the respective level of interaction. The intrapersonal level of the SEM is defined as individual characteristics such as knowledge, attitudes, behavior, skills, and self-efficacy, and this level also includes gender, religious identity, race/ethnic identity, age, economic status, and financial resources (McLeroy et al., 1988). In this dissertation, age, sex, race, education, marital status, and household income are covariates, which will be controlled for in these analyses. Hence, they are not depicted in Figure 1.1.

Different from the intrapersonal level, the interpersonal processes and primary groups are formal and informal social networks and social support systems including family, friendship networks, supervisors, work groups, diversity, customs, traditions, Greek life, and economic forces (McLeroy et al., 1988). In other words, the interpersonal level includes relationships among organizations, institutions, and informational networks within defined boundaries (McLeroy et al., 1988). Social connectedness is posited as an example of an interpersonal factor in Figure 1.1.

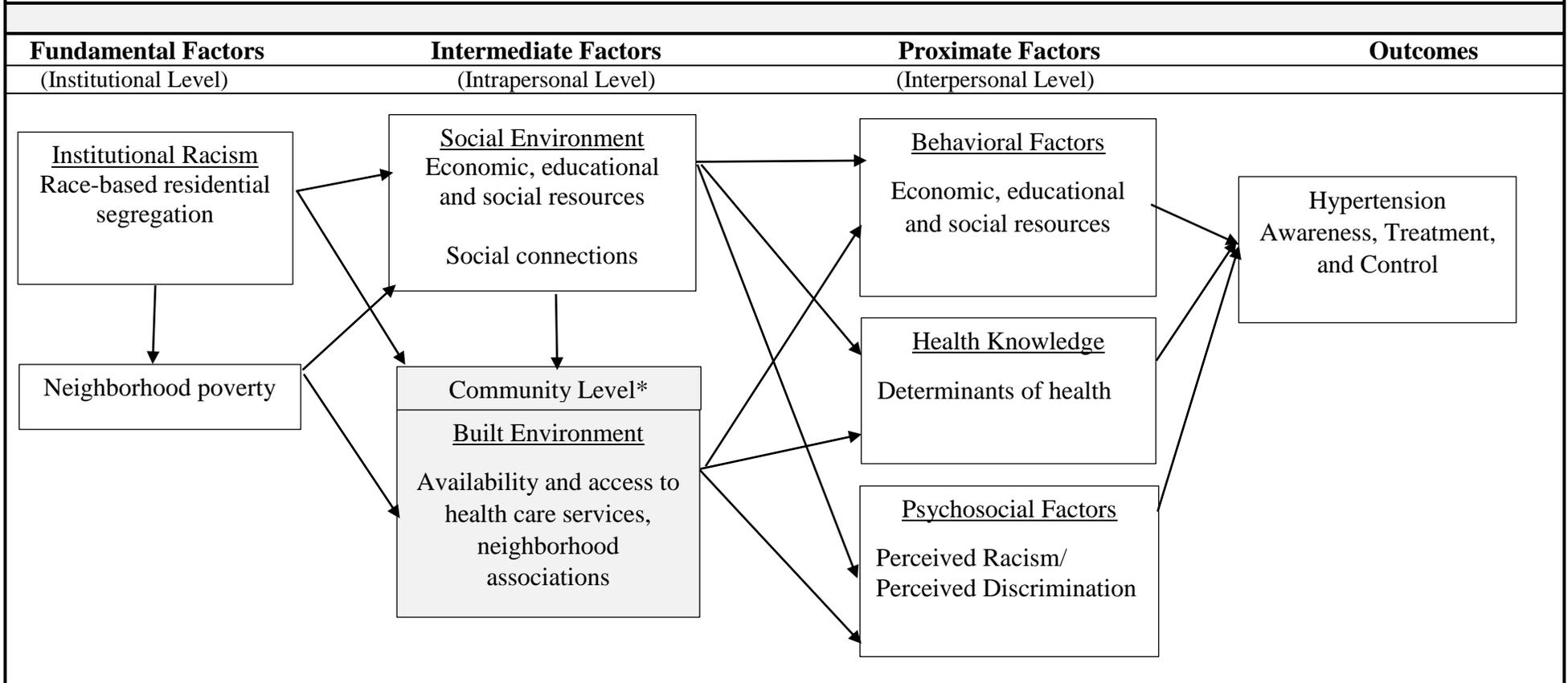
Figure 1.1 also shows NHB neighborhood racial composition (institutional racism) and neighborhood poverty as manifestations of a broader structure, and are classified as institutional level factors. Institutional factors comprise social institutions with organizational characteristics and formal (and informal) rules and regulations for operations (McLeroy et al., 1988). Financial

policies, unclean environments, distance, noise, air quality, safety, etc. are classified as institutional factors.

The community level explores relationships among organizations, institutions, and informational networks within defined boundaries (McLeroy et al., 1988). This level may include locations in the community such as built environment, community leaders, transportation, workplaces, businesses, and frequency of health care (Elder et al., 2007; McElroy, 1988). More specifically, the community level seeks to identify the characteristics of these settings that are associated with disease (Elder et al., 2007). While included in Figure 1.1, the community level, built environment, will not be explicitly examined in this dissertation since the focus of this dissertation is the social (context) environment. However, inferences may be drawn from the built environment to explain plausible associations with other factors.

In contrast to the previously identified levels, the public policy level is the manifestation of intentional rules, regulations, policies, and informed structures. Specifically, the public policy level refers to local, state, national and global laws and policies (McLeroy et al., 1988), where organizational decisions are made at a governmental or non-governmental level (Sallis et al., 2006; Sallis & Owen, 2002; Elder et al., 2007). This level will be highlighted in Chapter 5.

**Figure 1.1. Determinants of hypertension awareness, treatment, and control span multiple levels of the *Social Ecological Model (SEM)*.**



\*Adapted from Schulz, A.J., Zenk, S., Odoms-Young, A., Hollis-Neely, T., Nwankwo, R., Lockett, M., Ridella, W., & Kannan, S. (2005). Healthy eating and exercising to reduce diabetes: Exploring the potential of social determinants of health frameworks within the context of community-based participatory diabetes prevention. *American Journal of Public Health, 95*(4), 645-651.

\*\*Gray boxes are not explicitly examined.

In this dissertation, the SEM framework is further supported by the *Social Production of Disease/Political Economy of Health (SPD)* theory to provide a deeper conceptualization of the mechanisms through which institutional racism contributes to inequitable SEP and ultimately leads to poor health outcomes as described below (Krieger, 2001; CSDOH, 2007).

### **Social Production of Disease/Political Economy of Health**

The SPD theory hypothesizes that social and political contexts (including social structures, political institutions and economic processes) create, reinforce, and maintain economic and social privilege, and inequality, all of which are fundamental causes (Link & Phelan, 1996) of social inequities in health (CSDOH, 2007; Krieger, 2001). As with the SEM, SPD posits neighborhood poverty and NHB neighborhood racial composition as collective social structures, political institutions, and economic processes that contribute to unfavorable SEP and, ultimately, to unfavorable health outcomes. It is clearly established that groups with more resources, wealth and power, are better positioned to leverage new resources. Similarly, unfavorable outcomes are directly linked to a lack of resources, such as money, knowledge, prestige, power, and beneficial social connections that protect health no matter what mechanisms are relevant at any given time. The SPD coincides with Link and Phelan's (1995) claim that an ongoing association exists between SES and health status because SES "embodies an array of resources, such as money, knowledge, prestige, power, and beneficial social connections that protect health no matter what mechanisms are relevant at any given time." In other words, despite advances in vaccinations, screening techniques, or any other piece of health technology or knowledge, the underlying fact is that those from low SES communities lack resources to protect and/or improve their health (Link & Phelan, 1995). Sometimes this framework is described utilizing an upstream-downstream metaphor, which suggests there are greater

(structural) forces upstream contributing to unfavorable outcomes downstream (Krieger, 2001; CSDOH, 2007).

With regard to race and ethnicity, the social and political contexts that determine social inequality have been termed “institutional racism,” and contribute to inequitable distribution of resources at the community or neighborhood level. Institutional racism is defined as the structures, policies, practices, and norms resulting in differential access by race to the goods, services, and opportunities of society, and it occurs when seemingly harmless policies and practices result in the disproportionate harm to a particular racial and/or ethnic group (Jones, 2003; Shavers & Shavers, 2006). Individuals who reside in neighborhoods with a high percentage of NHBs tend to experience inequitable distribution of social and economic resources compared to individuals in neighborhoods with a low percentage of NHBs. These social inequities result in members of lower socioeconomic groups living in less favorable material circumstances than higher socioeconomic groups (CSDOH, 2007). One main pathway SPD attempts to examine is the health consequences of experiencing economic and non-economic forms of racial and ethnic discrimination (Krieger, 2001; Krieger, 1999; Williams, 1999). Residential segregation leads to greater economic deprivation among African Americans and increased likelihood of living in neighborhoods without quality resources that will provide for healthy outcomes (Krieger, 2001). Consequently, lack of healthy options are decreased and hypertension risk (and other health risks) is increased (Krieger, 2001). Similar social, political, environmental, and economic inequalities patterns effect health care facilities and businesses that are located in poor racially segregated neighborhoods. Building on the SPD theory and the SEM, I will provide a brief review of this dissertation’s focus.

## **Review**

I use multilevel, multivariate models to build on the extant literature in several important ways. In Chapter 2, I test the hypothesis that race is correlated with hypertension awareness, treatment, and control. Second, I test the hypotheses that NHB neighborhood racial composition, and neighborhood poverty, when entered individually in models, are correlated with awareness, treatment, and control, after adjusting for individual-level characteristics including race and ethnicity. I also test whether NHB neighborhood racial composition and neighborhood poverty, together, correlate with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity. In Chapter 3, I test whether social connectedness mediates the relationship between NHB neighborhood racial composition and hypertension awareness, and I test a main effect between social connectedness and hypertension treatment and control, while controlling for NHB neighborhood racial composition. In Chapter 4, I test the extent to which perceived discrimination moderates the relationship between NHB neighborhood racial composition and hypertension awareness and the extent to which perceived discrimination correlates with hypertension treatment and control, while controlling for NHB neighborhood racial composition.

Chapter 5 will discuss implications of the findings presented in Chapters 2-4, explicating associations between NHB neighborhood racial composition and hypertension awareness, treatment and control. The chapter will focus specifically on implications for social policies addressing racial, ethnic, and socioeconomic patterns. Moreover, I will identify potential social policies that are informed by the research that I present to address neighborhood poverty and RBRS.

## **Conclusion**

Limited published research explores the associations between NHB neighborhood racial composition and hypertension awareness, treatment, and control. This dissertation will attempt to address these critical gaps by examining the potential ways that social environment factors contribute to racial, ethnic, and socioeconomic patterns across hypertension awareness, treatment, and control as diagrammed in Figure 1.1. Published empirical research suggests that neighborhood and structural characteristics interact in important ways for residents' health. However, no studies of which I am aware have examined neighborhood and structural characteristics as underlying causes of racial and ethnic differences in hypertension awareness, treatment, and control. While some studies have included measures of race and ethnicity, there is a need to investigate the role of NHB neighborhood racial composition and neighborhood poverty as independent correlates of hypertension awareness, treatment, and control.

This dissertation will examine links between NHB neighborhood racial composition and hypertension awareness, treatment, and control (Figure 2.1, Chapter 2) by testing the role of race and ethnicity (Figure 2.1, Chapter 2) and the role of neighborhood poverty (Figure 2.3, Chapter 2). Also, this chapter examines the combined effects of NHB neighborhood racial composition and neighborhood poverty on hypertension awareness, treatment, and control, in each model respectively. Similarly, I examine independent correlates such as social connectedness (Figures 3.1-3.2, Chapter 3) and perceived discrimination (Figures 4.1-4.2, Chapter 4) in explaining racial and ethnic differences across hypertension awareness, treatment, and control.

Examining individual characteristics within the context of social and built environmental characteristics is critical to understanding the sources of racial and ethnic differences in hypertension awareness, treatment, and control. I hypothesize that social connectedness is an important correlate, independent of neighborhood racial composition, that may potentially yield

protective effects of social relationships even in the context of adverse structural conditions and explain the positive association between NHB neighborhood racial composition and hypertension awareness. Similarly, social connectedness may potentially yield protective effects on hypertension treatment and control but in different ways. Likewise, I hypothesize that perceived discrimination is an important correlate that may potentially yield harmful effects in explaining racial and ethnic differences in hypertension awareness, treatment, and control yet in different ways. Perceived discrimination may moderate the protective effects of NHB neighborhood racial composition on hypertension awareness and may exert a main effect on hypertension treatment and control. Collectively, these findings may help elucidate the extent to which racial and ethnic differences in hypertension awareness, treatment, and control are functions of their social (and built) environment among individuals who reside in neighborhoods with a high percentage of NHBs (Gordon-Larsen et al., 2006; Williams & Jackson, 2005; Morenoff et al., 2007).

### **Implications for Future Work**

This dissertation will add to the understanding of the impact of NHB neighborhood racial composition on health outcomes, specifically hypertension awareness, treatment, and control. The recognition that neighborhood characteristics have an effect on hypertension awareness, treatment, and control -- and not only on hypertension prevalence -- would open new avenues for exploring how the social environment of neighborhoods affects hypertension awareness, treatment, and control. Little is known, however, regarding which aspects of the social environment influence hypertension awareness, treatment, and control. To eliminate racial and ethnic health disparities, policy makers must examine the causes of and remedies for concentrated neighborhood poverty and RBRS. In conclusion, policies targeting increased social

and environmental risks are needed to address health disparities, rather than concentrating primarily on individual-level solutions.

## **General Methodological Approach**

### **Data Source**

Data from the Healthy Environments Partnership (HEP) 2002 Community Survey will be used in these analyses (Schulz et al., 2005). In January 2001, the University of Michigan Institutional Review Board for Protection of Human Subject approved the HEP study. The HEP Community Survey is a stratified, two-stage, equal probability sample of adults ages 25 and over living in occupied housing units or household in three areas of Detroit, Michigan, with the goal of obtaining 1000 completed interview among NHB, NHW, and Hispanics (Schulz et al., 2005). Face-to-face interviews were completed with 919 community residents between March 2002 and March 2003 with a response rate of 75% of all households completing the interviews. (Schulz et al., 2005). To account for missing data as well as to account for the sampling design in analyses, multiple imputations using IVEWARE (Raghunathan et al., 2002) were performed. Weights were created to accurately account for appropriate representation of racial and ethnic groups across SEP in this sample, and the weights were applied to adjust for probabilities of selections within strata and to match the sample to Census 2000 population distribution of the study communities (Schulz et al., 2005).

Within the HEP sample, statistical power to investigate the associations outlined in Figure 1.1 is reduced with each analysis. The analyses focused on hypertension awareness are limited to individuals who are hypertensive (n=377); hypertension treatment analyses are only relevant among individuals that were aware of their hypertensive status (n=250); and hypertension control analyses were conducted with the sample of adults receiving treatment for their hypertensive condition (n=216). Due to the sampling strategy, this HEP survey offers

unique opportunities to examine associations between both race and ethnicity and poverty in relation to hypertension outcomes. The sampling strategy intentionally randomly sampled individuals across socioeconomic and racial and ethnic groups, to enable our research to disentangle effects of both race and ethnicity and poverty.

### **Statistical Analyses**

Descriptive statistical analysis will be performed, including calculation of frequencies and percentages for categorical variables and means, medians, and standard deviations for continuous variables across the analytic samples (for awareness, treatment, and control separately). In addition, I will also perform logistic regressions, analysis of variance (ANOVA), and F-tests using SAS (Version 9.2, Cary, NC) to examine continuous sample characteristics across age, race, and gender categories. Categorical measures will be compared across samples by race, ethnicity, age, and gender groupings using chi-squared tests.

Two-level weighted hierarchical logistic regression models (with odds ratio and confidence intervals) will be estimated using HLM 7 (Scientific Software International, Lincolnwood, IL, 2006) to examine associations of interest. All models will be weighted for unequal probabilities of selection within each stratum to match the sample to Census 2000 population distributions for the study areas, and all missing data were imputed (Dvonch et al., 2009). Of the total sample (n=919), 377 NHBs, NHWs, and Hispanics had a systolic blood pressure of at least 140 mmHg, diastolic blood pressure of at least 90 mmHg, or reported being told by a health professional that they were hypertensive. Among the 377 with hypertension, 250 were aware of their hypertension, and 216 of the 250 received treatment for hypertension. A total of 111 adults who were treated for hypertension had the condition under control.

NHB neighborhood racial composition at the neighborhood level will be captured through the measure: “percent NHBs”, which reflects the percentage of NHBs in a neighborhood

and reflects the proportion of specific racial and ethnic groups within each neighborhood. NHB neighborhood racial composition is used to capture the racial and ethnic variability across the neighborhoods sampled in the 2002 HEP Survey.

### **Limitations**

The 2002 HEP data are cross-sectional, which limits my ability to draw causal inferences from the analyses. Finally, while my interests in RBRS and hypertension control have driven this work, the small geographic areas sampled in the HEP survey may reduce my ability to use commonly documented measures of residential segregation (such as dissimilarity), and requires use of proxy measures of residential segregation, such as NHB neighborhood racial composition.

### **Strengths**

Despite these limitations, this dissertation is one of the first to examine racial and ethnic differences in neighborhood racial composition as a plausible explanation for racial and ethnic differences in hypertension awareness, treatment, and control. The availability of measures of social relationships and discrimination is relatively unique and allows testing of specific ways linking NHB neighborhood racial composition to racial and ethnic differences across hypertension awareness, treatment, and control. While the prevalence of hypertension is frequently examined, this dissertation aids in furthering empirical research on hypertension awareness, treatment, and control.

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## CHAPTER 2

### **Do differences in neighborhood racial composition explain racial and ethnic differences in hypertension awareness, treatment, and control?**

#### **Introduction**

Regarding the causes of racial and ethnic differences in hypertension awareness, treatment, and control, the debate is increasingly expanding to factors beyond the largely individualistic explanations that center on genetics, lack of physical exercise, and poor diet. Although diet, genetics, physical exercise, and socioeconomic position (SEP) may play a role in shaping hypertension awareness, treatment, and control, focusing solely on such explanations lacks an analysis of economic and social factors that may serve as underlying causes of persistent racial and ethnic difference across hypertension outcomes, even when individual covariates are accounted for (Gorman & Sivaganesan, 2007; Kramer et al., 2004; Howard et al., 2006). Neighborhood effects are emerging as important determinants that shape the conditions that put individuals “at risk of risk” (Osterling, 2007; White & Borrell, 2011; Diez-Roux, 2003; Roux, 2003; Kawachi & Berkman, 2000). To fully understand the complex associations between NHB neighborhood racial composition and hypertension awareness, treatment, and control, the role of race, poverty, and other factors must be examined. An analysis of the role of race without regard to NHB neighborhood racial composition and neighborhood poverty, and an analysis of neighborhood poverty without regard to race and NHB neighborhood racial composition offers an incomplete picture of the potential importance of social factors in shaping racial and ethnic

differences in hypertension outcomes. Such an understanding is particularly important given the variable role of race-based residential segregation (RBRS) in influencing health outcomes, and the effects of economic restructuring in concentrating poverty in NHB neighborhoods (Williams & Collins, 2001; Sampson, 2000).

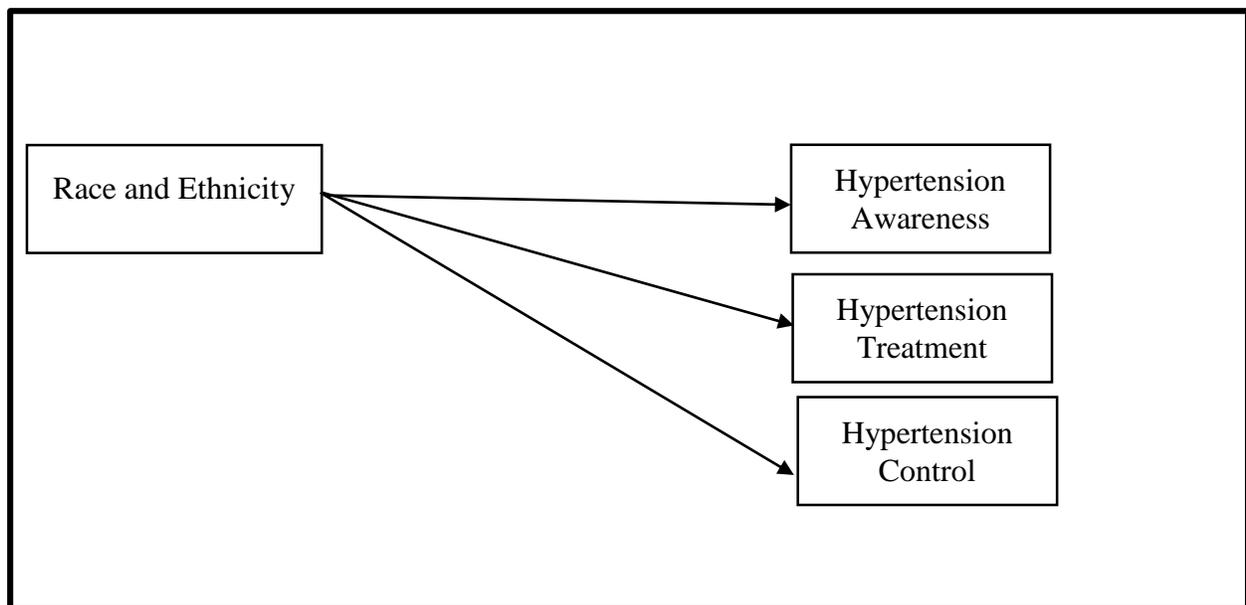
Increasingly, a growing body of literature suggests neighborhood measures such as RBRS and neighborhood poverty act as fundamental causes in explaining racial, ethnic and socioeconomic differences not only in hypertension outcomes but obesity, BMI, infant mortality, and stress (Williams & Collins, 2001; Sampson, 2000). Disentangling the social processes that shape neighborhood effects and the health of the residents is central to understanding and addressing social disparities that may contribute to racial and ethnic differences in hypertension awareness, treatment, and control. In this chapter, I examine several hypothesized associations: race and ethnicity, NHB neighborhood racial composition, and neighborhood poverty as correlates of hypertension awareness, treatment, and control (see Figures 2.1-2.4). In addition, I consider the extent to which NHB neighborhood racial composition and neighborhood poverty, together, influence hypertension awareness, treatment, and control, after adjusting for individual-level characteristics including race and ethnicity. Similarly, I consider the contribution of individual-level characteristics and the extent to which they are influenced by neighborhood characteristics (Schulz et al., 2008). Collectively, Chapter 2 explores the magnitude to which hypertension awareness, treatment, and control among individuals who reside in racially segregated neighborhoods are functions of the social environment (Williams & Jackson, 2005; Morenoff et al., 2007).

### **Theoretical Framework**

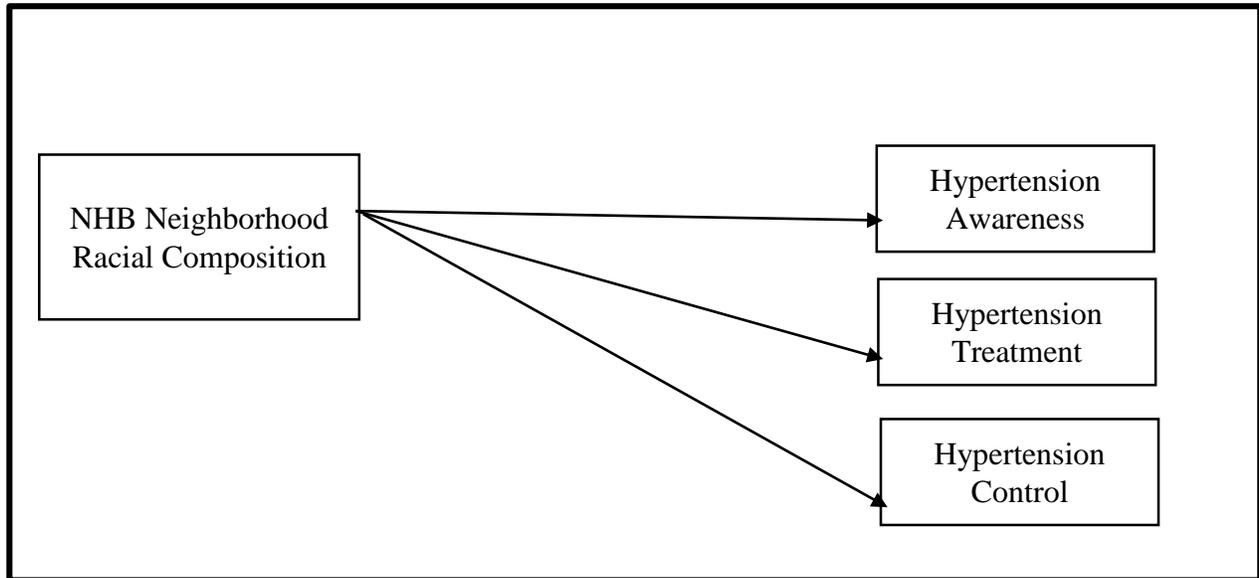
Figures 2.1-2.4 schematically show four ways by which racial and ethnic differences in hypertension awareness, treatment, and control span across multiple levels of the social

ecological model (SEM) of health (Elder et al., 2007). The theoretical frameworks for this research were discussed in greater depth in Chapter 1. My intent is to bring together research on NHB neighborhood racial composition and neighborhood poverty with epidemiological research on racial and ethnic patterns in hypertension awareness, treatment, and control to create a conceptual framework to generate research hypotheses that can be tested empirically.

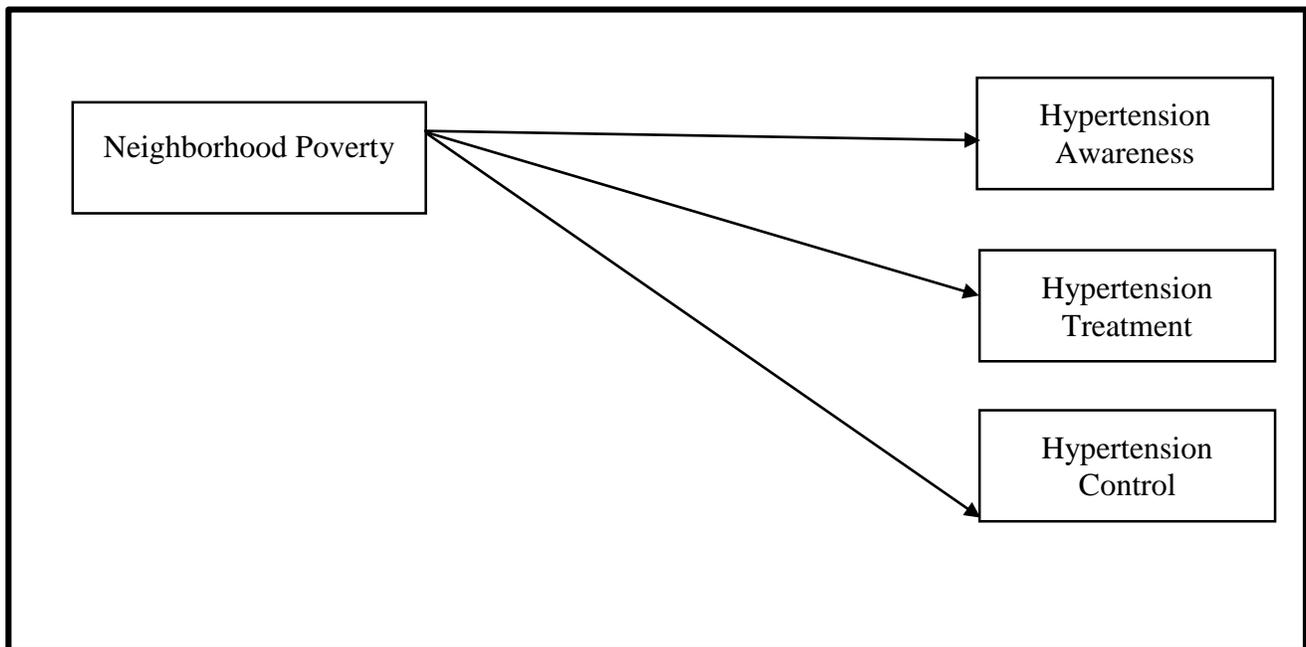
**Figure 2.1.** Race and ethnicity correlate with hypertension awareness, treatment, and control.



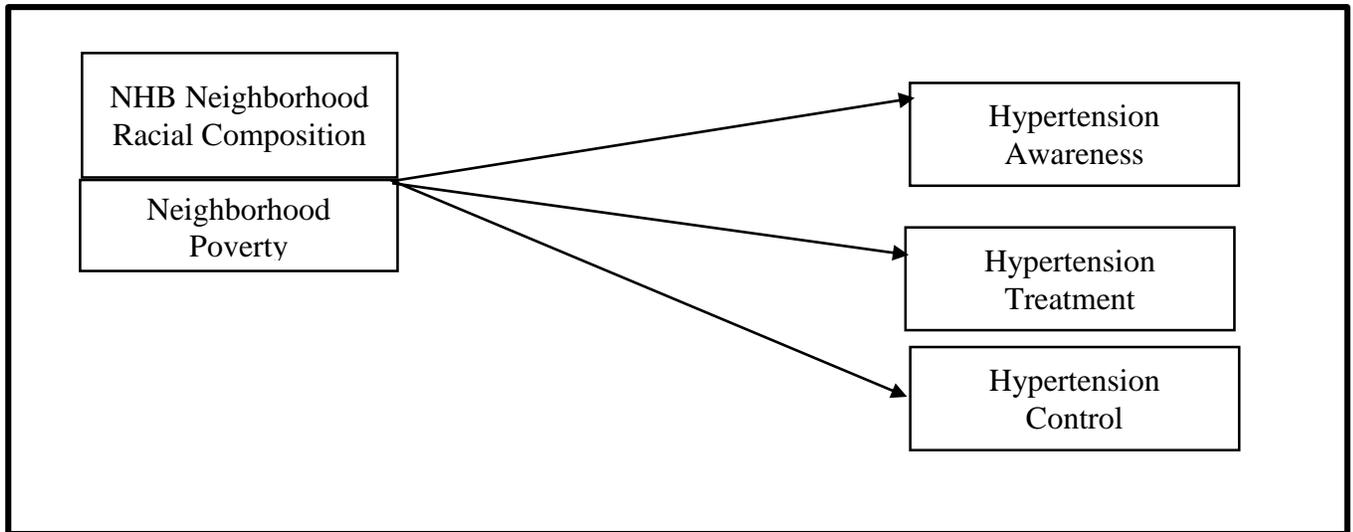
**Figure 2.2.** NHB neighborhood racial composition correlates with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity.



**Figure 2.3.** Neighborhood poverty correlates with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity.



**Figure 2.4.** Neighborhood racial composition and neighborhood poverty, together, correlate with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity.



## Background

Non-Hispanic Blacks (NHB) are disproportionately more likely to have hypertension compared with non-Hispanic Whites (NHW) and Hispanics. For NHBs, hypertension has been identified as the single most significant cause of death across all levels of SEP (CDC, 2011). Thirty-five percent of NHBs are hypertensive, and hypertension accounts for 20% of Black deaths in the United States, which is twice the percentage of deaths due to hypertension among NHWs (CDC, 2011). When compared with NHWs and Hispanics, previous studies have found that NHBs are more likely to be aware of their hypertension, and in most cases more likely to receive treatment, yet are less likely to achieve hypertension control when treated for hypertension (AHA, 2013; CDC, 2011; Hertz & Unger, 2005; Hajjar & Kotchen., 2003; Hajjar et al., 2006). Although racial and ethnic differences in hypertension awareness, treatment, and control are well established (AHA, 2013; CDC, 2011; Hertz & Unger, 2005; Hajjar & Kotchen.,

2003; Hajjar et al., 2006), the sources of these differences are not widely examined or identified. Understanding the relationships between race and ethnicity and hypertension awareness, treatment, and control is complicated but remains an important public health issue that is implicated in excess risk of cardiovascular mortality among NHBs.

### **Social Construction of Race**

In the United States, race has long been used and remains a powerful organizing construct to create and enforce social order, a pathway through which inequitable opportunities are structured, including health opportunities (Smedley & Smedley, 2005; Schulz et al., 2002). Racial categories represent and reinforce differential access to political, economic, and social sources (Schulz et al., 2002; Williams & Collins 2001). The term “race” has been employed to explain diverse physical characteristics and socio-geographical experiences among populations (Wilkinson & King, 1987). Scholars have suggested that a kind of "racial etiquette" exists, a set of interpretative codes and racial meanings that operate in the interactions of daily life (Omi & Winant, 1994; Darity et al., 2005). Racial codes and meanings are shaped by one’s perception of race, and the value one assigns to race in a comprehensively racial society. The assigned values determine the "presentation of self, distinctions of status and appropriate modes of conduct” (Omi & Winant, 1994; Darity et al., 2005). "Etiquette" is not mere universal adherence to the dominant group's rules, but it is a dynamic combination of rules with values and beliefs of racially subordinated groupings assigned to them (Omi & Winant, 1994; Darity et al., 2005). This “racial subjection" is characteristically ideological and persists despite advanced research in this area indicating that race is a social, rather than biological, construction (Omi & Winant, 1994; Darity et al., 2005). For instance, in the U.S., racial ideologies operate socially, politically, and legally to restrict the access of African Americans and other labeled racial groups to economic resources (Schulz et al., 2002; Darden 1986; Farley et al. 1994; Hummer 1996;

Krieger 1999; LaVeist 1992; Massey & Denton 1993; Williams 1996, 1999). More so, institutional or structural forms of systematic discrimination, usually termed institutional racism, can limit educational, employment, and housing opportunities (Schulz et al., 2002; Massey & Denton, 1988). Race-based residential segregation (RBRS) is a prominent feature of institutionalized racism.

### **NHB Neighborhood Racial Composition**

In the United States, RBRS remains a central focus of the African-American experience (Acevedo- Garcia & Lochner, 2003; Acevedo-Garcia et al., 2003; Charles, 2003; Farley & Frey, 1994; Griffith, et al., 2010; Iceland et al., 2002; Lichter et al., 2012; Logan & Stults, 2011; Williams & Collins, 2001). RBRS was designed to separate and protect Whites from social interaction with Blacks (Williams & Collins, 2001). Despite the vast literature that has examined correlations between RBRS and health outcomes, the patterns and pathways linking NHB neighborhood racial composition with health outcomes are not as examined or understood as RBRS. Similarly, the relationships among NHB neighborhood racial composition and hypertension awareness, treatment, and control are not widely examined (LaVeist et al., 2007), which leads to uncertainty regarding the probable associations. What has been established is that place of residence is strongly patterned by SEP and race (Diez-Roux & Mair, 2010). Patterns of segregation among Blacks in the U.S. remain the highest of all racial and ethnic groups, and racial (ethnic) segregation is even higher than levels of economic segregation (Massey et al., 2004; White & Borrell, 2011). Whether NHB neighborhood racial composition or RBRS, racial concentration of a neighborhood is a manifestation of institutional racism and is postulated to be related to discrimination, prejudice, crime, disinvestment, and poor neighborhood resources (White & Borrell, 2011; Blanchard et al., 2004; Taub et al., 1984).

### **Neighborhood Poverty**

Neighborhood poverty is typically included in analytical models in order to assess independent associations with outcomes, distinct from race, ethnicity, and/or RBRS. Few studies have examined the combined effects of NHB neighborhood racial composition and neighborhood poverty on hypertension awareness, treatment, and control. However, it is plausible that this unexamined association may lead to an underestimation of the effect of NHB neighborhood racial composition because neighborhood poverty is theorized to be a causal pathway linking NHB neighborhood racial composition and health. For instance, poor economic conditions often perpetuate social uncertainty (stressors) by driving down local property values, increasing the flight of jobs, and fostering a climate of fear among both businesses and White residents, which in turns lead to segregation (Gee & Payne-Sturges, 2004). Subsequently, many economically deprived neighborhoods have lower levels of services, reduced access to infrastructure, and limited or no political voice in land-use and permitting decisions (Iceland et al., 2002). Similarly, many Black communities are systematically excluded from social, economic, and political resources by administrative decisions made by elected and appointed officials (Iceland et al., 2002). These structural processes influence neighborhood factors such as access to quality health care and healthy choices, which plausibly influence hypertension awareness, treatment, and control.

### **Race and Hypertension Awareness, Treatment, and Control**

Heightened hypertension awareness does not appear to consistently translate into higher rates of control specifically among NHBs who are aware of their hypertension and treated for their hypertension. Rather, racial and ethnic differences persist in hypertension awareness, treatment, and control (Hertz & Unger, 2005; Hajjar & Kotchen., 2003; Hajjar et al., 2006), which suggests race and ethnicity reflect differences in social and cultural influences, such as

health behaviors, access to health care, and environmental exposures, that may all affect blood pressure (BP) (Kramer et al., 2004). Examining factors associated with racial and ethnic patterns in hypertension awareness, treatment, and control has demonstrated that age, education, income, and financial stress all influence hypertension (Hertz & Unger, 2005; Hajjar & Kotchen., 2003; Hajjar et al., 2006; Kramer et al., 2004; CDC, 2011). Prevalence of hypertension is much higher among NHBs compared with NHWs and Hispanics, as is awareness of hypertension status. While NHBs are more likely to be treated for hypertension, they continue to lag in hypertension control when compared to NHWs and Hispanics (Hajjar et al., 2006; Hertz & Unger, 2005; Hajjar & Kotchen., 2003; Hajjar et al., 2006; Kramer et al., 2004; CDC, 2011).

*Hypertension awareness: national trends.* According to the latest analysis of data from the National Health and Nutrition Examination Survey (NHANES, 2003-2010), hypertension awareness rates in the U.S. are improving and have increased substantially over the past decade (Valderrama et al., 2012). Among those with hypertension, Blacks (80.8%) consistently are equally or more aware of their hypertension compared to Mexican Americans (68.7%) and Whites (79.1%) (Valderrama et al., 2012). Among those with hypertension, the proportion of individuals who were aged <65 was greater for Blacks (74.1%) and Mexican Americans (71.9%) compared with Whites (57.4%) (Valderrama et al., 2012). In this same study, among those with hypertension, Valderrama and colleagues (2012) report that awareness was greater for Blacks (66.3%) compared with Whites (59.4%) and Mexican-Americans (51.4%).

*Hypertension treatment: national trends.* Findings from the 2003-2010 NHANES data suggested that Blacks were equally or more aware than Whites of the presence of hypertension and equally or more likely to be treated for hypertension (Valderrama, 2012). Hypertension treatment was lowest among Mexican-Americans (58.7%) compared with Whites (71.2%) and

Blacks (71.9%). From this same study, Valderrama and colleagues (2012) reported that among those with uncontrolled hypertension, treatment was greater for Blacks (50.7%) compared with Whites (44.0%) and Mexican-American (35.9%).

*Hypertension control: national trends.* Hypertension control represents awareness, the proportion of aware patients who were treated, and the proportion of treated patients whose blood pressure (BP) was controlled (systolic BP of  $\leq$ 140mm Hg and diastolic BP of  $\leq$ 90mmHg) (Egan et al., 2010). Valderrama and colleagues (2012) reported that hypertension control was lowest among Mexican-Americans (35.5%) compared with Whites (48.6%) and Blacks (43.0%).

*Local variations in patterns of awareness, treatment and control.* It is important to note, however, that these national statistics may vary substantially across local geographic areas. Detroit, Michigan is a highly segregated, predominantly African-American city (Logan & Stults, 2011), which provides a unique opportunity to research predictors and correlates of racial and ethnic differences across hypertension awareness, treatment, and control. Many of the underlying factors of RBRS and neighborhood poverty in Detroit are believed to be linked to the vast social and physical problems facing the city. Subsequently, deteriorating social conditions influence one's ability to become aware, treated, and controlled for hypertension. Additionally, Detroit has high rates of unemployment and low household incomes (Logan & Stults, 2011), which have decreased more than 30% since 2000 (White M., 2011; White M. M., 2011). In 2009, an estimated 31.3% of families lived below the federal poverty level (US Census Bureau, 2012), which is concordant with HEP findings from 2002 (see Table 2.1).

Hunte and colleagues (2012) described how residents in both Chicago and Detroit experienced less favorable rates of hypertension prevalence, awareness, treatment, and control compared to residents in the general US population. For example, the prevalence, awareness and

treatment rates of hypertension among Chicago residents lagged behind that of the general United States population by 5%–10% points in the weighted analyses; however, after accounting for the variation in age-sex-education-income distribution, the hypertension-related outcomes in Chicago lagged behind the general US population by 10%–14%. Overall, NHB, NHW and Hispanic residents of Detroit had less favorable rates of hypertension awareness compared with their U.S. counterparts, and residents lagged behind the general United States population by 10–18 % points (Hunte et al., 2012). The same study found that NHBs in Detroit had a significantly lower level of treatment than their national counterparts, 53.7% vs 71.9%, respectively. NHWs in Detroit, on the other hand, had higher prevalence of hypertension and lower awareness, treatment, and control than NHWs nationally (Hunte et al., 2012). Thus, both NHWs and NHBs in Detroit reported higher risk of adverse hypertensive outcomes compared with their counterparts in Chicago or nationally.

While prevalence remains the most examined hypertension outcome, it does not tell the whole story. Low levels of hypertension control among NHBs are particularly concerning because advantages that are often measured in hypertension awareness and treatment among NHBs are not translated into better rates of control compared to NHWs and Hispanics. These differences warrant further exploration of the lag in hypertension awareness, treatment, and control. Thus, it is critical to build upon the findings of Hunte and colleagues (2012) and to explore social and economic factors that may explain the persistence of racial and ethnic differences across awareness, treatment, and control.

Findings by Howard and colleagues (2006) suggest that hypertension awareness does not operate through the same mechanisms as postulated for hypertension treatment and control. Unlike hypertension treatment and control which require access to and utilization of health care,

hypertension awareness may be independent of health care utilization. In some cases, individuals learn of their hypertension status through health fairs and other public screening offerings while others are informed by a health care provider. Since Howard and colleagues (2006) reported awareness was not significantly associated with access to health care, and Morenoff and colleagues (2007) showed individuals who lived in neighborhoods with a greater percentage of NHBs are more likely to be aware of their hypertension, as a next step, a closer examination of potential pathways will be provided. In Chapter 3, I will examine the hypothesis that social connectedness is one mediator that may explain the relationship between NHB neighborhood racial composition and racial differences in hypertension awareness, treatment, and control.

### **NHB Neighborhood Racial Composition and Hypertension Awareness**

If NHB neighborhood racial composition is under analyzed or overlooked as a correlate of health outcomes, erroneous conclusions about the etiology of racial and social patterns in hypertension awareness, treatment, and control may be inferred or conflated (LaVeist et al., 2011). A paradoxical relationship is established between residence in a neighborhood with a high percentage of NHBs and hypertension awareness specifically for NHBs (Morenoff et al., 2007). Residence in a neighborhood with a high percentage of NHBs seems to serve as a protective factor for NHBs in terms of hypertension awareness, but pathways linking RBRS and increased hypertension awareness have not been elucidated. Further research is necessary to understand the protective benefits that partly explain racial and ethnic differences in hypertension awareness among individuals who live in neighborhoods with high concentrations of NHBs. It is unclear if the same positive relationship between increased hypertension awareness and RBRS holds for NHWs and Hispanics who reside in neighborhoods with high concentrations of NHBs.

Contrary to some literature that shows neighborhoods with high a percentage of NHBs combined with neighborhood poverty create disadvantaged neighborhoods with social problems (Macintyre & Ellaway, 2000), findings reported in a small number of studies suggest that NHBs who reside in neighborhoods with high a percentage of NHBs experience some benefit in terms of hypertension awareness, which result from within-group social support, a sense of community, and more connectedness (Bell et al., 2006; Inagami et al., 2006). However, despite the overall improved rates of hypertension awareness, the continuance of racial disparities in hypertension control is one compelling reason to take a closer look at the role NHB neighborhood racial composition in explaining racial and ethnic differences in hypertension treatment and control.

### **NHB Neighborhood Racial Composition and Hypertension Treatment**

NHB neighborhood racial composition differentially structures the quality and frequency of health care individuals receive for diagnosing and treating hypertension, which could lead to disparities in not only the prevalence of hypertension, but also treatment, and control of hypertension (Morenoff et al., 2007). The overlap among race, ethnicity and SEP exacerbates efforts to determine whether race, class, or the combined effect of race and class is the underlying cause of racial and ethnic health disparities in health status and outcomes (LaVeist et al., 2007).

Literature suggests that the distribution of community-level resources within cities and counties is related to the racial and ethnic composition of neighborhoods (Takeuchi et al., 2010, Diez-Roux et al., 2001; Massey & Denton, 1993; Williams & Collins, 2001). Likewise, some studies postulate racial and ethnic disparities are actually place disparities because geographical level factors are correlated with racial and ethnic composition of neighborhoods, communities, and towns (Gaskin et al., 2012; LaVeist et al., 2011). Subsequently, exploring the correlation

between NHB neighborhood racial composition and hypertension treatment is essential to identifying social factors that create, maintain, and replicate racial and ethnic differences (Gaskin et al., 2012). Some literature suggests NHBs are more likely to be treated for hypertension while other studies suggest conflicting findings that NHBs are less likely to be treated for hypertension (Hertz & Unger., 2005; Howard et al., 2006; Hajjar et al., 2006; Mayo Clinic, 2012).

### **NHB Neighborhood Racial Composition and Hypertension Control**

The racial composition of neighborhoods suggests there are characteristics embedded in the social, physical, and built environment (Batchis, 2010) that fundamentally contribute to uncontrolled hypertension (Kreiger, 1999). These factors act as forces and/or institutions that perpetuate and maintain racial and social inequities. Even though these macro level factors are more distant sources of uncontrolled hypertension, they directly contribute to hypertension risk markers (IOMOA, 2010) and influence access to healthy lifestyle options (IOMOA, 2010) and potentially hypertension control. In this dissertation, specific features of only the social environment will be examined.

### **Neighborhood Poverty and Hypertension Awareness, Treatment, and Control**

Neighborhood poverty may also be associated with hypertension awareness, treatment, and control through similar ways linking neighborhood poverty to increased risk of disease (Williams & Collins, 2001). The collaborative effects of neighborhood poverty, environmental exposures, and constructed isolation from society can create disadvantaged living conditions, which often lead to negative health outcomes and limited neighborhood resources for hypertension awareness, treatment, and control. Living under such adverse circumstances for an extended period of time threatens quality of life (Turner & Rawlings 2009). For instance, LaVeist and colleagues (2007) concluded that racial differences in social and environmental exposure partially accounted for race differences in hypertension. Like segregation by race,

segregation by SEP can lead to differential environmental and social risk exposures as well as differential access to health promoting life options.

Based on the literature reviewed above, in this chapter, I examine the following research question and hypotheses:

Research Question: What is the role of race, NHB neighborhood racial composition, and neighborhood poverty as predictors of hypertension awareness, treatment, and control?

(Hypothesis 2.1) Hypertension awareness, treatment, and control will vary significantly by race and ethnicity.

(Hypothesis 2.2) Hypertension awareness, treatment, and control positively correlate with NHB neighborhood racial composition.

(Hypothesis 2.3) Hypertension awareness, treatment, and control inversely correlate with neighborhood poverty.

(Hypothesis 2.4) Hypertension awareness, treatment, and control positively correlate with NHB neighborhood racial composition and inversely correlate with neighborhood poverty.

## **Methods**

### **Study Design and Sample Description**

Data for this study are drawn from the 2002 Healthy Environments Partnership (HEP) Community Survey Wave 1, which has been described in previous works (Schulz et al., 2005). HEP is a community-based participatory research partnership comprised of community-based organizations, community residents, and academic researchers who work to address factors that contribute to excess risk of CVD among residents in Detroit, Michigan (Schulz, et al., 2005). The University of Michigan Institutional Review Board for Protection of Human Subjects approved the HEP study in January 2001.

The HEP survey used a stratified 2 stage probability sample of occupied housing units designed for 1,000 completed interviews with adults ages  $\geq 25$  years across Detroit. The was a sample of census block groups within 6 strata that were categorized and sectioned by percent neighborhood racial composition (which was measured by mean percent NHB) and neighborhood poverty. This design allows for comparisons of residents of similar demographics across three distinct geographical areas (Eastside, Northside, and Southwest) of the city of Detroit (Schulz, et al., 2005). The survey sample was designed to achieve adequate variation in socioeconomic position within each of the three predominant racial and ethnic groups in Detroit: African-Americans, Latinos, and Whites in order to conduct analysis of socioeconomic status within and across racial and ethnic groups. Because Detroit, Michigan is approximately 80% NHB, some groups were oversampled that resulted in a set of respondents that is not fully representative of the populations.

All models were weighted for unequal probabilities of selection within each stratum to match the sample to Census 2000 population distributions for the study areas, and all missing data were imputed (Dvonch et al., 2009). The final sample consisted of 919 face-to-face interviews: interviews were completed with 75% of households in which an eligible respondent was identified and 55% of households with a known or potential respondent (Schulz, et al., 2005). The 919 respondents were nested within 69 census blocks. Of the total multiethnic sample, analysis for this study focuses on the 377 individuals who have hypertension nested in 69 census block groups throughout the Eastside, Southwest, and Northwest Detroit study areas. All regression analyses were weighted using Strata and Sampling Error Computing Units (SECU) to properly account for design features of HEP that would yield biased estimations of

variance. These weights were developed for HEP by the University of Michigan Survey Research Center (Lepkowski & Xie, 2004).

## **Measures**

### **Dependent Variables**

Hypertension awareness. Hypertension awareness is an individual level variable measuring whether individuals with hypertension have been told by a health care provider that they have hypertension (yes=1 no=0).

Hypertension treatment. Hypertension treatment is an individual level variable measuring whether individuals who are aware of their hypertension are currently being treated for hypertension (yes=1 no=0).

Hypertension Control Treated Hypertension control treated is an individual level variable measuring whether individuals who are treated for hypertension have SBP <140mmHg and DBP<90mmHg (yes=1 no=0).

### **Individual Control Variables**

Several variables were included as control variables, which previous literature have demonstrated as correlates of hypertension awareness, treatment, and control (Hajjar & Kotchen, 2003; Hajjar et al., 2006; Hertz & Unger, 2005). These included both neighborhood and individual level variables, as described below.

Self-reported *gender* (male or female), *age* (continuous), *education level* (less than high school, high school diploma or GED, and some college or greater), *marital status* (married/in a relationship or not currently married /separated /divorced /widowed) and *employment status* (currently working for pay or not currently working for pay) were controlled for due to their associations with hypertension awareness, treatment, and control. *Household Poverty* was calculated for the HEP sample using 2002 census estimates for the U.S. poverty thresholds (organized by family size and number of children) and HEP survey data available for total

household income and the total number of adults and children in the household for 2002.

Household poverty was modeled as a binary variable of whether household per capita income fell below or above the Federal Poverty Level for 2002.

### **Neighborhood Level Controls**

Neighborhood poverty (measured as mean percent poverty) and NHB neighborhood racial composition (measured as mean percent NHB) were modeled as census block group (Level-2) control variables due to their indirect associations with hypertension awareness, treatment, and control among individuals who live in neighborhoods with high poverty concentrations and high NHB neighborhood racial composition. Modeling Level-2 block group variables, mean percent poverty and mean percent NHBs, provided the opportunity to control for non-independence of observations at Level-2 (block) and Level-1 (individual) in these analyses. Percent poverty was defined as the percent of individuals in the census block group who had household incomes below the federal poverty line (FPL). NHB neighborhood racial composition is defined as the percentage of residents who are NHB based on data from the 2000 U.S. Census. Neighborhood poverty and NHB neighborhood racial composition are continuous measures in the regression analyses. The mean percent poverty and mean percent NHB for each census block group were modeled as continuous measures in the analysis.

### **Data Analysis**

Several data analytical steps were taken to address the research questions in this chapter. Weighted descriptive statistics and univariate procedures were performed using SAS software, Version [9.3] for Windows. For unequal probabilities of selection within each stratum and to match the sample to Census 2000 population distributions for the study areas, all sample statistics were adjusted for sample weights. Demographic statistics were calculated using proc

surveyfreq and proc surveymeans describe commands to estimate weighted means and proportions given the complex sample design,.

To test the study hypotheses, two-level hierarchical regression models for a Bernoulli Outcome were estimated using HLM 7 (Scientific Software International, Lincolnwood, IL, 2011). Level-1 varied among survey respondents based on the dependent variable tested: N=250 (Hypertension Awareness), N=216 (Hypertension Treated), and N=111(Hypertension Control Treated) and Level-2 were the 69 census block groups. The first hypothesis tested whether race was as an independent correlate of hypertension awareness, treatment, and control after accounting for known covariates such as age, gender, education, marital status, and household poverty (Level-1). Model 2 tested if NHB neighborhood racial composition correlated with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity.

Model 3 tested whether neighborhood poverty correlated with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity. Model 4 tested whether the combined effects of NHB neighborhood racial composition and neighborhood poverty correlated with hypertension awareness, treatment, and control after adjusting for individual-level characteristics including race and ethnicity.

All models controlled for Level-1 demographic variables. Model 2 specifically controlled for percent NHB while Model 3 specifically controlled for percent neighborhood poverty, and Model 4 controlled for both percent NHB and percent neighborhood poverty at Level-2.

## **Results**

Table 2.1 provides a summary of the weighted socio-demographic distribution of individual- and area-level variables for the 2002 HEP study sample. Data in Tables 2.1- 2.4

were collected using a two-stage probability sample. Approximately 377 of the 919 individuals in the 2002 HEP study sample had hypertension. Table 2.1 displays weighted socio-demographic characteristics of the various subsamples of interest: prevalence of hypertension, awareness, treatment, and control of hypertension among those treated. Among those with hypertension, roughly 66% (N=250) are aware of their hypertension. Of those who are aware of their hypertension, approximately 86% (N=216) are being treated for their hypertension. Among those who are treated for hypertension, nearly 52% (N=111) have their hypertension adequately controlled. The percentages presented in Table 2.1 are unweighted (unadjusted) values (measured in percent) and are of particular interests because the data highlight that no systematic biases were introduced into the data when the data were further restricted to the corresponding subsamples. In other words, as I restricted the data into the four distinct subsamples (based on the criteria listed in the Methods Section) to only those who were hypertensive among the total sample; who were aware among those with hypertension; who were treated among those who are aware; who were controlled treated among treated, the proportions remain relatively stable across subsamples. For example, women comprised roughly 50% of the total sample and there were no statistical differences among women in each subsample at  $p=0.14$ . While Table 2.1 is important, it does not allow for comparison among race, ethnicity, or hypertension subsamples (awareness, treatment, and control). In order to compare across racial and ethnic groups and hypertension outcomes, inferences must be gleaned from data presented in Table 2.1.1. Table 2.1 allows for comparisons between each subsample across race and ethnicity, specifically.

As presented in Table 2.1, demographic characteristics among the four subsamples were very similar. Among those with hypertension, the mean age was 54.25 years; the mean age of those aware of their hypertension was 57.74 years; the mean age of those who are treated for

their hypertension was 59.57 years; and the mean age of those controlled while treated for hypertension was 60.23 years. Increasing age was a correlate of hypertension outcomes ( $p < 0.0001$ ). While 52.26% of the study sample was women, no statistical significance was present in the number of women across the various subsamples at  $p = 0.14$ ; women represented 50.61% of those with hypertension, 55.61% of those aware, 60.48% of those treated, and 56.07% of those whose hypertension is controlled.

NHBs represented 56.83% of the total 2002 HEP sample as noted in Figure 2.1. By comparison, NHBs represented 64.34% of those with hypertension, 70.28% of those aware of their hypertension, 72.80% of those being treated for hypertension, and 70.64% of those whose hypertension is controlled. Approximately 18.70% of the total 2002 HEP sample is NHWs; NHWs represent 19.29% of those with hypertension; 17.74% of those who are aware; 16.57% of those being treated, and approximately 16.39% of those whose hypertension is controlled. Similarly, nearly 23% of the total 2002 HEP sample is Hispanic; Hispanics represent 15.05% of those with hypertension; 11.31% of those who were aware of their hypertension status; 10.62% of those treated for hypertension; and 12.97% of those who were controlled for hypertension while treated. As depicted in Table 2.1, racial and ethnic differences across prevalence, awareness, treatment, and control while treated were statistically significant at  $p < 0.001$ .

While there were few differences in the percent currently married among the full sample, those with hypertension, those who were aware, and those who were treated for hypertension, those who had achieved hypertension control while treated were more likely (41%) to be married, a difference which was marginally significant ( $p = 0.08$ ). Similarly, those who had achieved hypertension control while treated were more likely to be older ( $p < 0.001$ ). More so, NHB neighborhood racial composition was higher (68.82%) among those who were aware of

their hypertension compared with those who were treated for their hypertension (70.39%), and controlled for hypertension while treated (68.98%), which is statistically significant at  $p=0.004$ . Furthermore, neighborhood poverty is lower among those who are controlled while treated (30.31%) compared with those who are treated (31.30%) and aware (31.86%), which is also statistically significant at  $p=0.005$ .

Table 2.1.1 displays unweighted hypertension prevalence, awareness, treatment, and control for the full sample, and for each racial and ethnic group. NHBs were more likely to be aware (71.55%) of their hypertension status compared with Hispanics (52.08%) and NHWs (61.63%) ( $p=0.01$ ). Not only were Hispanics less likely to be aware of their hypertension status than NHBs, but Hispanics were less likely than NHWs to be aware of their hypertension status ( $p=0.01$ ). Marginally significant ( $p=0.06$ ), hypertension treatment trends are in the expected direction and NHBs (88.30%) were as or more likely as Hispanics (84.00%) and NHWs (83.02%) to be treated for hypertension. Hispanics were more likely to be treated for hypertension than NHWs ( $p=0.06$ ). No racial or ethnic differences ( $p=0.15$ ) were measured in hypertension control among NHBs (58.99%), Hispanics (66.67%) and NHWs (40.91%).

Results from each of the four research questions are presented below, organized according to each of the three dependent variables: awareness, treatment and control.

### **Hypertension Awareness**

Model 1 in Table 2.2 is a fully unconditional model (OR=1.90, 95% CI [.26, 2.85],  $p=0.003$ ) that shows variation in hypertension awareness can be clearly divided between variation over individuals and variance at the neighborhood level. Sigma squared ( $\sigma^2$ ) represented the total variance in hypertension awareness within neighborhoods that may be explained by a Level-1 model, while Tau ( $T\beta$ ) was the total explainable variation at Level-2 (neighborhood). In the fully unconditional model, the intraclass correlation represented the

proportion of the variance in hypertension awareness between neighborhoods. The equation for this correlation was: the total variation in outcome at the census block group (census block group neighborhood variation divided by the sum of the census block group neighborhood variation + total variance in outcomes within neighborhood). Fifty-two percent or  $0.98/(0.98+0.89)$  of the variation in hypertension awareness was between census blocks groups.

Individual sociodemographic variables were collectively added to Model 2 (Table 2.2). After adjusting for individual- level covariates in Model 2 (Table 2.2), the total variation in outcome at the census block group (census block group neighborhood variation divided by the sum of the census block group neighborhood variation + total variance in outcomes within neighborhood) was  $0.82/(0.91+0.82)$  or 0.47% of the variance in hypertension awareness remained at the census block groups. Despite low intraclass correlations, indicating that a relatively small proportion of the variance in hypertension awareness was explained by variance across neighborhoods, multilevel modeling was used for the analyses presented below due to the structure of the data collected. Ignoring the preceding described multilevel nature of the data would be inappropriate for the study sampling design.

Results for the first research question, examining the association between race and ethnicity and hypertension awareness, are shown in Table 2.2 (Model 2 and Figure 2.1). NHWs were significantly less likely than NHBs (referent group) to be aware of their hypertension (OR=0.51, 95% CI [0.27, 0.97],  $p=0.04$ ) when controlling for other individual characteristics. While not statistically significant, racial and ethnic trends for Hispanics (OR=0.47, 95% CI [0.19, 1.51],  $p=0.10$ ) were in the expected direction.

Results for the second research question, examining the association between NHB neighborhood racial composition and hypertension awareness, are shown in Model 3 (Table 2.2

and Figure 2.2). NHB neighborhood racial composition was positively associated with hypertension awareness. In other words, residents of neighborhoods with a high percent of NHBs were more likely to report that they were aware of their hypertension status (OR=1.01, 95% CI [1.00, 1.02], p=0.05) than individuals who reside in neighborhoods with a lower percent of NHBs. This association was significant after accounting for individual race and ethnicity, and demographic controls. However, as seen in Model 3, significant racial differences in hypertension awareness were attenuated once NHB neighborhood racial composition was included in the model [NWHs (OR=0.72, 95% CI [0.26, 2.04], p=0.54)]. This finding suggests that the NHB neighborhood racial composition measured as percent NHBs may help account for the protective effect of NHB race in Model 2 (Table 2.2).

Results from research question three, examining the association between neighborhood poverty and hypertension awareness, are shown in Model 4 (Table 2.2 and Figure 2.3). Mean percent poverty did not influence racial and ethnic differences in hypertension awareness (OR=0.99, 95% CI [0.96, 1.02], p=0.04). NWH remained significantly less likely than NHB (referent group) to be aware of their hypertension (OR=0.51, 95% CI [0.27, 0.97], p=0.04) after accounting for neighborhood poverty and controlling for individual characteristics.

Results for research question four, examining the association between hypertension awareness and the combined effect of NHB neighborhood racial composition and neighborhood poverty, are shown in Model 5 (Table 2.4 and Figure 2.4). NHB neighborhood racial composition was marginally significant (OR=1.01, 95% CI [1.00, 1.02], p=0.08) with hypertension awareness after accounting for neighborhood poverty in the same model. While neighborhood poverty trended in the expected direction, it was not significantly associated with hypertension awareness (OR=0.99, 95% CI [0.96, 1.02], p =0.44). As with Model 3, racial and

ethnic differences in awareness were no longer statistically significant after accounting for neighborhood racial composition and neighborhood poverty.

### **Hypertension Treatment**

Model 1 in Table 2.3 is a fully unconditional model (OR=5.60, 95% CI [3.42, 9.15],  $p < 0.001$ ) that indicates variation in hypertension treatment can be clearly divided between variation over individuals and variance on a neighborhood level. The intraclass correlation for Model 1 (Table 2.3) was 0.67, which suggest 67% of the variation in hypertension treatment was between census block groups. Individual sociodemographic variables were collectively added to Model 2. After adjusting for individual- level covariates in Model 2 (Table 2.2), 7% of the variance in hypertension awareness remained at the census block groups. Multilevel modeling, despite low intraclass correlations, was necessary for this study due to the structure of the data collected. Ignoring the preceding described multilevel nature of the data would be inappropriate for the study sampling design.

Results for the first research question, examining the association between race, ethnicity and hypertension treatment, are shown in Model 2 (Table 2.3 and Figure 2.1). No racial and ethnic differences were found in the likelihood of treatment among those who are aware of their hypertension. This finding suggests that becoming aware of hypertension is critical to receiving hypertension treatment as reported in Model 2. Therefore, I was unable to reject the null hypothesis that individual race and ethnicity were not protective for hypertension treatment as it was for hypertension awareness.

Results for the second research question, examining the association between NHB neighborhood racial composition and hypertension treatment, are shown in Model 3 (Table 2.2 and Figure 2.2). NHB neighborhood racial composition was not associated with hypertension treatment (OR=1.01, 95% CI [0.99, 1.02],  $p=0.33$ ). In other words, I was unable to reject the

null hypothesis that NHB racial composition of the neighborhood was not protective for hypertension treatment as it was for hypertension awareness.

Results for the third research question, examining the association between neighborhood poverty and hypertension treatment, are shown in Model 4 (Table 2.3 and Figure 2.3). Mean percent poverty was not significantly associated with hypertension treatment (OR=0.97, 95% CI [0.93, 1.01],  $p=0.14$ ). While not statistically significant, trends between neighborhood poverty and hypertension treatment were in the expected direction for NWH (OR=0.49, 95% CI [0.17, 1.43],  $p=0.19$ ) and Hispanics (OR=0.95, 95% CI [0.22, 4.07],  $p=0.94$ ).

Results for research question four, examining the combined effect of NHB neighborhood racial composition and neighborhood poverty on hypertension awareness, treatment, and control are shown in Model 5 (Table 2.3 and Figure 2.4). While NHB neighborhood racial composition was in a protective direction as with hypertension awareness and trends for neighborhood poverty were in the expected direction, neither were statistically significant. Therefore, I am unable to reject the null hypothesis that the combined effects of NHB neighborhood racial composition and neighborhood poverty explained racial and ethnic differences in hypertension treatment.

### **Hypertension Control**

Model 1 in Table 2.4 is a fully unconditional model (OR=1.15, 95% CI [0.85, 1.55],  $p=0.35$ ) that indicates variation in hypertension treatment can be clearly divided between variation over individual and variance on a neighborhood level. The intraclass correlation for Model 1 (Table 2.4) was 0.08, which suggests 8% of the variation in hypertension treatment was between census block groups. Individual sociodemographic variables were collectively added to Model 2 (Table 2.4). After adjusting for individual-level covariates in Model 2 (Table 2.4), 6% of the variance in hypertension awareness remained at the census block groups. Multilevel

modeling, despite low intraclass correlations, was necessary for this study due to the structure of the data collected. Ignoring the preceding described multilevel nature of the data would be inappropriate for the study sampling design.

Results for the first research question, examining the association between race and ethnicity and hypertension control, are shown in Model 2 (Table 2.4 and Figure 2.1). No racial and ethnic differences in hypertension control among those who were treated were reported. While not significant, racial and ethnic trends presented mixed findings for NHW (OR=0.90, 95% CI [0.38, 2.13],  $p=0.81$ ) and Hispanics (OR=1.56, 95% CI [0.55, 4.46],  $p=0.40$ ).

Results for the second research question, examining the association between NHB neighborhood racial composition and hypertension control, are shown in Model 3 (Table 2.4 and Figure 2.2). NHB neighborhood racial composition was not associated with hypertension control (OR=1.00, 95% CI [0.99, 1.02],  $p=0.73$ ). In other words, I was unable to reject the null hypothesis that the racial composition of the neighborhood was not protective for hypertension control as it was for hypertension awareness.

Results for the third research question, examining the association between neighborhood poverty and hypertension control, are shown in Model 4 (Table 2.4 and Figure 2.3). Mean percent poverty did not account for racial and ethnic differences in hypertension treatment (OR=0.98, 95% CI [0.95, 1.02],  $p=0.36$ ). While not significant, the trends between neighborhood poverty and hypertension control were in the expected direction.

Results for the fourth research question, examining the association between the combined effect of NHB neighborhood racial composition and neighborhood poverty and hypertension control, are shown in Model 5 (Table 2.4 and Figure 2.4). Neither NHB

neighborhood racial composition (OR=0.98, 95% CI [0.95, 1.02], p=0.35) nor neighborhood poverty (OR=1.00, 95% CI [0.99, 1.02], p =0.70) were associated with hypertension control.

**TABLE 2.1. Descriptive Statistics for Individual and Census Block Group Variables by Hypertension Prevalence, Awareness, Treatment, and Control in the 2002 HEP Sample**

	<b>HYPERTRNSION</b>					
	<b>Total Sample N=919</b>	<b>Prevalence N=377</b>	<b>Awareness N=250</b>	<b>Treatment N=216</b>	<b>Control N=111</b>	<b>ANOVA <i>p</i>-values</b>
	Values reported as Mean(SE) or Percent					
<b>LEVEL-1: Individual-Level Correlates and Covariates***</b>						
Age (years)	46.28(0.84)	54.25(1.28)	57.74(1.69)	59.57(1.71)	60.23(1.79)	<0.0001
Female	52.26	50.61	55.61	60.48	56.07	0.14
Race						
Hispanic*	22.17	15.05	11.31	10.62	12.97	<0.0001
Black	56.83	64.34	70.28	72.80	70.64	
White	18.70	19.29	17.74	16.57	16.39	
Education <12 years	37.01	39.47	39.52	39.64	47.08	0.63
Marital Status	26.36	24.59	24.66	24.42	41.97	0.08
Households with incomes above the Federal Poverty Level, FPL	36.36	40.95	43.01	42.72	30.34	0.03
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Poverty	31.47(0.95)	32.05(1.16)	31.86 (1.45)	31.30(1.59)	30.31(1.68)	0.005
Mean Non-Hispanic Black	55.45(1.83)	62.90(2.52)	68.82 (2.01)	70.39(2.24)	68.98(2.97)	0.004
*Others are omitted in these analyses.						
**All Level-1 summary statistics were weighted.						

<b>TABLE 2.1.1. Descriptive Statistics* for Racial and Ethnic Groups by Hypertension Prevalence, Awareness, Treatment, and Control in the 2002 HEP Sample</b>					
	<b>Total Sample N=919</b>	<b>Hispanics N=182</b>	<b>Non-Hispanic Whites N=198</b>	<b>Non-Hispanic Blacks N=523</b>	<b>Chi-square p-values</b>
	Value reported as Percent				
<b>Dependent Variables</b>					
Hypertension Prevalence (of the total sample =N/919)**	41.02 (N=377)	19.80 (N=182)	21.55 (N=198)	56.91(N=523)	<0.0001
Hypertension prevalence among racial and ethnic group (=X/Group Total)***		26.37 (N=48)	43.43 ( N=86)	45.70 (N=239)	
Hypertension Awareness (of those with hypertension)	66.31 (N=250)	52.08 (N=25)	61.63 (N=53)	71.55 (N=171)	0.01
Hypertension Treated (of those who are aware)	86.40 (N=216)	84.00 (N=21)	83.02 (N=44)	88.30 (N=151)	0.06
Hypertension Control (of those who are treated)	50.50(N=111)	66.67(N=14)	40.91(N=18)	58.99 (N=77)	0.15
*Unweighted percent					
**Prevalence percent for each racial and ethnic category is calculated by column total divided by HEP sample total= N/919					
***Actual number of racial and ethnic individuals among corresponding racial and ethnic group who are hypertensive = X/N					
Hypertension- SBP $\geq$ 140 mmHg, or DBP $\geq$ 90 mmHg, or taking anti-hypertensive medications in the last 12 months.					
Awareness-The subset of individuals with hypertension who have been told by a health care provider that they have hypertension.					
Treatment- The subset of individuals who are aware of their hypertension and who are currently being treated for hypertension.					
Control Treated- The subset of individuals who are treated for hypertension and whose SBP<140mmHg and DBP<90mmHg.					

**Table 2.2. Hypertension Awareness Regressed on Race, NHB Neighborhood Racial Composition, and Neighborhood Poverty**

	MODEL 1: Fully Unconditional			MODEL 2: Race and Individual Covariates			MODEL 3: Race, Covariates, and NHB Neighborhood Racial Composition		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	1.90	(1.26, 2.85)	0.003	1.72	(0.91,3.25)	0.09	1.52	(0.78, 2.97)	0.21
Age(years)*				1.05	(1.02,1.08)	<0.001	1.05	(1.02, 1.08)	<0.001
Gender (reference: male)				1.57	(0.83, 2.96)	0.16	1.60	(0.85, 3.03)	0.15
Race(reference: Black)									
Hispanics				0.47	(0.19,1.15)	0.10	0.72	(0.26, 2.04)	0.54
Whites				0.51	(0.27, 0.97)	0.04	0.70	(0.34, 1.48)	0.35
Marital status (reference: married)				1.71	(0.76, 3.83)	0.19	1.78	(0.82, 3.89)	0.14
Education < High School (ref: at least some college)				0.84	(0.43, 1.65)	0.61	0.84	(0.43, 1.66)	0.61
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)				1.49	(0.81,2.73)	0.20	1.50	(0.82, 2.75)	0.18
<b>LEVEL-2: Census Block Group</b>									
Mean Percent Poverty*									
Mean Non-Hispanic Black *							1.01	(1.00,1.02)	0.05
Sigma Squared, $\sigma^2$			0.89			0.91			0.92
Tau Beta, $T\beta$			0.98			0.82			0.75
* Variables were grand-mean centered.									
** p<0.05.									
†Census block group variable was entered only in Model 3.									
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.									

<b>CONTINUED Table 2.2. Hypertension Awareness Regressed on Race, NHB Neighborhood Racial Composition, and Neighborhood Poverty</b>						
	<b>MODEL 4: Race, Covariates, and Neighborhood Poverty</b>			<b>MODEL 5: Race, Covariates, NHB Neighborhood Racial Composition, and Neighborhood Poverty</b>		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Intercept	1.75	(0.92 ,3.34)	0.09	1.54	(0.79, 3.04)	0.20
Age(years)*	1.05	(1.02,1.08)	<0.001	1.05	(1.02, 1.08)	<0.001
Gender (reference: male)	1.55	(0.82, 2.94)	0.18	1.58	(0.83, 3.00)	0.16
Race(reference: Black)						
Hispanics	0.47	(0.19,1.13)	0.09	0.73	(0.26, 2.05)	0.55
Whites	0.51	(0.27,0.96)	0.04	0.70	(0.34, 1.47)	0.35
Marital status (reference: married)	1.67	(0.73,3.85)	0.22	1.74	(0.78, 3.90)	0.17
Education < High School (ref: at least some college)	0.83	(0.42,1.61)	0.57	0.83	(0.42, 1.62)	0.57
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)	1.50	(0.82,2.74)	0.19	1.52	(0.84, 2.76)	0.17
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Poverty*	0.99	(0.96, 1.02)	0.51	0.99	(0.96, 1.02)	0.44
Mean Non-Hispanic Black *				1.01	(1.00, 1.02)	0.08
Sigma Squared, $\sigma^2$			0.92			0.92
Tau Beta, $T\beta$			0.81			0.73
* Variables were grand-mean centered.						
** p<0.05.						
LCensus block group variables were entered separately in Model 4 and together in Model 5.						
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.						

**Table 2.3. Hypertension Treatment Regressed on Race, NHB Neighborhood Racial Composition, and Neighborhood Poverty**

	MODEL 1: Fully Unconditional			MODEL 2: Race and Individual Covariates			MODEL 3: Race, Covariates, and NHB Neighborhood Racial Composition		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	5.60	(3.42,9.15)	<0.001	4.18	(1.86, 9.39)	<0.001	3.46	(1.43, 8.41)	0.01
Age(years)*				1.07	(1.03, 1.11)	<0.001	1.06	(1.03, 1.10)	<0.001
Gender (reference: male)				3.62	(1.57, 8.33)	0.03	3.88	(1.71, 8.81 )	0.001
Race(reference: Black)									
Hispanics				0.96	(0.22, 4.25)	0.95	1.72	(0.21, 14.01)	0.61
Whites				0.52	(0.18, 1.48)	0.22	0.75	(0.20, 2.84)	0.67
Marital status (reference: married)				0.91	(0.33, 2.55)	0.86	0.98	(0.33, 2.91)	0.97
Education < High School (ref: at least some college)				0.94	(0.40, 2.16)	0.88	0.90	(0.38, 2.12)	0.81
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)				1.02	(0.43, 2.40)	0.97	1.05	(0.45, 2.48)	0.90
<b>LEVEL-2: Census Block Group</b>									
Mean Non-Hispanic Black *							1.01	(0.99,1.02)	0.33
Sigma Squared, $\sigma^2$			0.68			1.42			1.36
Tau Beta, $T\beta$			1.39			0.01			0.01

\* Variables were grand-mean centered.

\*\* p<0.05.

† Census block level variable was entered only in Model 3.

All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.

<b>CONTINUED Table 2.3. Hypertension Treatment Regressed on Race, NHB neighborhood Racial Composition, and Neighborhood Poverty</b>						
	<b>MODEL 4: Race, Covariates, and Neighborhood Poverty</b>			<b>MODEL 5: Race, Covariates, NHB Neighborhood Racial Composition and Neighborhood Poverty</b>		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Intercept	4.75	(2.13 10.57)	<0.001	3.87	(1.61, 9.30)	0.003
Age(years)*	1.07	(1.03,1.11)	<0.001	1.07	(1.03, 1.11)	<0.001
Gender (reference: male)	3.34	(1.47, 7.64)	0.004	3.61	(1.59, 8.18)	0.002
Race(reference: Black)						
Hispanics	0.95	(0.22, 4.07)	0.94	1.80	(0.23, 14.17)	0.57
Whites	0.49	(0.17, 1.43)	0.19	0.72	(0.19, 2.73)	0.63
Marital status (reference: married)	0.80	(0.28, 2.27)	0.67	0.87	(0.29, 2.62)	0.80
Education < High School (ref: at least some college)	0.83	(0.36,1.92)	0.67	0.80	(0.34, 1.87)	0.60
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)	1.07	(0.45, 2.54)	0.88	1.12	(0.47, 2.65)	0.80
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Poverty*	0.97	(0.93, 1.01)	0.14	0.97	(0.93, 1.01)	0.13
Mean Non-Hispanic Black *				1.01	(0.99, 1.02)	0.27
Sigma Squared, $\sigma^2$			1.65			1.59
Tau Beta, $T\beta$			0.01			0.01
* Variables were grand-mean centered.						
** p<0.05.						
‡Census block level variables were entered separately in Model 4 and together in Model 5.						
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.						

**Table 2.4. Hypertension Control Regressed on Race, NHB Neighborhood Racial Composition, and Neighborhood Poverty**

	MODEL 1: Fully Unconditional			MODEL 2: Race and Individual Covariates			MODEL 3: Race, Covariates, and NHB Neighborhood Racial Composition		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	1.15	(0.85,1.55)	0.35	0.82	(0.32, 2.07)	0.67	0.78	(0.30, 2.00)	0.59
Age(years)*				1.00	(0.98, 1.03)	0.71	1.00	(0.98, 1.03)	0.73
Gender (reference: male)				0.87	(0.41, 1.81)	0.69	0.87	(0.42, 1.82)	0.74
Race(reference: Black)									
Hispanics				1.56	(0.55, 4.46)	0.40	1.84	(0.40, 8.46)	0.43
Whites				0.90	(0.38, 2.13)	0.81	1.00	(0.37, 2.74)	1.00
Marital status (reference: married)				1.95	(0.83, 4.57)	0.12	1.99	(0.84, 4.71)	0.12
Education < High School (ref: at least some college)				1.84	(0.81, 3.96)	0.12	1.84	(0.86, 3.96)	0.12
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)				0.99	(0.49, 2.00)	0.98	0.99	(0.49, 2.00)	0.97
<b>LEVEL-2: Census Block Group</b>									
Mean Non-Hispanic Black *							1.00	(0.99,1.02)	0.73
Sigma Squared, $\sigma^2$			0.98			0.98			0.98
Tau Beta, $T\beta$			0.09			0.07			0.06
* Variables were grand-mean centered.									
** p<0.05.									
ECensus block group variable was entered only in Model 3.									
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.									

<b>CONTINUED Table 2.4. Hypertension Control Regressed on Race, NHB Neighborhood Racial Composition, and Neighborhood Poverty</b>						
	<b>MODEL 4: Race, Covariates, and Neighborhood Poverty</b>			<b>MODEL 5: Race, Covariates, and NHB Neighborhood Racial Composition and Neighborhood Poverty</b>		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Intercept	0.86	(0.33, 2.21)	0.74	0.81	(0.31, 2.11)	0.66
Age(years)*	1.01	(0.98, 1.03)	0.62	1.01	(0.98, 1.03)	0.64
Gender (reference: male)	0.84	(0.40, 1.79)	0.65	0.85	(0.41, 1.80)	0.68
Race(reference: Black)						
Hispanics	1.53	(0.52, 4.54)	0.44	1.83	(0.40, 8.47)	0.44
Whites	0.88	(0.38, 2.07)	0.78	1.00	(0.37, 2.72)	1.00
Marital status (reference: married)	1.83	(0.77, 4.34)	0.17	1.87	(0.77, 4.50)	0.17
Education < High School (ref: at least some college)	1.75	(0.81, 3.78)	0.15	1.75	(0.81, 3.78)	0.15
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)	1.02	(0.50, 2.07)	0.96	1.02	(0.50, 2.07)	0.96
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Poverty*	0.98	(0.95, 1.02)	0.36	0.98	(0.95, 1.02)	0.35
Mean Non-Hispanic Black *				1.00	(0.99, 1.02)	0.70
Sigma Squared, $\sigma^2$			0.98			0.98
Tau Beta, $T\beta$			0.07			0.06
* Variables were grand-mean centered.						
** p<0.05.						
‡Census block group variables were entered separately in Model 4 and together in Model 5.						
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.						

## **Discussion**

There are three main findings of the results reported here. First, in the analyses presented here, race and ethnicity were associated with hypertension awareness, but not treatment or control, when included in models that do not account for neighborhood effects. Second, associations between race and ethnicity and hypertension awareness were attenuated when NHB neighborhood racial composition is included in the model. Neighborhood poverty was not associated with hypertension awareness. Finally, there were no significant associations between individual race and ethnicity, neighborhood NHB racial composition or neighborhood poverty, with hypertension treatment or control in the analyses presented here. In the paragraphs below, I discuss each of these results in greater detail, organized according to the three dependent variables: hypertension awareness, treatment and control.

### **Hypertension Awareness**

One of the central aims of this study was to understand racial and ethnic differences in hypertension awareness. Among those with hypertension, NHBs were more likely to be aware of their hypertension status compared to NHWs. This finding is consistent with both national data, which suggest similar pattern (AHA, 2013; CDC, 2011; Hertz & Unger, 2005; Hajjar & Kotchen, 2003; Hajjar et al., 2006), and with similar studies conducted with urban communities (Hunte et al 2012). Perhaps an increase in hypertension awareness among NHBs and individuals who reside in neighborhoods with high concentrations of NHB maybe a result of federal guidelines and standards implemented by agencies such as *The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)*(completed by the U.S. Department of Health and Human Services, National Institutes of Health and National Heart, Lung, and Blood Institute) that have targeted hypertension awareness and screening in certain neighborhoods and specifically among NHBs

(NHLBI, 2009). The finding reported here suggest that residing in neighborhoods with high concentrations of NHB acts as a protective factor for those who are aware. Initial advantages by race (Hypothesis 2.1) were reduced to non-significance once NHB neighborhood racial composition was included in the models, which suggest that the advantage experienced by NHBs is partially accounted for by protective effects for those living in neighborhoods with higher percent NHBs. It is feasible that NHB neighborhood racial composition safeguards individuals from prejudice and provide access to social support and community resources (White & Borrell, 2011). More so, some researchers suggest that segregation produces differential exposures to health risks (LaVeist, 2003; Williams & Collins, 2001; LaVeist et al., 2007; LaVeist et al., 2011). Subsequently, racial disparities may be confounded by racial and ethnic differences based on place (LaVeist et al., 2011). Thus, further research is warranted to examine the pathways through which these protective effects occur.

No statistically significant association between neighborhood poverty and hypertension awareness was found after adjusting for individual-level characteristics including race and ethnicity. This finding is contrary to other studies that found a correlation between poverty and hypertension awareness (Morenoff et al., 2007). Previous data show that poverty can impact health through several paths. Residence in high poverty neighborhoods may increase stress as the result of loss employment; social isolation due to a lack of transportation; poor housing conditions; perceived social disorder etc.; and risk of disease such as increased BMI and hypertension. As a consequence of the cumulative impact of repeated experience with social and economic adversity and political marginalization, NHB experience early health deterioration (Geronimus et al., 2000). This study may have yielded different results from those reported elsewhere because of the small size of this sample used for this dissertation and the use of NHB

neighborhood racial composition instead of measures of RBRS. Populations with larger differences in neighborhood poverty across neighborhoods may yield larger effects.

### **Hypertension Treatment**

Among those who are aware, there were no significant racial and ethnic differences in odds of being treated for hypertension. I am unable to reject the null hypothesis that hypertension treatment varied by race. This finding also suggests hypertension awareness is critical in reaching treatment. Equal treatment across racial and ethnic groups may be a result of national public health and health care efforts designed to decrease hypertension prevalence and increase awareness, screening, diagnosing, and initiating treatment of high risk groups (Morenoff et al., 2007). While NHBs are *as likely* as NHW and Hispanics to be treated for hypertension in this sample, this finding is dissimilar from many prior studies that have reported NHB as *more* likely to be treated for hypertension when they are aware of their hypertension status (AHA, 2013; CDC, 2011; Hertz & Unger, 2005; Hajjar & Kotchen., 2003; Hajjar et al., 2006). While dissimilar from several other studies, this finding is also consistent with the findings of Morenoff and colleagues (2007). Morenoff and colleagues (2007) found that treatment for hypertension is not strongly patterned by race/ethnicity, education, or income (Morenoff et al., 2007). Similarly, Morenoff and colleagues (2007) found that neighborhood context does not appear to play a role in the likelihood of being treated in their sample. The sample size (N=216) for my study analyses is relatively small compared to previous national data samples. The small sample size has likely contributed to this sample being underpowered to reach statistical significance. Another important fact to note is that Detroit, Michigan is plagued by high rates of crime, disinvestment, and poor economic conditions. The sample for this study was stratified in order to sample NHB and NHW participants from higher and lower SES neighborhoods equitably, in order to allow analyses that disentangle the effects of race and class. As a result, those who are represented in

this sample may be residing in neighborhoods that are more similar to each other across racial lines than would be the case if the sample were, for example, a nationally representative sample. Consequently, no racial differences may be present in this sample.

### **Hypertension Control**

No significant racial and ethnic differences were reported for hypertension control.

Despite the encouraging findings regarding awareness among NHBs, I found that once individuals are treated, there is no racial or ethnic difference in control of hypertension. This finding differs from previous studies that show that NHBs are less likely to achieve hypertension control compared with NHWs (Ostchega et al., 2008; AHA, 2012; CDC, 2011). Similarly, NHB neighborhood racial composition and poverty were not significantly associated with hypertension control. This finding is consistent with other studies that showed neighborhood effects do not appear to play a role in explaining racial and ethnic differences in both hypertension treatment and control (Morenoff et. al, 2007).

One reason for the lack of association between hypertension control and neighborhood characteristics may be that hypertension control, unlike hypertension awareness, may be more closely related to health care utilization. Hypertension treatment is required for control.

### **Study Limitations**

As with most studies, these analyses have several limitations. NHB neighborhood racial composition is not a true reflection of a metropolitan-area or RBRS. The use of NHB neighborhood racial composition may not provide a complete indication of the degree to which groups interact with one another and may not capture the complex process of residential segregation (White & Borrell, 2011). Subsequently, this underestimation of interaction between racial and ethnic groups could potentially lead to an underestimation of the contribution of residential segregation to health and health disparities. Moreover, it may be hypothesized that

the mechanisms by which a formal measure of segregation operates are different from a proxy measure of segregation such as the racial composition measure used here. The racial composition of geographic units is not linked to the spatial organization or the broader process of racial and spatial inequality of a geographic area (Morello-Frosch & Lopez, 2006).

RBRS is usually measured using the dissimilarity index, and RBRS reflects the dynamics of racial inequality (Wong, 2002). Unlike RBRS, NHB neighborhood racial composition measures the composition of a particular race and ethnicity in a neighborhood and not necessarily the area's spatial organization (Wong, 2002). More so, a formal measure of RBRS recognizes the degree to which neighborhood processes are affected by interconnections across more or less permeable boundaries, greater or lesser physical distance from similar and dissimilar local areas, and differential situations of groups within society (White & Borrell, 2011). The lack of formal RBRS measures may have suppressed a significant relationship between NHB neighborhood racial composition and hypertension treatment and control.

Given that Detroit has a large population of NHBs with relatively high levels of NHB neighborhood racial composition, NHBs in Detroit experience lower levels of hypertension awareness, treatment, and control compared to national samples. Therefore, racial and ethnic differences in these outcomes may be smaller than in a national sample. Both of these characteristics of the city may work to minimize racial and ethnic differences, and may influence the associations between NHB neighborhood racial composition and the health outcomes in unknown ways due to the relatively higher levels of NHB neighborhood racial composition. Similar studies should be conducted in nationally representative samples and in other communities to examine the robustness of these effects across contexts.

Another limitation is the sample size. Because of the small subsample size for individuals with hypertension, each subsequent subsample, hypertension awareness, treatment, and control became increasingly smaller, which affected the power of the sample and the precision of each sample. The reliance on cross-sectional data also limits my ability to establish directionality, to test the order of associations between variables, and to examine exposures over the life course. Additional research using longitudinal data will help establish the order of associations, examine implications of duration of exposure to neighborhood poverty and racial composition and associated psychosocial stress, and explore lagged effects.

### **Implications**

The findings from this study have several implications. First, understanding hypertension prevalence and changes in systolic and diastolic blood pressures are important public health concerns. However, it is equally as important to understand social and economic that shape racial and ethnic differences hypertension awareness, treatment, and control, separately. While this dissertation is one of few studies that simultaneously examine individual- and neighborhood-level factors in explaining racial and ethnic differences in hypertension awareness, treatment and control, additional empirical studies should examine other (untested) social and economic factors that may shape racial and ethnic differences in hypertension awareness, treatment, and control.

Second, while NHBs are more likely to be aware of their hypertension in comparison with NHWs and Hispanics, further investigation is warranted to explain why this advantage is not carried through to control. More hypertension prevention interventions are needed. Such interventions should target decreasing the likelihood of developing hypertension among NHBs as a central focus of the intervention. Decreasing prevalence and improving hypertension treatment and control among NHBs will aid in decreasing cardiovascular disparities between NHBs and NHWs.

Third, while NHB neighborhood racial composition attenuated the racial differences in hypertension awareness, RBRS can also yield deleterious outcomes as explained previously in current research. Thus, it is crucial to understand the causes of RBRS and the social and economic consequences of RBRS on society (Boustan, 2013). Therefore, continued exploration of RBRS as both a factor in promoting healthy outcomes and contributing to social and economic inequalities, which may adversely affect health, is clearly warranted.

Fourth, future research is necessary to develop a more comprehensive understanding of RBRS as an expression of institutional racism. Additional research that focus on segregation as an expression of institutional racism could be strengthened with a multilevel framework and attention to other forms of urban inequality (Acevedo-Garcia et al., 2003). This comprehensive understanding will allow for future studies with new conceptual and empirical explorations of mediators between NHB neighborhood racial composition and hypertension, awareness, treatment, and control; and neighborhood poverty and hypertension awareness, treatment, and control. This process must entail further consideration of NHB neighborhood racial composition and concentrations of poverty as an underlying factor of hypertension control inequities.

## **Conclusion**

Findings for hypertension awareness, treatment, and control that are presented in this dissertation are comparable to finding of studies conducted by Morenoff and colleagues (2007) and Hunte and colleagues (2012). While race is an independent correlate of hypertension awareness in this sample, race did not correlate with hypertension treatment and control. By decomposing racial and ethnic differences into within- and between-area components, I was able to elucidate plausible effects of residential segregation in explaining racial and ethnic differences in hypertension awareness, treatment, and control (Morenoff et al., 2007). Specifically, by using single- and multi-level models to analyze I was able to examine: (1) specific social and economic

factors that may shape racial and ethnic differences in hypertension awareness, treatment, and control, while controlling for individual-level covariates and (2) the degree to which racial and ethnic differences are reduced after accounting for neighborhood effects. While NHBs were more likely to be aware of their hypertension status than NHWs and Hispanics, this advantage did not translate into higher rates of hypertension treatment and control. Small sample size may explain a lack of statistical significance in hypertension treatment and control. Similarly, it is important to note that all racial and ethnic groups in Detroit live under similar residential conditions that are plagued with high concentrations of poverty and disinvestment and may also explain a lack of statistical significance in hypertension treatment and control.

While NHBs neighborhood racial composition may offer some protective benefits for hypertension awareness, this is not an endorsement of residential segregation because residential segregation can also have deleterious effects on health outcomes. Unlike other studies that found neighborhood poverty to be a main correlate of racial or ethnic differences in hypertension awareness, treatment, or control, in this sample neighborhood poverty did not explain racial and ethnic differences in hypertension awareness, treatment, or control. This may be in part due to the manner in which the 2002 HEP data were collected, which allowed for the independent examination of NHB neighborhood racial composition and neighborhood poverty. While the Chicago Community Adult Health Study (CCAHS 2002-2003) is a groundbreaking study that examined the impact of social inequalities, such as social context, socioeconomic position, race and ethnicity, psychosocial factors, and biological markers of stress among a variety of health outcomes in a sample of 4000 adults in a major American city, this study did not distinctly separate neighborhoods with greater proportion of NHBs and neighborhood poverty into independent categories, which may sometime conflate the effects of one or both variables and

make it unclear which of the two is the greatest correlate. In the CCAHS, neighborhood poverty and percent of NHBs in a neighborhood were collectively treated as *disadvantaged neighborhoods*.

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## CHAPTER 3

### **NHB neighborhood racial composition and social connections: Associations with hypertension awareness, treatment, and control**

#### **Introduction**

Hypertension awareness is a major determinant of both hypertension treatment and control (CDC, 2012). Awareness of hypertension varies by race, ethnicity, age, sex, and socioeconomic factors (Ostchega et al. 2008; CDC, 2012; Hajjar et al., 2006). A strong and consistent finding of epidemiologic research is that hypertension awareness is higher among Non-Hispanic Blacks (NHBs) compared with Non-Hispanic Whites (NHWs) and Hispanics, and that awareness is higher among NHWs compared with Hispanics (Egan et al., 2010; Hajjar et al., 2006; Hertz & Unger, 2005). Likewise, the odds of being aware of hypertension appear to be higher among NHBs who reside in neighborhoods with higher proportions of other NHBs (i.e. NHB neighborhood racial composition), higher levels of poverty, lower family income, and fewer Hispanics and foreign-born immigrants (Morenoff et al., 2007). To expand the findings of Morenoff and colleagues (2007), in Chapter 2 I tested several relationships: specifically, whether race, NHB neighborhood racial composition and neighborhood poverty correlates with hypertension awareness, treatment, and control. These analyses showed NHBs were more likely to be aware of their hypertension compared with NHWs and Hispanics, and that NHB neighborhood racial composition (defined as percent NHBs) was significantly associated with an increase in hypertension awareness. Similarly, NHB neighborhood racial composition was a protective factor for awareness of hypertension; once NHBs neighborhood racial composition

was included in the models, racial differences between NHB and NHW residents were no longer significant. The reason for this relationship --increased NHB neighborhood racial composition associated with increased hypertension awareness -- is unexplained and warrants further investigation.

An increasing number of studies have documented beneficial or protective effects of race-based residential segregation (RBRS) on health, especially the effects of enhanced social connections (Walton et al., 2012; Bell et al., 2006; Morello-Frosch et al., 2006; Inagami et al., 2006). The social environments of neighborhood can shape health through characteristics of the social relationships among residents including the degree of mutual trust and feelings of connectedness amid neighbors (Walton et al., 2012; Bell et al., 2006; Morello-Frosch et al., 2006; Inagami et al., 2006). Residents of “close-knit” neighborhoods may be more likely to work collaboratively to achieve common goals such as cleaner and safer public places and healthier behaviors; to exchange information and other resources that affect health; and to maintain informal social controls such as discouraging crime and other undesirable behaviors like smoking or alcohol use (Wilder Research, 2012; Cacioppo & Hawkey, 2003). Ultimately, both social connections and social contexts are recognized as important determinants of health with major contributing influence on health outcomes over and above the contributions of individual and household factors (Morenoff et al., 2007; Wilder Research, 2012). Less closely knit neighborhoods and greater degrees of social disorder have been related to unfavorable health outcomes (Wilder Research, 2012; Cacioppo & Hawkey, 2003).

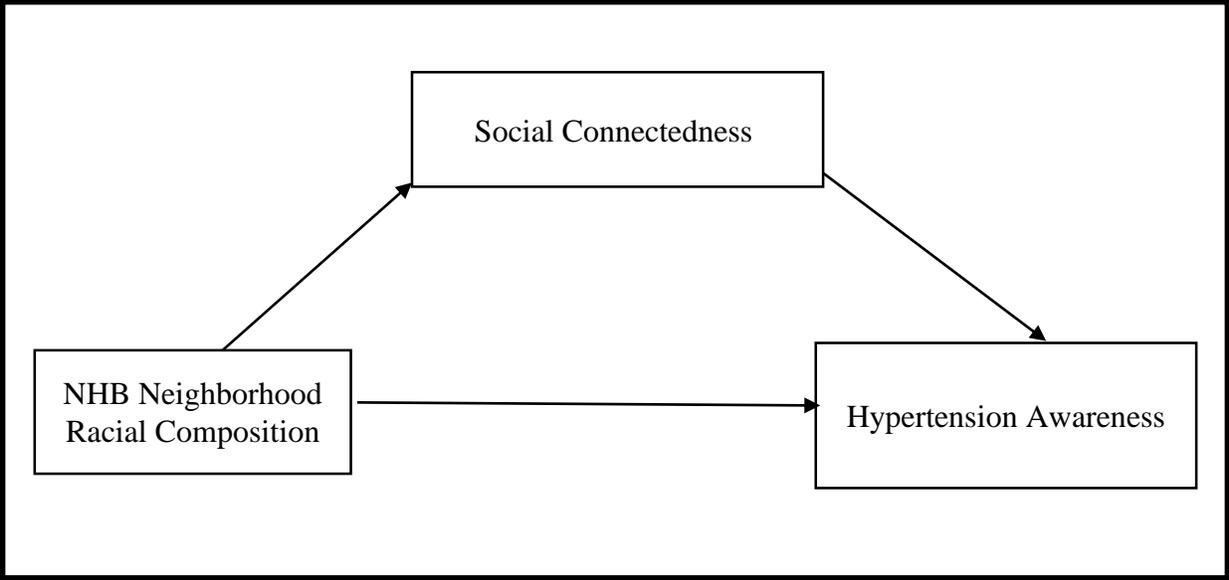
Specifically, I seek to examine a gap in the literature by investigating the role of social connectedness in explaining the relationships between NHB neighborhood racial composition and hypertension awareness by analyzing social connectedness as a plausible explanation for an

increase in hypertension awareness among individuals who live in neighborhoods with high a percentage of NHBs. Similarly, I investigate the role of social connectedness as a main correlate of hypertension treatment and control. I hypothesize that social connectedness will mediate the relationship between NHB neighborhood racial composition and hypertension awareness. Based on the findings of Chapter 2, I hypothesize a different relationship between NHB neighborhood racial composition and hypertension treatment and control; specifically that social connectedness is an independent correlate of hypertension treatment and control and that NHB neighborhood racial composition exerts an indirect effect on hypertension treatment and control through social connectedness. Below, I present a theoretical framework and review the relevant literature that informs these specific hypotheses, before turning to a description of the analysis and results.

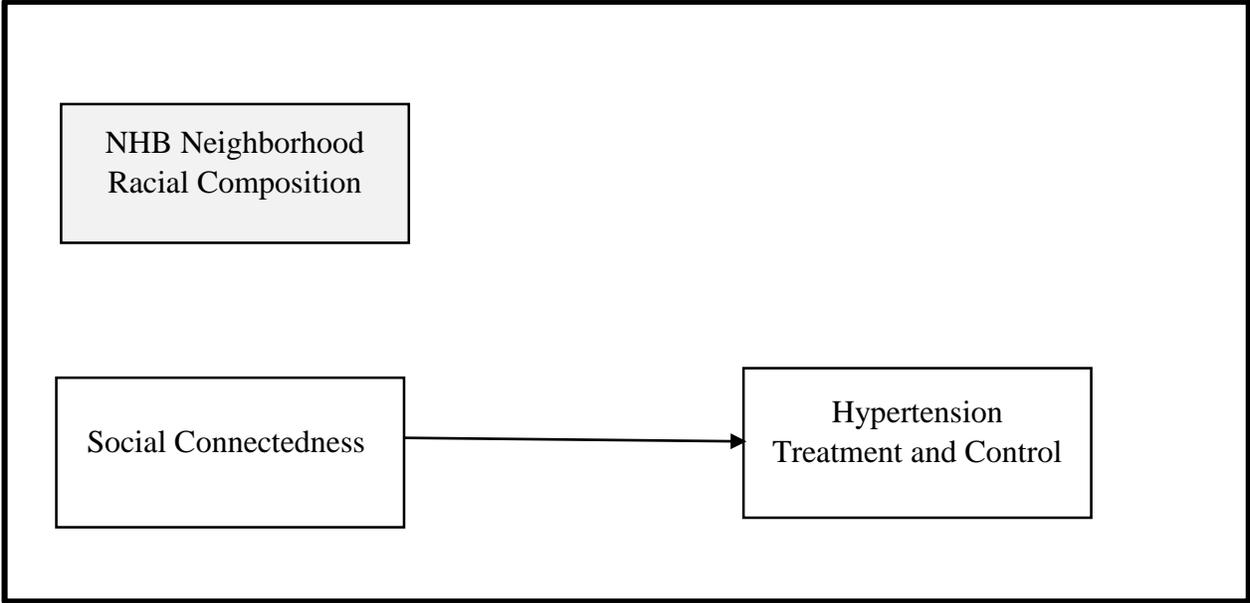
### **Theoretical Framework**

Previous research has suggested that social ties and relationships may play critical roles in the determination of health status (Berkman & Syme, 1979). Recognition of the importance of social connections for health dates back as far as the work of Emile Durkheim (Berkman et al., 2000). An independent social determinant of health is the extent, quality and strength of social connections with others (Berkman et al., 2000). Figures 3.1 and 3.2 are limited versions of Figure 1.1 and build on the *Social Ecological Model* (SEM) and the *Social Production of Disease* (SPD) models that were discussed in Chapter 1. Figure 3.1 suggests that social connectedness mediates the relationship between neighborhoods with high percentage of NHB and hypertension awareness. Figure 3.2 suggests NHB neighborhood racial composition exerts an indirect effect on hypertension treatment and control through social connectedness which independently correlates with hypertension treatment and control.

**Figure 3.1.** Social connectedness (individual-level) mediates the relationship between NHB neighborhood racial composition and hypertension awareness.



**Figure 3.2.** Social connectedness (individual-level) is a main correlate of hypertension treatment and control. The gray box acknowledges the possible influence of NHB neighborhood racial composition and will be controlled for in the model.



## **Background**

### **NHB Neighborhood Racial Composition and Hypertension Awareness, Treatment and Control**

A clearer understanding of the factors or characteristics of neighborhoods with relatively higher percentages of NHBs is needed to better elucidate the protective benefits that partly explain racial and ethnic differences in hypertension awareness. Similarly, given the absence of an association between NHB racial composition and treatment and control, a more comprehensive understanding is warranted to better elucidate the factors that may influence these outcomes. A few empirical studies have focused on features of the social and built environments that are characterized by persistently low socioeconomic position (SEP) (Acevedo-Garcia 2000, 2001; Peterson & Krivo, 1999) and high percentages of NHBs who have higher rates of mortality and morbidity. In the case of hypertension awareness, there is a paradoxical relationship between residence in a neighborhood with a high percentage of NHBs and awareness of hypertension. Residence in a neighborhood with a high percentage of NHBs has been suggested to serve as a protective factor for hypertension awareness because NHBs tend to reside in neighborhoods with more NHBs and maybe more interactive with other NHBs (Walton, 2009; Bell et al., 2006; Morello-Frosch et al., 2006; Inagami et al., 2006). Similarly, national public health campaigns maybe more likely to not only target NHBs but where they reside as well since they have the highest prevalence of hypertension (Morenoff et al., 2007).

Contrary to some literature that shows neighborhoods with high a percentage of NHBs coupled with neighborhood poverty create disadvantaged neighborhoods with social problems (Williams & Collins, 2001; Macintyre & Ellaway, 2000), NHBs, in this dissertation, appear to experience some benefit from the high percentage of NHB residents, and this benefit is robust after accounting for neighborhood poverty levels. However, the advantages conferred for awareness were not apparent for hypertension treatment or control as demonstrated in Chapter 2.

Despite the overall improved rates of hypertension awareness, the continuance of racial and ethnic differences in hypertension treatment and control is one compelling reason to take a closer look at the role of NHB neighborhood racial composition and other indirect pathways such as social connectedness.

### **NHB Neighborhood Racial Composition and Measures of Social Connectedness**

Measures of social connectedness are of particular interest due to evidence of their health-enhancing qualities (Berkman et al., 2000). There are both conceptual and empirical grounds for assuming that NHB neighborhood racial composition is associated with distinctive social connectedness measures. Most social interactions are not randomly distributed in the population; rather, they are socially patterned and often cluster with one another (Nelson, 2003). Still a relatively emerging phenomenon in explaining racial and ethnic differences in health outcomes, social context is highly correlated with race and ethnicity in the United States, as neighborhoods are stratified along SEP, race, and ethnicity (DeNavas-Walt et al., 2009). Moreover, many risk factors for hypertension, such as comorbidities, inactivity, social withdrawal, poor self-rated health, poverty, and lifestyle have been associated with poor health outcomes and especially among individuals who reside in poor and disadvantaged areas. All of these factors have been investigated almost exclusively at an individual-level.

These patterns guided Link and Phelan (1995) to speak of social settings that place individuals “at risk of risks.” Few studies have assessed the influence of the neighborhood environment on hypertension awareness, treatment or control. Subsequently, the social contexts in which people live are increasingly recognized as an additional determinant of health and a major contributing factor to health disparities in excess of individual and household risk factors (Morenoff et al., 2007). Thus, it is plausible to hypothesize a relationship between social connectedness and NHB neighborhood racial composition.

Some researchers have approximated that 62.7% of NHBs in the U. S. reside in mostly NHB neighborhoods, and NHBs continue to be the most segregated minority group (Logan, 2011). Residence in neighborhoods with high percentages of NHBs has been shown to have positive effects on certain health outcomes, for reasons that are only partially understood. Perhaps, large percentages of NHBs clustered in a dense area may foster greater social connections (TMOFSD, 2010). Clustering of residents who generally get along and feel neighbors can be trusted often lead to shared values and to close-knit neighborhoods and networks (TMOFSD, 2010; Morenoff et al., 2007; Lochner et al., 2003), which may afford some protection against poor health outcomes. Equally, social networks and connections can possibly lead to the exchange of health information (TMOFSD, 2010; Kim et al., 2008). More specifically, individual-level measures of social connectedness may explain an increase in hypertension awareness among individuals who reside in neighborhoods with a high percentage of NHBs, which was established in Chapter 2. However, the extent to which racial and ethnic differences in hypertension awareness are influenced by differences in social factors particularly, individual-level sense of community, neighborhood satisfaction, neighborhood participation, social support, and social connectedness index, remain untested.

### **Social Connectedness**

Social connectedness is often defined as the relationships or quality ties people have with others and the benefits these relationships can bring to the individual as well as to society (TMOFSD, 2010; Keyes et al., 2002). This phenomenon includes relationships with neighbors, family, friends, and colleagues, as well as connections people make through paid employment, sporting events, and other leisure activities, or through voluntary work or community service (TMOFSD, 2010). Subsequently, the review of the literature demonstrates that social connectedness may be measured in various ways. Measures often examined are items that reflect

quality ties or social connections such as partnership status, social network characteristics and social support (DiMatteo, 2004; House et al., 1988; Umberson, 1987). Epidemiologic literature investigating how neighborhoods affect health highlights the environmental characteristics that provoke adaptation and have included measures of neighborhood participation, neighborhood satisfaction, and sense of belonging when measuring social connectedness (Yen et al., 2012; Berkman et al., 2000). The concept of belonging highlights social exchanges, routines, and attachment that develop within settings over time. Investigating belonging promotes understanding positive aspects of health, as in well-being and quality of life (Yen et al., 2012). It is important to highlight the intersections of the individual's behaviors within an environment together with their social experience (e.g., connections or attachment). The social ecological model (SEM) captures individual's activity and how it relates to their social environment (Berkman et al., 2000; McLeroy; 1988; Sallis & Owen, 2002).

In this dissertation, social connectedness is operationalized using four distinct constructs (scales): *neighborhood satisfaction*, *neighborhood participation*, *social support*, and *sense of community*. In addition, models were run using an index that combines those dimensions into a single, cumulative indicator, called social connectedness.

### **Sense of Community**

According to Stronegger and Titze (2010), neighborhoods are the most important place to establish connections with other individuals inclusive of daily routine activities; therefore the physical and social environments of neighborhoods have been postulated to affect the health and health behavior of the residents. Similarly, Berkman and colleagues (2000) concluded that social networks influence individual health through multiple pathways, one of which is: social engagement and attachment. While a social network refers to the web of social relationships that surround an individual and the characteristics of those ties in particular, the type and strength of

each social relationship (Umberson & Montez, 2010), a sense of community may arise from a social network or a social network may arise from a sense of community. Social engagement and attachment is an indication for sense of community (Kitchen & Chowhan., 2012). *Sense of community* is a concept related to levels of social attachment among individuals and is indicative of social engagement and participation within communities (Kitchen & Chowhan, 2012).

Individuals live in specific neighborhoods, and they have day-to-day experiences in them and share their sense of community with their neighbors. While social engagement and attachment can lead to positive health outcomes and significantly reduce mortality risk (Holt-Lunstad et al., 2010), few studies have examined the association between sense of community and hypertension awareness, treatment, and control. Due to the health promoting benefits of sense of community, it plausible to hypothesize that sense of community may exert similar health promoting benefits on hypertension outcomes. Moreover, Shields (2008) proposes feeling connected to one's community can promote health through the building of mutual respect and by increasing self-esteem.

### **Neighborhood Satisfaction**

*Neighborhood satisfaction* often functions as a critical factor for resident's intention to remain in their current neighborhood or to move. Neighborhood satisfaction is predicted by perception and evaluation of the attributes of the environment (Hur et al., 2010). Higher perceived environmental characteristics and higher evaluations of them positively influence residents' overall neighborhood satisfaction and desire to remain in current neighborhood (Hur et al., 2010). Higher neighborhood satisfaction is also believed to have the potential to attract others to move into a neighborhood (Hur et al., 2010) and to influence quality of life and specific disease outcomes (Hur et al., 2010). Similarly, Mujahid and colleagues (2008) found that individuals who self-reported better neighborhood characteristics such as availability of healthy

foods, walkability, safety, and social cohesion were less likely to be hypertensive, even after adjustment for individual-level characteristics of age, gender and SES (education and income). While Mujahid and colleagues (2008) studied the association between hypertension prevalence and perceptions of neighborhood characteristics, few studies have examined the association between neighborhood satisfaction and hypertension awareness, treatment and control. Subsequently, the plausible links that may exist are unclear and warrant additional examination.

### **Neighborhood Participation**

A relevant concept for understanding contextual social effects on individual health is neighborhood participation (Merlo et al., 2003; Subramanian et al., 2003; Kawachi & Berkman, 2000; Cullen, 2001). This concept has been used in the operationalization of social integration that originally focused on the social support of the person (Merlo et al., 2003). *Neighborhood participation* is measured as involvement in neighborhood social activities, and it is a relevant concept for understanding neighborhood contextual effects on individual health (Merlo et al., 2003). Neighborhood participation is directly influenced by the characteristics of the neighborhood (Lindstrom et al., 2002). For instance, greater perceptions of neighborhood problems (e.g., traffic, noise, trash, smells, and fires) have been associated with lower quality of life and worse physical functioning among some individuals (Mujahid et al. 2008). Individuals who perceived greater problems may view their neighborhood as unsafe and maybe less likely to participate in social activities and may lead to fewer social connections (Ziersch et al., 2005; Baum et al., 2009). Conversely, higher levels of neighborhood participation may result in better social networks and better social networks have been hypothesized to be positively correlated with health behaviors, possibly as a result of information exchange and the establishment of health-related group norms (Kawachi & Berkman, 2000; Rogers, 1985). Similarly, better networks may not only precipitate greater exchange of information but may precipitate greater

medication compliance as a result of greater exchange of information (Merlo et al., 2003). Greater exchange of health information may explain higher rates of awareness among NHBs and may explain equal rates of treatments among all racial and ethnic groups who reside in neighborhoods with high percentages of NHBs as presented in Chapter 2. It is important to note that hypertension treatment and control does not appear to be influenced by the same factors that impact hypertension awareness. However, greater social networks and connections may precipitate greater utilization of health care facilities, which may result in greater hypertension treatment and control.

### **Social Support**

For over 30 years, researchers have examined the relationship between social support and health outcomes (Heaney & Israel, 2002; Berkman & Syme, 1979; Blazer, 1982; House et al., 1985). *Social support* refers to the various types of assistance that people receive from their social networks and may be viewed as the number of friendships, nearby relatives, and organizational involvements (Eckenrode & Gore, 1981). Social support has also been presented as an improving survival and functional recovery following physical disability and illness (such as stroke or heart attack (Wallston et al., 1983; Heaney & Israel, 2002; Berkman & Syme, 1979; Blazer, 1982; House et al., 1985) because family, friends, and other social contacts aid in the reduction of emotional distress and problems resulting from illness (Porrit, 1979). While social support has health promoting benefits, research acknowledges that there is variation in the type, frequency, intensity, and extent of support provided (Berkman et al., 2000). Social support is typically differentiated into subtypes which include emotional, instrumental, appraisal and informational support (Sarason et al., 1983), but for the purpose of this dissertation, I will focus only on emotional and instrumental support.

Emotional support includes less tangible (but equally important) forms of assistance that make people feel cared for and loved (such as sharing confidences, talking over problems), which is often defined as the amount of "love and caring, sympathy and understanding and/or esteem or value available from others" (Thoits, 1995). Emotional support is most often provided by a confidant or intimate other, but less intimate ties can also provide such support under circumscribed conditions (Berkman et al., 2000). Instrumental support refers to the tangible resources (such as cash loans, labor in kind) that people receive from their social networks and aid or assistance with tangible needs such as getting groceries, getting to appointments, phoning, cooking, cleaning or paying bills (Berkman et al., 2000). House (1981) refers to instrumental support as aid in kind, money or labor.

Some studies have even suggested that social support, may provide opportunities for instrumental support and to connect individuals to information that increases the likelihood of seeking medical care, becoming aware of high blood pressure, and adhering to medical treatment (DiMatteo 2004; House et al., 1988; Umberson, 1987). For example, Cornwell and Waite (2009) and Kim and colleagues (2008) found there is strong evidence that suggest social relationships are associated with hypertension diagnosis and awareness because residents are more likely to share health information and act as support networks for diagnosis. More so, hypertension is commonly asymptomatic, and many individuals are unlikely to seek treatment because of discomfort or declining function (Cornwell & Waite, 2009). Subsequently, factors that raise awareness encourage individuals to undergo preventive screenings are critical (Cornwell & Waite, 2009).

In general, social connectedness is comprised of many, somewhat overlapping components to include sense of community, neighborhood satisfaction, neighborhood

participation, and social support, which separately and jointly may impact health outcomes, specifically hypertension awareness, treatment, control. Chapter 2 established a relationship between NHB neighborhood racial composition and hypertension awareness; however, the same association was not found for NHB neighborhood racial composition and hypertension treatment and control. Thus, it is plausible that NHB neighborhood racial composition may exert an indirect effect through social connectedness on hypertension treatment and control. These alternative associations warrant further investigation.

### **Social Connectedness as an Indicator of Social Context: Association with Hypertension Awareness, Treatment, and Control**

Understanding features of the social context is not only important for decreasing uncontrolled hypertension disparities, which often lead to CVD disparities, but it is important for disentangling the paradoxical relationship between increased hypertension awareness and decreased hypertension control among NHBs. Current literature continues to highlight the long history of interest in the ways in which the residential environment can contribute to hypertension (Roux, 2003). The concept of place, particularly place of social interaction (e.g., geographic location, local context, neighborhood), has emerged as an important construct in understanding the contributions of residential environments, in particular, race-based residential segregation in fostering health outcomes (Mujahid et al., 2008; Diez-Roux 2001; Morenoff & Lynch, 2004). To explore the inconsistency between hypertension awareness and uncontrolled hypertension, I will build upon findings by Morenoff and colleagues (2007) and examine the associations between social connectedness and hypertension awareness, treatment, and control and variations in neighborhood racial composition. Morenoff and colleagues (2007) reported that an initial protective effect of Black race for awareness is accounted for by race based residential segregation in their Chicago based sample. This result was replicated in this Detroit-

based sample, as presented in Chapter 2. However, Morenoff and colleagues (2007) did not investigate the reasons for increased awareness among residents. Some prior empirical studies have established some protective effects of RBRS (Walton, 2009; Bell et al., 2006; Morello-Frosch et al., 2006; Inagami et al., 2006). Thus, it is critical to examine various pathways to explain factors that influence hypertension awareness, treatment, and control in different ways.

To that end, in this chapter I build on results reported in Chapter 2 to examine the following research questions and hypotheses:

Research Question 3.1: Does social connectedness (individual-level) mediate the relationship between NHB neighborhood racial composition and hypertension awareness?

(Hypothesis 3.1) Social connectedness (individual-level) will mediate the relationship between NHB neighborhood racial composition and hypertension awareness. Individuals with higher social connectedness will have higher hypertension awareness.

Research Question 3.2: Is social connectedness (individual-level) a correlate of hypertension treatment when controlling for NHB neighborhood racial composition?

(Hypothesis 3.2) Social connectedness is a correlate of increased hypertension treatment. NHB neighborhood racial composition exerts an indirect effect on hypertension treatment through social connectedness.

Research Question 3.3: Is social connectedness (individual-level) a correlate of hypertension control when controlling for NHB neighborhood racial composition?

(Hypothesis 3.2) Social connectedness (individual-level) is a correlate of increased hypertension control among those treated. NHB neighborhood racial composition exerts an indirect effect on hypertension control through social connectedness.

## **Methods**

### **Study Design and Sample Description**

Data for this study are drawn from the 2002 Healthy Environments Partnership (HEP) Community Survey Wave 1, which has been described in previous works (e.g. Schulz et al.,

2005). HEP is a community-based participatory research partnership comprised of community organizations, residents, and academic researchers who collaborate to address factors that contribute to excess risk of CVD among residents in Detroit, Michigan (Schulz, et al., 2005). The University of Michigan Institutional Review Board for Protection of Human Subjects approved the HEP study in January 2001.

The HEP survey uses a stratified 2-stage probability sample of occupied housing units designed for 1,000 completed interviews with adults ages  $\geq 25$  years across Detroit. This design allows for comparisons of residents of similar demographics across three distinct geographical areas (Eastside, Northside, and Southwest) of the city of Detroit (Schulz, et al., 2005). The survey sample was designed to achieve adequate variation in socioeconomic position within each of the three predominant racial and ethnic groups in Detroit: African-Americans, Latinos, and Whites in order to conduct analyses of socioeconomic status within and across racial and ethnic groups. Data were imputed to account for missing values. The final sample consisted of 919 face-to-face interviews: interviews were completed with 75% of households in which an eligible respondent was identified (Schulz, et al., 2005). The 919 respondents were nested within 69 census block groups throughout the Eastside, Southwest, and Northwest Detroit study areas. Of the total multiethnic sample, analysis for this study focuses on the 377 individuals who have hypertension.

## **Measures**

### **Dependent Variables**

Hypertension awareness. Hypertension awareness is an individual level variable measuring whether individuals with hypertension have been told by a health care provider that they have hypertension (yes=1 no=0).

Hypertension treatment. Hypertension treatment is an individual level variable measuring whether individuals who are aware of their hypertension are currently being treated for hypertension (yes=1 no=0).

Hypertension control treated. Hypertension control treated is an individual level variable measuring whether individuals who are treated for hypertension have SBP <140mmHg and DBP<90mmHg (yes=1 no=0).

### **Individual-Level Independent Variables**

Four scales representing different dimensions of social connectedness were included in the models described here: sense of community, neighborhood satisfaction, neighborhood participation, and social support. In addition, a composite index was created that represented a cumulative indicator of social connectedness. Each is described below.

Sense of community is a scale of six items (of which at least 5 items must be answered) assessing how individuals feel about their neighborhoods. They included, “I think this neighborhood is a good place for me to live,” “People in this neighborhood share the same values,” “I feel at home in this neighborhood,” “It is very important to me to live in this particular neighborhood,” “I expect to live in this neighborhood for a long time,” and “People in this neighborhood generally know each other.” Possible responses were strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree. Analyses were run measuring sense of community as a continuous measure based upon the mean of these six items (Cronbach’s alpha=0.68).

Neighborhood satisfaction was a single item: “I would move out of this neighborhood if I could.” Response options ranged from (1) strongly disagree to (5) strongly agree. Responses were reverse coded so that higher scores represented greater satisfaction. This question was

recoded in reverse order to ensure consistency with the other social connectedness indicators, in which a high score indicates a higher level of social connectedness.

Neighborhood participation was assessed through the mean of three items representing participation over the last 12 months, and included “Have you attended a block club, neighborhood association, or police precinct meeting?,” “Have you participated in neighborhood clean-up or beautification project, crime watch, Angel’s Night, or other neighborhood activity?,” and “Have you served on a committee, helped organize meetings, or served in a position of leadership for any local organization such as a block club, church, parent teacher or other school organization, or any other organization?” Possible responses for each question were (0) =no, (1) =yes, but due to the distribution of the variable, I recoded the variable to where (0) =none, and (1) =one or more. Higher scores were indicative of greater neighborhood participation.

Analyses were run measuring neighborhood participation as a continuous measure.

Social support is a mean scale composed of seven items, including dimensions of both Instrumental and emotional support. Instrumental support questions included “If you needed help around the house, for example with cleaning or making small repairs, how often could you get somebody to help without paying them?,” “If you were sick, how often would there be somebody who would help care for you?,” “If you couldn’t use your car or your usual way of getting around for a week, how often could you find somebody who would take you wherever you needed to go?,” “If you needed to borrow a fairly large sum of money, how often would you have somebody or somewhere you could borrow it from?,” and “If you were worried about an important personal matter, how often would there be somebody you could confide in?” Response options ranged from (1) never to (5) always. Higher scores were indicative of greater social support. Analyses were run measuring social support as a continuous measure. Emotional

support questions included “When you have problems, how often would there be somebody you could trust to help you solve them?” and “How often is there somebody who makes you feel loved and cared for?” Response options ranged from never (1) to always (5). Higher average responses indicated a greater perceived level of social support. Analyses were run measuring social support as a continuous measure (Cronbach’s alpha =0.72).

In addition to the above conceptually distinct scales (sense of community, neighborhood satisfaction, neighborhood participation, and social support) of social connectedness, a composite index of social connectedness was constructed. For each question of each respective scale, the values were dichotomized as “yes” or “no”. Thus, the social connectedness index consisted of 17 dichotomized (yes or no) responses and were grouped into an index where participants were required to provide answers to at least 75% of each respective scale (sense of community, neighborhood satisfaction, neighborhood participation, and social support). Individuals received a “1” for “yes” and a “0” for no. The sum of the indicator variables was the index social connectedness variable. Thus, social connectedness was modeled as an index of the number of questions to which the participant indicated “yes”, ranging from 0-17. Higher scale scores and higher index scores indicated higher levels of social connectedness. If participants responded “no” to all 17 questions, they were categorized as having no social connectedness. Finally, because associations between neighborhood participation and the outcome variables were in the opposite direction from the other three social connectedness scales, models were run using a version of the index that included only sense of community, social support and neighborhood satisfaction to test for sensitivity. However, these models were not significantly different than the models that included neighborhood participation as a part of the index and therefore were not reported

### **Individual Control Variables**

Several variables were included as control variables, which previous literature have demonstrated as correlates of hypertension awareness, treatment, and control (Hajjar & Kotchen, 2003; Hajjar et al., 2006; Hertz & Unger, 2005). These included both individual- and neighborhood-level variables, as described below.

Self-reported *gender* (male or female), *age* (continuous), *education level* (less than high school, high school diploma or GED, and some college or greater), *marital status* (married/in a relationship or not currently married /separated /divorced /widowed) and *employment status* (currently working for pay or not currently working for pay) were controlled for. *Household Poverty* was calculated for the HEP sample using 2002 census estimates for the U.S. poverty thresholds (organized by family size and number of children) and HEP survey data available for total household income and the total number of adults and children in the household for 2002. Household poverty was modeled as a binary variable of whether household per capita income fell below or above the Federal Poverty Level for 2002. Length of residence in the neighborhood was defined as a continuous variable of participants' self-report of the number of years they have resided in their current neighborhood. The neighborhood was defined to participants as the blocks that surround the block in which they lived and was within walking distance of their homes.

### **Neighborhood Level Control Variables**

NHB neighborhood racial composition was modeled as a census block group (Level-2) control variable due to its indirect association with social connectedness. Similarly, the social connectedness index was modeled as a continuous measure at Level-2 to control for mediation and correlation of the social connectedness index at Level-1 (Zhang et al., 2009). NHB neighborhood racial composition was defined as the percent of NHB residents in each census

block group. For models testing mediation, each of the four subscales (sense of community, neighborhood satisfaction, neighborhood participation, and social support) was also aggregated and included as a Level-2 (neighborhood level) variable. Similarly, the social connectedness index was defined as the aggregate proportion of social connectedness among individuals at Level-2 (neighborhood level). Data for percent NHB measures were generated from Census 2000 data files. NHB neighborhood racial composition for each census block group was modeled as a continuous measure in the analysis.

### **Data Analysis**

Several data analytical steps were taken to address the research questions in this chapter. Weighted descriptive statistics and univariate procedures were performed using SAS software, Version [9.3] for Windows. For unequal probabilities of selection within each stratum and to match the sample to Census 2000 population distributions for the study areas, all sample statistics were adjusted for sample weights. Demographic statistics were calculated using proc surveyfreq and proc surveymeans commands to estimate weighted means and proportions given the complex sample design.

To test the study hypotheses, two-level hierarchical regression models for a Bernoulli Outcome were estimated using HLM 7 (Scientific Software International, Lincolnwood, IL, 2011). Level-1 varied among survey respondents based on the dependent variable tested: N=250 (Hypertension Awareness), N=216 (Hypertension Treated), and N=111 (Hypertension Control Treated), and Level-2 were the 69 census block groups. The first hypothesis tested whether social connectedness mediated the relationship between NHB racial composition (Level-2) and hypertension awareness after accounting for known covariates such as age, gender, education, marital status, and household poverty (Level-1). The second hypothesis tested whether social connectedness predicted hypertension treatment and control accounting for

known covariates such as age, gender, education, marital status, and household poverty (Level -) and NHB racial composition (Level-2). Before testing the social connectedness index as a mediator or independent predictor, each independent measure -- sense of community, neighborhood satisfaction, neighborhood participation, and social support -- were tested for potential main (independent) effects on hypertension awareness, treatment, and control.

## **Results**

Sociodemographic characteristics and descriptions of hypertension awareness, treatment, and control, the main dependent variables at the individual- level (Level-1) for this study, are described in Tables 2.1 and 2.1.1 of Chapter 2. Table 3.1, shows the distribution of participants' across hypertension prevalence, awareness, treatment, and control along with the distribution of sense of community, neighborhood satisfaction, neighborhood participation, and social support. Of the total sample, individuals reported a mean (SE) sense of community of 3.59(0.04), on a scale of 1-5. Mean (SE) levels of neighborhood satisfaction were 2.43(0.05). The mean (SE) response to three items asking about neighborhood participation was 0.73(0.04) (range=0-1). The mean (SE) response to seven items asking about social support was 3.68 (0.03) (range=0-5). Mean responses to the four social connectedness variables did not vary significantly across those who were aware of their hypertension, those who were treated, and those whose hypertension was controlled while treated. These results are presented in Table 3.1

Of the total sample, mean (SE) levels of neighborhood social connectedness was 9.19(0.14). Mean neighborhood level social connectedness did not vary significantly ( $F=0.50$ ) across those who were aware of their hypertension, those who were treated, and those who hypertension was controlled while treated. The results are presented in Table 3.1. Among those in the total sample, the average length in a neighborhood was 18 years as noted in Figure 3.1.

Length of years varied significantly ( $p=0.03$ ) across prevalence (22.0 years), awareness (23.4 years), treatment (24.7 years), and control (24.6 years).

### **Hypertension Awareness**

Models 1 and 2 in Table 3.2 were reported in Chapter 2 and are presented here to facilitate interpretation of the new models. Model 1 is a fully unconditional model that showed that 52% of the variance in awareness was between census block groups. Model 2 (Figure 2.2) showed NHB neighborhood racial composition was positively associated with hypertension awareness (OR=1.01, 95% CI [1.00, 1.02],  $p=0.05$ ).

Results for research question 3.1, examining individual-level (Level-1) social connectedness as a mediator between NHBs racial composition and awareness, are shown in Model 7, Table 3.2.

Models 3-6 (also Table 3.2) show results for associations with awareness for each measure of the social connectedness index separately. Specifically, Model 3 shows results for individual-level (Level-1) measures of sense of community (OR=0.86, 95% CI [0.63, 1.18],  $p=0.35$ ); results for neighborhood satisfaction are shown in Model 4 (OR=0.81, 95% CI [0.66, 1.00],  $p=0.05$ ); results for neighborhood participation are shown in Model 5 (OR=1.03, 95% CI [0.79, 1.35],  $p=0.82$ ); and results for social support are shown in Model 6 (OR=0.72, 95% CI [0.49, 1.04],  $p=0.08$ ). Neighborhood satisfaction was not only statistically associated with hypertension awareness as an individual-level main correlate ( $p=0.05$ ), but it also statistically correlated with hypertension awareness at the aggregate-level (OR=1.66, 95% CI [1.11, 2.48],  $p=0.01$ ). Similarly, social support was marginally significant at the individual-level ( $p=0.08$ ) but statistically insignificant at the aggregate-level ( $p=0.47$ ). This paradoxical relationship is unclear. However, it is important to note that the patterns were not in the expected direction at the individual-level. High levels of individual-level social support were inversely associated

with hypertension awareness. While this finding is not easily understood, this paradoxical relationship may be attributable to the fact that individuals who may have more social support may not be receiving support that would increase awareness of hypertension. Trends at the aggregate-level were in the expected positive direction.

Formal tests assessed the mediation effects for each of the social connectedness indicators: sense of community ( $t=-2.5$ ), neighborhood satisfaction ( $t=-2.5$ ), neighborhood participation ( $t=-2.5$ ), social support ( $t=-2.5$ ), and the social connected index ( $t=-2.5$ ) are presented in Table 3.3. Neither the individual measures of social connectedness nor the individual-level social connectedness index (Level-1) or aggregate social connectedness index (Level-2) mediated the relationship between NHBs racial composition and hypertension awareness according to the Freedman- Schatzkin for multi-level mediation. I hypothesized that the individual social connectedness index (Level-1) was a mediator between NHBs racial composition and hypertension awareness; therefore, I was unable to reject the null hypothesis. While not a mediator (at Level-2) between NHB neighborhood racial composition and hypertension awareness, the aggregate social connectedness index was marginally significant as a correlate of hypertension awareness at  $p=0.08$ , and NHB neighborhood racial composition became increasingly more significant at  $p=0.001$  once the social connectedness index was incorporated in the models. This association suggests the full effect of NHB neighborhood racial composition are not visible until social connectedness is accounted for.

### **Hypertension Treatment**

Models 1 and 2 in Table 3.4 were initially reported in Chapter 2. Model 1 is a fully unconditional model that depicts 67% of the variance was between census block groups. Model 2 (Figure 2.2) shows NHBs racial composition was not significantly associated with hypertension

treatment (OR=1.01, 95% CI [0.99, 1.02],  $p = 0.33$ ) after adjusting for individual-level characteristics above and beyond race and ethnicity.

Results for research question 3.2 examining individual-level (Level-1) social connectedness index as a correlate of hypertension treatment, are presented in Table 3.4. First, sense of community Model 3 (Table 3.3) (OR=0.83, 95% CI [0.51, 1.33],  $p = 0.45$ ); neighborhood satisfaction Model 4 (Table 3.3) (OR=0.87, 95% CI [0.65, 1.22],  $p = 0.10$ ); neighborhood participation Model 5 (Table 3.3) (OR=0.73, 95% CI [0.43, 1.24],  $p = 0.25$ ); and social support Model 6 (Table 3.3) (OR=1.14, 95% CI [0.63, 2.05],  $p = 0.66$ ) were tested as main(independent) correlates of hypertension treatment. No significant association between individual-level (Level-1) measures of: sense of community and hypertension treatment; neighborhood satisfaction and hypertension treatment; neighborhood participation and hypertension treatment, and social support and hypertension treatment were reported. Similarly, there were no significant associations between neighborhood level (Level-2) measures of sense of community, neighborhood satisfaction, neighborhood participation, and social support and hypertension treatment as shown in Table 3.3. When these measures were combined into an index, the individual-level (Level-1) social connectedness index did not correlate with hypertension treatment (OR=1.12, 95% CI [0.63, 2.01],  $p = 0.69$ ) nor did the neighborhood level (Level-2) social connectedness index correlate with hypertension treatment. Therefore, I was unable to reject the null hypothesis of no association between social connectedness and hypertension treatment.

### **Hypertension Control**

Models 1 and 2 in Table 3.5 were initially reported in Chapter 2. Model 1 is a fully unconditional model that depicts 8% of the variance was between census block groups. Model 2 (Figure 2.2) shows NHBs racial composition was not significantly associated with hypertension

control (OR=1.00, 95% CI [0.99, 1.02],  $p = 0.73$ ) after adjusting for individual-level characteristics above and beyond race and ethnicity.

Results for the research question 3.3, examining individual-level (Level-1) social connectedness index as a correlate of hypertension control while treated, are presented in Table 3.5. First, individual measures (Level-1) of sense of community Model 3 (Table 3.4) (OR=1.27, 95% CI [0.87, 1.95],  $p = 0.57$ ); neighborhood satisfaction Model 4 (Table 3.4) (OR=1.01, 95% CI [0.83, 1.24],  $p = 0.90$ ); neighborhood participation Model 5 (Table 3.4) (OR=0.75, 95% CI [0.52, 1.10],  $p = 0.14$ ); and social support Model 6 (Table 3.4) (OR=1.07, 95% CI [0.71, 1.60],  $p = 0.76$ ) were tested as main (independent) correlates of hypertension control. No significant association between sense of community and hypertension control; neighborhood satisfaction and hypertension control; neighborhood participation and hypertension control, and social support and hypertension control were reported at the individual-level. When the items were combined into an index, the individual social connectedness index (Level-2) did not predict hypertension control (OR=1.00, 95% CI [0.75, 1.34],  $p = 1.00$ ). I hypothesized that the individual social connectedness index (Level-1) would correlate with hypertension control; therefore, I was unable to reject the null hypothesis.

**TABLE 3.1. Weighted Descriptive Statistics\* for Individual and Census Block Group Variables by Hypertension Prevalence, Awareness, Treatment, and Control in the 2002 HEP Sample**

	<b>HYPERTENSION</b>					
	<b>Total Sample N=919</b>	<b>Prevalence N=377</b>	<b>Awareness N=250</b>	<b>Treatment N=216</b>	<b>Control N=111</b>	<b>ANOVA** F-value</b>
	Values reported as Mean(SE) or Percent					
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Age (years)	46.28(0.84)	54.25(1.28)	57.74(1.69)	59.57(1.71)	60.23(1.79)	<0.0001
Female	52.26	50.61	55.61	60.48	56.07	0.14
Race						
Hispanic***	22.17	15.05	11.31	10.62	12.97	<0.0001
Non-Hispanic Black	56.83	64.34	70.28	72.80	70.64	
Non-Hispanic White	18.70	19.29	17.74	16.57	16.39	
Education <12 years	37.01	39.47	39.52	39.64	47.08	0.63
Marital Status	26.36	24.59	24.66	24.42	41.97	0.08
Households with incomes above the Federal Poverty Level, FPL	36.36	40.95	43.01	42.72	30.34	0.03
Length of Residence (years)	18.31(0.62)	22.01(0.76)	23.40(1.04)	24.71(1.05)	24.66(1.59)	0.03
Sense of Community	3.59(0.04)	3.73(0.07)	3.72(0.07)	3.73(0.08)	3.84(0.09)	
Social Support	3.68(0.03)	3.70(0.04)	3.64(0.05)	3.70(0.05)	3.71(0.06)	
Neighborhood Satisfaction	2.43(0.05)	2.53(0.08)	2.49(0.09)	2.56(0.09)	2.60(0.09)	
Neighborhood Participation	0.73(0.04)	0.73(0.05)	0.74(0.07)	0.71(0.07)	0.59(0.09)	
Social Connectedness Index	9.20 (0.14)	9.53(0.17)	9.39(0.20)	9.44(0.22)	9.73(0.27)	
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Poverty	31.47(0.95)	32.05(1.16)	31.86 (1.45)	31.30(1.59)	30.31(1.68)	0.005
Mean Non-Hispanic Black	55.45(1.83)	62.90(2.52)	68.82 (2.01)	70.39(2.24)	68.98(2.97)	0.004
Aggregate Sense of Community	3.70(0.05)	3.70(0.05)	3.70(0.05)	3.71(0.05)	3.75(0.05)	
Aggregate Neighborhood Satisfaction	2.56(0.06)	2.56(0.06)	2.56(0.07)	2.62(0.07)	2.64(0.07)	
Aggregate Neighborhood Participation	0.78(0.04)	0.77(0.04)	0.79(0.04)	0.78(0.05)	0.78(0.06)	
Aggregate Social Support	3.71(0.03)	3.71(0.03)	3.70(0.04)	3.71(0.04)	3.73(0.05)	
Aggregate Social Connectedness Index	9.19(0.14)	9.54(0.17)	9.39(0.20)	9.44(0.22)	9.73(0.27)	

\*All Level-1 summary statistics were weighted.

\*\* $p < 0.05$

\*\*\*Others are omitted in these analyses.



**Table 3.2. Hypertension Awareness Regressed on Social Connectedness**

	MODEL 3: NHB Neighborhood Racial Composition, Sense of Community <sup>+</sup> , and Individual, Covariates			MODEL 4: NHB Neighborhood Racial Composition, Neighborhood Satisfaction <sup>+</sup> , and Individual Covariates			MODEL 5: NHB Neighborhood Racial Composition, Neighborhood Participation <sup>+</sup> , and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	p <sup>**</sup>	Odds Ratio	Confidence Interval 95%	p <sup>**</sup>	Odds Ratio	Confidence Interval 95%	p <sup>**</sup>
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	1.46	(0.78, 2.73)	0.23	1.46	(0.76,2.79)	0.25	1.48	(0.79, 2.76)	0.22
Age(years)*	1.05	(1.02, 1.08)	<0.001	1.05	(1.02, 1.08)	<0.001	1.05	(1.02, 1.08)	<0.001
Gender (reference: male)	1.60	(0.88, 2.91)	0.12	1.68	(0.92, 3.07)	0.09	1.63	(0.90, 2.96)	0.11
Race(reference: Non-Hispanic Black)									
Hispanic	0.83	(0.30,2.27)	0.71	0.88	(0.31, 2.51)	0.81	0.87	(0.30, 2.44)	0.77
Non-Hispanic White	0.71	(0.34, 1.49)	0.36	0.73	(0.35, 1.56)	0.42	0.72	(0.36, 1.45)	0.36
Marital status (reference: married)	1.53	(0.83, 2.83)	0.18	1.45	(0.79, 2.68)	0.23	1.52	(0.83, 2.82)	0.18
Education < High School (ref: at least some college)	0.91	(0.52, 1.59)	0.73	0.96	(0.53, 1.73)	0.89	0.92	(0.52, 1.63)	0.77
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)									
	1.50	(0.86, 2.63)	0.15	1.44	(0.84, 2.47)	0.18	1.44	(0.83, 2.48)	0.19
Length of Residence (years)*	0.95	(0.93, 0.98)	<0.001	0.96	(0.93, 0.98)	<0.001	0.96	(0.94, 0.98)	<0.001
Sense of Community*	0.86	(0.63, 1.18)	0.35						
Neighborhood Satisfaction*				0.81	(0.66, 1.00)	0.05			
Neighborhood Participation*							1.03	(0.79, 1.35)	0.82
<b>LEVEL-2: Census Block Group<sup>E</sup></b>									
Mean Percent Non-Hispanic Black*	1.02	(1.01, 1.03)	0.001	1.02	(1.01 1.03)	0.001	1.02	(1.01, 1.03)	0.004
Aggregate Sense of Community*	1.81	(0.89, 3.69)	0.10						
Aggregate Neighborhood Satisfaction*				1.66	(1.11, 2.48)	0.01			
Aggregate Neighborhood Participation*							0.91	(0.46, 1.81)	0.79
Sigma Squared, $\sigma^2$			1.08			1.05			1.00
Tau Beta, T $\beta$			0.02			0.06			0.10

\*Variables were grand-mean centered.

\*\* p<0.05.

+Social connectedness measure tested in specified model.

E Census block group variables were entered separately in the model.

All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.



<b>TABLE 3.3. Freedman- Schatzkin for Multi-Level Mediation</b>	
<b>Measure (Scale) of Social Connectedness</b>	<b>t-value</b>
Sense of Community*	-2.5
Neighborhood Satisfaction*	-2.5
Neighborhood Participation*	-2.5
Social Support*	-2.5
Social Connectedness Index*	-2.5
*df=67; two-tails $t_{0.05}$	



**Table 3.4. Hypertension Treatment Regressed on Social Connectedness**

	MODEL 3: NHB Neighborhood Racial Composition Sense of Community <sup>+</sup> , and Individual, Covariates			MODEL 4: NHB Neighborhood Racial Composition, Neighborhood Satisfaction <sup>+</sup> , and Individual Covariates			MODEL 5: NHB Neighborhood Racial Composition, Neighborhood Participation <sup>+</sup> , and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	3.53	(1.48, 8.74)	0.003	3.48	(1.37, 8.82)	0.010	3.47	(1.44, 8.38)	0.01
Age(years)*	1.07	(1.03, 1.11)	0.001	1.07	(1.03, 1.11)	0.001	1.06	(1.02, 1.10)	0.003
Gender (reference: male)	3.84	(1.59, 9.24)	0.003	3.78	(1.65, 8.67)	0.002	4.06	(1.68, 9.79)	0.002
Race(reference: Non-Hispanic Black)									
Hispanic	1.36	(0.17, 10.79)	0.78	0.74	(0.20, 12.17)	0.67	1.68	(0.22, 12.87)	0.62
Non-Hispanic White	0.64	(0.19, 2.19)	0.48	0.80	(0.21, 2.59)	0.64	0.87	(0.24, 3.20)	0.83
Marital status (reference: married)	0.99	(0.36, 2.68)	0.98	0.96	(0.33, 2.79)	0.17	1.06	(0.34, 3.27)	0.92
Education < High School (ref: at least some college)	0.90	(0.39, 2.19 )	0.81	0.94	(0.38, 2.30)	0.64	0.83	(0.32, 2.15)	0.69
Household Poverty (reference: households with incomes above the Federal Poverty Level, FPL)	1.20	(0.46, 3.09)	0.71	1.10	(0.45, 2.71)	0.83	1.06	(0.45, 2.50)	0.89
Length of Residence (years)*	1.00	(0.95, 1.05)	0.93	1.01	(0.97, 1.06)		1.02	(0.97, 1.07)	0.44
Sense of Community*	0.83	(0.51, 1.33)	0.43						
Neighborhood Satisfaction*				0.87	(0.63, 1.22)	0.10			
Neighborhood Participation*							0.73	(0.43, 1.24)	0.25
<b>LEVEL-2: Census Block Group<sup>L</sup></b>									
Mean Percent Non-Hispanic Black *	1.01	(0.99, 1.02)	0.27	1.01	(0.99, 1.02)	0.47	1.01	(0.99, 1.03)	0.39
Aggregate Sense of Community*	2.38	(0.86, 6.61)	0.09						
Aggregate Neighborhood Satisfaction*				1.33	(0.71, 2.50)	0.36			
Aggregate Neighborhood Participation*							0.97	(0.33, 2.91)	0.96
Sigma Squared, $\sigma^2$			1.00			1.00			1.00
Tau Beta, T $\beta$			0.06			0.06			0.13

\*Variables were grand-mean centered. \*\* p<0.05

+Social connectedness measure tested in specified model.

<sup>L</sup>Census block group variables were entered separately in the model.

All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty and at the census block group for % NHB.

**Table 3.4. Hypertension Treatment Regressed on Social Connectedness**

	MODEL 6: NHB Neighborhood Racial Composition , Social Support+, and Individual Covariates			MODEL 7: NHB Neighborhood Racial Composition, Individual Social Connectedness Index, Aggregate Social Connectedness Index, and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Intercept	3.65	(1.52, 8.79)	0.005	3.52	(1.41, 8.82)	0.01
Age(years)*	1.06	(1.02, 1.10)	0.002	1.06	(1.02, 1.10)	0.002
Gender (reference: male)	3.47	(1.53,7.88)	0.003	3.80	(1.52, 9.55)	0.01
Race(reference: Non-Hispanic Black)				1.69	(0.19, 15.19)	0.64
Hispanic	1.40	(0.17, 11.50)	0.76	0.83	(0.25, 2.80)	0.77
Non-Hispanic White	0.74	(0.21, 2.64)	0.64			
Marital status (reference: married)	0.92	(0.31, 2.70)	0.87	1.78	(0.84, 2.52)	0.07
Education < High School (reference: at least some college)	1.04	(0.40, 2.70)	0.94	0.84	(0.34, 2.14)	0.73
Household Poverty (reference: households with incomes above the Federal Poverty Level, FPL)	1.17	(0.47, 2.93)	0.73	1.01	(0.39, 2.59)	0.98
Length of Residence (years)*	1.02	(0.98, 1.06)	0.41	1.01	(0.96, 1.06)	0.68
Social Support+	1.14	(0.63, 2.05)	0.66			
Social Connectedness Index*				0.97	(0.85, 1.12)	0.70
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Non-Hispanic Black *	1.00	(0.99, 1.02)	0.58	1.01	(0.99, 1.02)	0.37
Aggregate Social Support*	1.58	(0.43, 5.82)	0.49			
Social Connectedness Index*				1.12	(0.63, 2.01)	0.69
Sigma Squared, $\sigma^2$			1.00			1.00
Tau Beta, T $\beta$			0.03			0.10
*Variables were grand-mean centered.						
** p<0.05.						
+Social connectedness measure tested in specified model.						
L Census block group variables were entered separately in the model.						
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty and at the census block group for % NHB.						

**Table 3.5. Hypertension Control Regressed on Social Connectedness**

	MODEL 1: Fully Unconditional			MODEL 2: NHB Neighborhood Racial Composition and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual-Level Covariates</b>						
Intercept	1.15	(0.85, 1.55)	0.35	0.78	(0.30, 2.00)	0.59
Age(years)*				1.00	(0.98, 1.03)	0.73
Gender (reference: male)				0.87	(0.42, 1.82)	0.74
Race(reference: Non-Hispanic Black)				1.84	(0.40, 8.46)	0.43
Hispanic				1.00	(0.37, 2.74)	1.00
Non-Hispanic White						
Marital status (reference: married)				1.99	(0.84, 4.71)	0.12
Education < High School (ref: at least some college)				1.84	(0.86, 3.96)	0.12
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)				0.99	(0.49, 2.00)	0.97
<b>LEVEL-2: Census Block Group</b>						
Mean Percent Non-Hispanic Black *				1.00	(0.99,1.02)	0.73
Social Connectedness Index*						
Sigma Squared, $\sigma^2$			0.98			0.98
Tau Beta, $T\beta$			0.09			0.06
*Variables were grand-mean centered.						
**p<0.05.						
†Census block group variable was entered only in Model 2.						
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.						

**Table 3.5. Hypertension Control Regressed on Social Connectedness**

	<b>MODEL 3: NHB Neighborhood Racial Composition, Sense of Community<sup>+</sup>, and Individual, Covariates</b>			<b>MODEL 4: NHB Neighborhood Racial Composition, Neighborhood Satisfaction<sup>+</sup>, and Individual Covariates</b>			<b>MODEL 5: NHB Neighborhood Racial Composition, Neighborhood Participation<sup>+</sup>, and Individual Covariates</b>		
	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**	Odds Ratio	Confidence Interval 95%	p**
<b>LEVEL-1: Individual- Level Correlates and Covariates</b>									
Intercept	0.74	(0.29, 1.86)	0.51	0.76	(0.30, 1.91)	0.54	0.77	(0.30, 2.00)	0.59
Age(years)*	1.00	(0.98, 1.03)	0.97	1.00	(0.98, 1.03)	0.80	1.00	(0.98, 1.03)	0.94
Gender (reference: male)	0.91	(0.44, 1.91)	0.81	0.88	(0.44, 1.78)	0.72	0.91	(0.44, 1.91)	0.81
Race(reference: Non-Hispanic Black)									
Hispanic	1.64	(0.33, 8.29)	0.55	1.81	(0.39, 8.32)	0.44	1.92	(0.41,8.99)	0.41
Non-Hispanic White	1.07	(0.38, 3.02)	0.89	1.02	(0.37, 2.83)	0.97	1.06	(0.37, 2.97)	0.92
Marital status (reference: married)	1.97	(0.80, 4.82)	0.14	2.01	(0.84, 4.80)	0.11	2.09	(0.87, 5.03)	0.10
Education < High School (ref: at least some college)	2.01	(0.91,4.44)	0.08	1.86	(0.87, 4.01)	0.11	1.71	(0.81, 3.64)	0.16
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)	0.95	(0.47, 1.93)	0.84	1.01	(0.50, 2.06)	0.98	0.97	(0.49, 1.92)	0.92
Length of Residence (years)	0.99	(0.96, 1.02)	0.57	1.00	(0.97, 1.03)	0.93	1.00	(0.98, 1.03)	0.98
Sense of Community*	1.27	(0.87, 1.86)	0.12						
Neighborhood Satisfaction*				1.01	(0.83, 1.24)	0.90			
Neighborhood Participation*							0.75	(0.52, 1.10)	0.14
<b>LEVEL-2: Census Block Group<sup>E</sup></b>									
Mean Percent Non-Hispanic Black *	1.01	(0.99, 1.02)	0.47	1.00	(0.99, 1.02)	0.70	1.00	(0.99, 1.02)	0.74
Aggregate Sense of Community*	1.21	(0.50, 2.90)	0.67						
Aggregate Neighborhood Satisfaction*				1.07	(0.67, 1.70)	0.77			
Aggregate Neighborhood Participation*							1.45	(0.63, 3.33)	0.38
Sigma Squared, $\sigma^2$			1.00			1.00			1.00
Tau Beta, $T\beta$			0.03			0.05			0.05
*Variables were grand-mean centered.      **p<0.05									
+Social connectedness measure tested in specified model.									
<sup>E</sup> Census block level variables were entered separately in the model.									
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty and at the census block group for % NHB.									



## **Discussion**

Analyses presented here examined the question of whether social connectedness mediated previously reported associations between racial composition and awareness (Chapter 2), and whether they are associated with hypertension treatment or control. Taken together, these findings suggest mixed results about measure of social connectedness and hypertension awareness, treatment, and control. Findings are discussed below for each research question, organized according to each of the three dependent variables: awareness, treatment, and control.

### **Social Connectedness as a Mediator between NHB Neighborhood Racial Composition and Hypertension Awareness**

Measures of social connectedness, sense of community, neighborhood satisfaction, neighborhood participation, and social support, and the individual social connectedness index did not significantly mediate the relationship between NHB neighborhood racial composition and hypertension awareness as shown in Table 3.3. These results do not allow us to reject the null hypothesis of no mediation effect of social connectedness on relationships between NHB neighborhood racial composition and hypertension awareness. A lack of statistical significance observed in the individual-level social connectedness index may be due to the compilation of scales used to create the social connectedness index. While none of the measures (scales) of social connectedness were significant mediators of associations between NHB neighborhood racial composition and hypertension awareness, two of the indicators were associated with awareness above and beyond the effects of NHB neighborhood racial composition, as discussed below.

Neighborhood satisfaction yielded mixed finding at Level-1 and Level-2. At Level-1, neighborhood satisfaction was inversely associated with hypertension awareness. For instance, paradoxical findings at Level-1 and Level-2 for neighborhood satisfaction suggest other untested variables, such as neighborhood stability, maybe influencing the association between neighborhood satisfaction and hypertension awareness. Potentially, neighborhood satisfaction is an indicator of neighborhood stability: that is, people who are more satisfied with their neighborhoods may have fewer neighbors who turn over (Rohe, 1996). While neighborhood stability was not measured in this dissertation, a few studies have suggested that neighborhood stability can have negative effects on residents' well-being in economically disadvantaged neighborhoods (Ross, 2000). In part this may occur because residents of poor, stable neighborhoods face high levels of disorder in their neighborhoods (Ross, 2000). In Ross's study, stability did not reduce perceived disorder under conditions of poverty, perhaps leaving residents feeling powerless to leave a dangerous place (Ross, 2000). Finally, the negative effects of poor, stable neighborhoods on residents' well-being do not stem from a lack of social ties among neighbors (Ross, 2000), which may also explain the positive association between neighborhood satisfaction and hypertension awareness at the aggregate-level. In other words, residents of neighborhoods in which there is an aggregate higher sense of neighborhood satisfaction were more likely to be aware of their hypertension, compared to residents of neighborhoods with a lower collective or aggregate satisfaction with the neighborhood.

No known empirical studies have tested the relationship between neighborhood satisfaction and hypertension awareness, but one prior study tested individual-level social support and neighborhood-level social ties as potential mediators of the relationship between segregation and emotional well-being and suggested a beneficial effect of residence in

segregated neighborhoods (Yuan, 2008). Thus, other variables and in different combinations may yield the hypothesized associations.

### **Social Connectedness as Correlate of Hypertension Treatment**

Measures of social connectedness, sense of community, neighborhood satisfaction, neighborhood participation, and social support, and the individual social connectedness index at Level-1 were not significantly associated with hypertension treatment. These findings are inconsistent with this dissertation's hypothesis that the measures of social connectedness and the aggregate social connectedness index would correlate with hypertension treatment. Reasons for a lack of statistical significance may be that hypertension treatment may be more closely correlated with health care utilization. While measures of social connectedness may encourage health care utilization, this sample lacked measure of health care. Therefore, this potential explanation was untested in this analysis.

### **Social Connectedness as a Correlate of Hypertension Control**

Measures of social connectedness, sense of community, neighborhood satisfaction, neighborhood participation, and social support, and the individual social connectedness index were not significantly associated with hypertension control. These findings are inconsistent with this dissertation's hypothesis that the individual social connectedness index correlates with hypertension control. As with hypertension treatment, reasons for a lack of statistical significance maybe that hypertension control is largely reliant upon health care utilization. While measures of social connectedness may encourage health care utilization, this sample lacked measure of health care. Therefore, this association was untested.

### **Study Limitations**

As with most studies, these analyses have several limitations. NHBs racial composition is not a true reflection of a metropolitan-area or RBRS. The use of NHB neighborhood racial

composition may not provide a complete indication of the degree to which groups interact with one another and may not capture the complex process of residential segregation (White & Borrell, 2011). Subsequently, possible underestimation of interaction could potentially lead to an underestimation of the contribution of residential segregation to health and health disparities. Moreover, it may be hypothesized that the mechanisms by which a formal measure of segregation operates is different from a proxy measure of segregation. The racial composition of geographic units is not linked to the spatial organization or the broader process of racial and spatial inequality of a geographic area (Morello-Frosch & Lopez 2006).

RBRS is usually measured using the dissimilarity index, and RBRS reflects the dynamics of racial inequality (Wong, 2002). Unlike RBRS, NHB neighborhood racial composition measures the composition of a particular race and ethnicity in a neighborhood and not necessarily the area's spatial organization (Wong, 2002). More so, a formal measure of RBRS recognizes the degree to which neighborhood processes are affected by interconnections across more or less permeable boundaries, greater or lesser physical distance from similar and dissimilar local areas, and differential situations of groups within society (White & Borrell, 2011). The lack of formal RBRS measures may have suppressed a significant relationship between social connectedness and hypertension awareness, treatment, and control. Another limitation is the sample size. Because of the small subsample size for individuals with hypertension, each subsequent subsample, hypertension awareness, treatment, and control became increasingly smaller, which affected the power of the sample and the precision of each sample.

The reliance of cross-sectional data limits my ability to establish directionality, to test the order of associations between variables, and to examine exposures over the life course.

Additional research using longitudinal data will help establish the order of associations, examine implications of duration of exposure to NHB neighborhood racial composition and associated psychosocial stress, and explore lagged effects. Moreover, the lack of statistical significance may be due to a lack of statistical power. A power analysis test suggests, that at least 660 participants should be included in the sample for internal validity. Hypertension awareness is an individual-level variable measuring whether individuals with hypertension have been told by a health care provider that they have hypertension, which included only 250 out of the total sample of 919.

### **Implications**

The research presented in this chapter has several implications for future research and policy actions. While measures of social connectedness did not mediate the relationship between NHB neighborhood racial composition and hypertension awareness in this sample, results suggest that measures of social connectedness may contribute to our understanding of factors that influence hypertension awareness, although not always in anticipated ways. Specifically, the findings reported here suggest that neighborhood satisfaction was found to be a correlate of hypertension awareness. In this instance, neighborhood satisfaction may have captured certain features of neighborhood stability. Thus, it is important to examine the role of neighborhood stability in explaining the protective association between NHB neighborhood racial composition and hypertension awareness in future studies. Similarly, while not significant, the trends between individual-level social support and hypertension awareness suggest that while individuals may have social support but the support does not increase awareness. Thus, it is important to further investigate social support and the specific types of support individuals may receive.

Similarly, policy recommendations and interventions to improve social connectedness and positive health outcomes, hypertension awareness, treatment, and control, may benefit from a better understanding of the mechanisms responsible for the association at both the individual- and aggregate-levels. For instance, land use and housing policies that create safe and affordable neighborhoods maybe more likely to increase neighborhood participation and subsequently, social ties, is just one example of a policy solution that may exert possible influence on hypertension awareness, treatment, and control. These findings may also inform interventions that build and strengthen social support while recognizing the resiliency within some predominantly NHB neighborhoods and their potentially protective functions for health. Another policy solution may focus on ways to further enhance mechanisms that maintain high levels of hypertension awareness among populations at high risk.

## **Conclusion**

The analyses presented in the dissertation are the first efforts at examining the association between measures of social connectedness and hypertension awareness, treatment, and control. Despite the lack of other similar studies with which to make a direct comparison with these findings, aggregate-level neighborhood satisfaction results are in accordance with previous literature demonstrating association between neighborhood satisfaction and health (Luz et al., 2011). The mechanisms through which the neighborhood influences their health have yet to be elucidated, but the uniqueness of this study was the simultaneous analyses of social connectedness as individual and neighborhood mediators and correlates of hypertension awareness and hypertension treatment and control, respectively. Also testing social connectedness as a plausible explanation for the protective effects of NHB neighborhood racial composition on hypertension awareness provided the basis to test other measures of social connectedness as plausible mediators. Similarly, these findings support the need to develop

area-based programs and strategies related to the social and built environments because the ways in which individuals perceive their neighborhoods and social connections may be beneficial to their health and well-being.

While measures (sense of community, neighborhood satisfaction, neighborhood participation, and social support) of social connectedness did not mediate the relationship between NHB neighborhood racial composition and hypertension awareness or act as main correlates of hypertension treatment or control, further analytical testing of other untested measures such as neighborhood stability, number of social connections, frequency of interaction (with social networks), is warranted to better understand the atypical association between neighborhood satisfaction and hypertension awareness.

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## CHAPTER 4

### **Perceived discrimination as a source of psychosocial stress: Racial and ethnic differences in hypertension awareness, treatment, and control**

#### **Introduction**

Little is known about the effects of social context or “place” factors on individuals’ experiences and perception of racism (Hunt et al., 2007; Diez Roux, 2001; Ellen et al., 2001; Morenoff & Lynch, 2004), or the ways that characteristics of places may modify associations between perceived discrimination and health outcomes. Perceived racial or ethnic discrimination is one aspect of racism that is increasingly receiving empirical attention as a source of psychosocial stress that could have deleterious consequences for health (Williams & Mohammad, 2009), particularly hypertension (Sims et al., 2012), leading to further racial disparities in health. Historically perceived discrimination is a neglected race-related aspect of life that may adversely affect health (Williams & Mohammed, 2009). Racism is deeply embedded in the American culture and institutions, and it is difficult to tackle (Jones, 2000; Williams & Mohammed, 2009; Mays et al., 2007) because its effects are cumulative and frequently create long-term exclusionary policies and practices that remain in place at the institutional level even when drastic declines occur in individual levels of prejudice and discrimination (Williams & Mohammed 2009). Consequently, researchers have only examined

whether experiences of racial discrimination, above and beyond individuals' social economic position (SEP), manifests into racial and ethnic disparities across health outcomes over the past several decades. Similarly, research on the determinants of Black-White differences (in health outcomes) have typically concentrated on diet, genetics, physical activity, medication compliance, etc. and how individual-level factors such as age, education, and gender explain racial and ethnic disparities (Appel et al., 2006). Often, these investigations have lacked an understanding of, and data that would enable them to examine, the interplay of social factors and health outcomes.

Viewing racism and discrimination as health risks shifts the way health and social factors are viewed, specifically the impact of discrimination on health. This shift further engenders the examination of institutional racism as normative, legalized, and inherited disadvantages that have been codified in our institutions of customs, practices, and laws (Jones, 2003). Racism is manifested in racial differences in status, power, and access to societal rewards, as well as in people's self-perceptions and their interpersonal relationships (Brondolo et al., 2011). The effects of racism extend broadly, often exacerbating existing health problems that can lead to illness or mortality (Brondolo et al., 2011). Racism can potentially block economic opportunities and lead to social isolation and exclusion and in turn act as a powerful stressor (Brondolo et al., 2011). Limited research in these areas may contribute to underestimation of several critical links between institutional racism (Omi & Winant, 1994; Darity et al., 2005) and sustained health inequities. Understanding the pathways linking institutionalized and interpersonal racism to health outcomes is essential to understanding and addressing the social processes which continue to separate the advantaged from disadvantaged and to widen Black-White health disparities in health (Mays et al., 2007; Williams & Collins, 2001).

The aim of this chapter is to investigate the ways by which social context, specifically perceptions of racism, affect hypertension awareness, treatment, and control. I investigate two potential roles of perceived discrimination. First, I examine whether individual perceived discrimination modifies the relationship between NHB neighborhood racial composition and hypertension awareness. Second, I examine whether there are independent effects of perceived discrimination on hypertension treatment and control, after adjusting for individual- and neighborhood-level characteristics. By doing so, I examine the potential contributions of unfair treatment to uncontrolled hypertension.

### **Theoretical Framework**

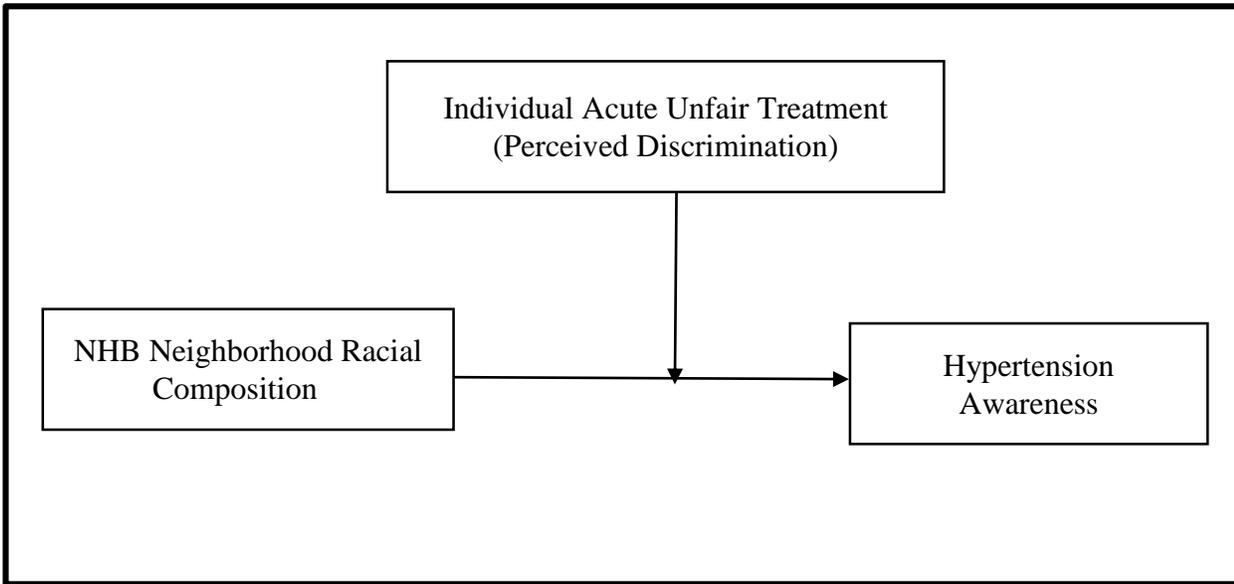
Despite overall improvements in health in the United States, the continued legacy of poor health in African Americans is one compelling reason to take a closer look at the role perceived discrimination may play (May et al., 2007) in contributing to racial and ethnic differences in hypertension awareness, treatment, and control. Research has shown that perceived discrimination is commonplace (Brown et al., 2006; Williams et al., 1997), and people who described themselves as NHB, Black, or African American are more likely to suffer from perceived discrimination and cardiovascular reactions compared to non-Hispanic Whites (NHWs) and Hispanics (Sims et al., 2012; Kessler et al, 1999). African Americans' exposure to discrimination could influence their risk for hypertension through various pathways such as unhealthy eating, sedentary lifestyles, and tobacco and alcohol intake (Sims et al., 2012). Similarly, the experience of discrimination could cause emotional distress (Krieger & Sidney, 1996), which can trigger physiological responses involving the hypothalamic-pituitary-adrenal axis and the sympathetic-parasympathetic systems, which play an important role in the pathophysiology of hypertension. Therefore, higher levels of perceived discrimination may

partly explain why NHBs with hypertension have poorer blood pressure control than NHWs and Hispanics (Brondolo et. al., 2011; Williams & Collins, 2001; Fiscella et al., 2000).

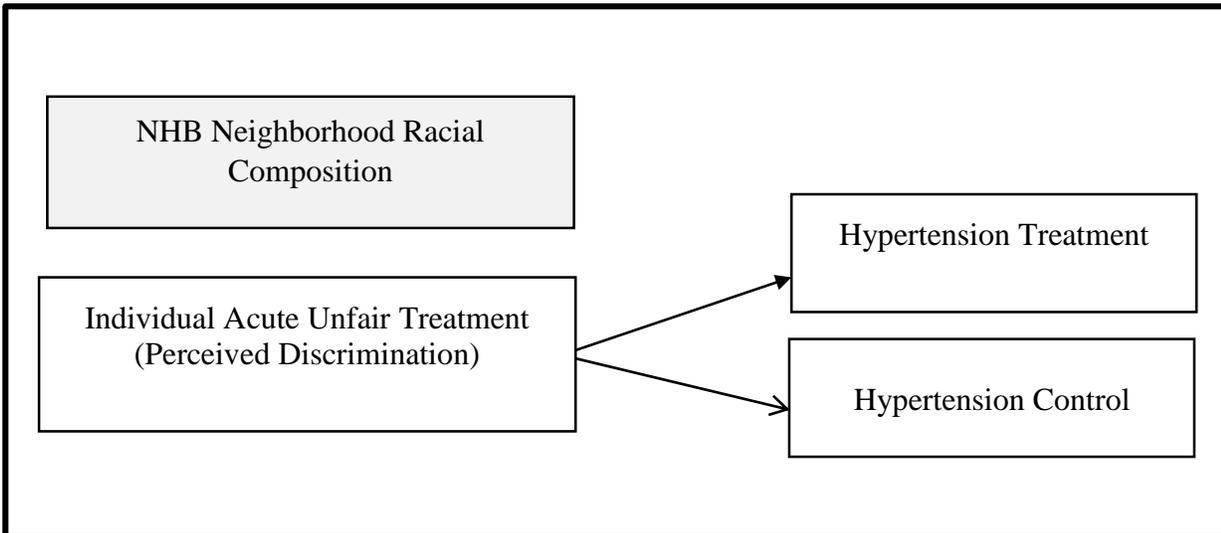
The focus of this chapter is to examine factors of the social environment that may contribute to racial and ethnic variations in hypertension awareness, treatment, and control. Prior research established race-based residential segregation (RBRS) as the most decisive way in which racism affects health, through institutional racism (Williams & Mohammad, 2009) and the aspect of institutional discrimination most widely studied for health implications (Williams & Collins, 2001; Acevedo-Garcia et al., 2003). However, for this study, NHBs neighborhood racial composition is posited as an institutional measure of the *Social Ecological Model (SEM)* as shown in Figure 1.1. Similarly, the conceptual model shown in Figure 4.1 includes acute unfair treatment, a form of perceived discrimination and as an indicator of the neighborhood social environment with implications for hypertension awareness, treatment and control.

Figures 4.1 and 4.2 below also build upon the premises of the *Social Production of Disease (SPD)* model, which was discussed in part in Chapter 1. Moreover, Figures 4.1 and 4.2 show distinct pathways that begin with two correlated factors: NHB neighborhood racial composition and individual acute unfair treatment. More specifically, Figure 4.1 shows individual acute unfair treatment as a moderator of associations between NHB neighborhood racial composition and hypertension awareness, and Figure 4.2 shows individual acute unfair treatment as a main (independent) correlate of hypertension treatment, and of hypertension control among those who are treated. In the following sections, I will examine the specific pathways through which NHB neighborhood racial composition and individual acute unfair treatment may be associated with hypertension awareness, treatment, and control.

**Figure 4.1.** Individual acute unfair treatment moderates the relationship between NHB neighborhood racial composition and hypertension awareness.



**Figure 4.2.** Individual acute unfair treatment predicts hypertension treatment and control. The gray box acknowledges the possible influence of NHB neighborhood racial composition and will be controlled for in the model.



## **Background**

### **NHB Neighborhood Racial Composition**

In the United States, race-based residential segregation (RBRS) is still a profound problem that is not naturally determined, but shaped by social, cultural and economic factors and policies (Smedley & Smedley, 2005) that are institutionalized to protect Whites from social interaction with Blacks (Williams & Collins, 2001). RBRS is defined as the “spatial manifestation of macrolevel social processes and racial ideologies known as institutional racism, that keeps many African Americans from resources needed to maintain health” (Schulz, et al., 2002). The origins of RBRS in the U.S. can be traced back to efforts by Whites to remain residentially separate from African Americans because of ideological beliefs about the inferiority of African Americans (Collins & Williams, 1999; Griffith et al., 2010). From 1896 to 1964, Jim Crow segregation was not just the physical separation of residences by race, but a political ideology based on racism (Bell, 2004; Griffith, et al., 2010) that has now become ingrained in housing, access to health, education, and employment. The effect of segregation was to economically, politically, and socially marginalize NHBs, specifically, and other marginalized populations. Thus, the over-representation of NHBs in the lowest SEP and neighborhoods with a high concentration of other NHBs is postulated to be a contributing factor for their increased risk for hypertension (Bell et al., 2004) despite the protective effects of NHB neighborhood racial composition for hypertension awareness (as discussed in Chapter 2).

Residential segregation by racial characteristics and SEP is predictive of health, and place-based features are contributors and perpetuators of social differences in health (Kershaw et al., 2010; Diez Roux & Mair, 2010). Kershaw and colleagues (2010) examined whether Black-White hypertension disparities varied by level of metropolitan level racial residential segregation and whether this was explained by race differences in neighborhood poverty. Results from this

study suggest that racial disparities in hypertension are not invariant and are modified by contextual levels of racial segregation and neighborhood poverty, highlighting the role of environmental factors in the genesis of disparities (Kershaw et al., 2010). Similarly, Diez Roux and Mair (2010) concluded that features of neighborhoods or residential environments may affect health and contribute to social, racial, and ethnic inequalities in health. While research has consistently established that residential segregation shapes SEP and affects health by restricting access to education and employment opportunities, discounting the economic value of a given level of SEP, and creating health-damaging conditions in residential environments (Williams & Collins, 2001), exposure to acute unfair treatment is just one type of health-damaging conditions specifically for NHBs. Krieger and Sidney (1996) argues that racial discrimination shapes patterns of hypertension among the U.S. Black population and Black-White differences in blood pressure.

### **NHB Neighborhood Racial Composition and Hypertension Awareness, Treatment, and Control**

Little data are available assessing the probable relationships between NHB neighborhood racial composition and hypertension awareness, treatment, and control. Consequently, many of the inferences drawn between NHB neighborhood racial composition and hypertension outcomes are patterned by links between RBRS and hypertension prevalence and awareness. For example RBRS has been recognized to contribute to racial and ethnic differences in hypertension prevalence (Kershaw et al., 2010). Similarly, a strong and consistent link between hypertension awareness and neighborhood NHB neighborhood racial composition was demonstrated in Chapter 2.

## **Perceived Discrimination**

Perceived discrimination research usually distinguishes between two main types: “everyday” discrimination and “acute” discrimination events (Hunt, 2007; Forman et al., 1997; Williams et al., 2003). Everyday (or “day-to-day”) discrimination refers to routine, often familiar practices that pervade the day-to-day existence of racial minorities (e.g., being treated as if one is dishonest, unintelligent, etc.) (Hunt et al., 2007). Acute (or “major”) events of discrimination refer to unfair treatment in key institutional contexts, such as searching for a home or in the workplace (Williams et al., 1997; Hunt et al., 2007). More specifically, acute unfair treatment encompasses institutional or structural forms of systemic discrimination such as differential access to educational or employment opportunities, which may or may not be subjectively experienced as unfair treatment by the individual (Schulz et al., 2002). Since the focus of these analyses concentrate on structural factors in the social environment that may lead to racial and ethnic variations in hypertension awareness, treatment, and control, I will only examine the influence of individual-level acute unfair treatment at Level-1. For instance, individual acute unfair treatment and the resulting discriminatory practices of (individual) acute unfair treatment may be more prevalent among individuals who reside in poor racially segregated neighborhoods as RBRS is a form of institutional racism and acute unfair treatment reflects perception of structural racism.

Several studies have reported that Blacks experience higher levels of each type of racial discrimination than Whites (Hunt et al., 2007; Kessler et al., 1999). For example, one empirical study (Forman et al., 1997) found that 70% of Blacks, compared to 36% of Whites, report at least one incident of acute unfair treatment event in their lifetime (and 32% of Blacks vs. 12% of Whites report at least one event in the prior year). Regarding the determinants of perceived discrimination, among African Americans, such perceptions are more prevalent among younger

persons, males, and those with higher levels of education (Hunt et al., 2007; Forman et al., 1997).

Williams and Collins (2001) and other researchers argue that racism is a fundamental cause of racial and ethnic health inequities in health outcomes (Jones, 2000, 2002). A growing body of literature suggests that chronic exposure to racial discrimination is critical to understanding racial disparities in health (Williams & Jackson, 2005). More specifically, understanding chronic exposure to racial discrimination is critical to understanding the mechanisms that link perceived discrimination to elevated hypertension risk (Mays et al., 2007; Schulz et al. 2005). One aspect of *personally mediated racism* is discrimination (Jones, 2000). Discrimination means differential actions towards others according to their race (Jones, 2000). According to some studies, repeated subjection to race-based discrimination or perceived discrimination is associated with higher hypertension levels and more frequent diagnoses of hypertension (Davis et al., 2005; Williams et al., 2001; Williams & Neighbors, 2001; Mays et al., 2007). Sellers et al., 2009) and low self-esteem (Romero & Roberts, 2003; McCoy & Major, 2003), which can ultimately negatively affect blood pressure levels (Marshall et al., 1997; Cohen et al., 1994; Mays et al., 2007). Furthermore, one researcher has hypothesized that the chronic triggering of cardiovascular reactions due to discrimination could lead to the development of hypertension (Krieger & Sidney 1996). Consequently, reducing stress caused by discrimination could alleviate the excess burden of hypertension, cardiovascular diseases and other health inequalities experienced, specifically by NHBs.

### **Perceived Discrimination and Hypertension Awareness, Treatment, and Control**

Perceived discrimination against African Americans is a pervasive problem in the United States (Bobo & Fox 2003; Feagin & McKinney 2003). Though many researchers have examined social factors shaping experiences of discrimination, as well as the consequences that such

experiences have for individuals' health and well-being (Kessler et al., 1999; Krieger & Sidney 1996; Schulz et al. 2002), few researchers have explicitly examined the effects of perceived discrimination on hypertension awareness (Brondolo et al., 2003). Several studies have reported that perceived racism contributed to higher levels of stress and low self-esteem among Black men (Davis et al., 2005; Williams & Neighbors, 2003). These authors suggested that higher stress and lower self-esteem might contribute to excess risk of hypertension in this population. Similarly, Cozier et al. (2006) specifically examined whether perceptions and experiences of racism were associated positively with increased risk for hypertension in Black women and found that racism was modestly associated with increases in resting blood pressure levels. While these studies are important in understanding how racism affects hypertension, they do not explore or explain racism from an institutional perspective, which is the focus of this chapter.

My search of the literature did not identify any studies analyzing associations between perceived discrimination and hypertension awareness, treatment or control. The research in this chapter is intended to address this gap in the literature. I hypothesize that individual-level acute unfair treatment will weaken the protective effects of NHB neighborhood racial composition on hypertension awareness. That is, individuals who report higher levels of acute unfair treatment will be less likely to be aware of their hypertension compared to those who report lower levels of acute unfair treatment. These effects may operate through many potential ways, including the effects of perceived discrimination on stress. Exposure to chronic stress (acute unfair treatment), which NHBs are more exposed to than NHWs and Hispanics, has the potential to increase hypertension (Brondolo et al., 2011). While Brondolo and colleagues (2011) have examined the relationship between stress and hypertension, no known studies have examined the moderating effects of individual perceived discrimination on hypertension awareness.

Further, I hypothesize that individual-level acute unfair treatment will negatively correlate with hypertension treatment. That is, individuals who are aware of their hypertension, and who report higher levels of acute unfair treatment will be less likely to receive treatment for their hypertension compared to those who report lower levels of individual acute unfair treatment. These effects may operate through many potential pathways, including the effects of perceived discrimination on access to health care. Similarly, I test the hypothesis that individual acute unfair treatment will negatively correlated with the probability that those who are receiving treatment for hypertension will achieve control while treated. Perceived discrimination may reduce hypertension control. That is, individuals who are aware of their hypertension, and who report higher levels of individual acute unfair treatment will be less likely to be controlled, while treated, for their hypertension compared to those who report lower levels of acute unfair treatment. These effects may operate through many potential ways, including the effects of perceived discrimination on access to health care. The goal of this chapter is to obtain additional insight into the potential impact of the individual acute unfair treatment on the risk of hypertension awareness, treatment and control among residents of Detroit, Michigan. To these ends, I will address the following research questions:

Research Question 4.1: Does individual-level acute unfair treatment moderate the relationship between NHB neighborhood racial composition and hypertension awareness?

(Hypothesis 4.1) Individual-level area acute unfair treatment will modify the relationship between NHB neighborhood racial composition and hypertension awareness. The protective association between NHB neighborhood racial composition and hypertension awareness will be weakened as individual levels of acute unfair treatment increases.

Research Question 4.2: Is individual-level acute unfair discrimination a correlate of hypertension treatment when controlling for NHB neighborhood racial composition?

(Hypothesis 4.2) Individual-level acute unfair treatment will be inversely associated with hypertension treatment. Individuals who experience high levels of individual acute unfair treatment will be less likely to be treated for hypertension.

Research Question 4.3 Is individual-level acute unfair treatment a correlate of hypertension control when controlling for NHB neighborhood racial composition?

(Hypothesis 4.3) Individual-level acute unfair treatment will be inversely associated with hypertension control. Individuals who experience high levels of individual acute unfair treatment will be less likely to be controlled for hypertension when treated.

## **Methods**

### **Study Design and Sample Description**

Data for this study are drawn from the 2002 Healthy Environments Partnership (HEP) Community Survey Wave 1, which has been described in previous works (e.g. Schulz et al., 2005). HEP is a community-based participatory research partnership comprised of community organizations, residents, and academic researchers who collaborate to address factors that contribute to excess risk of CVD among residents in Detroit, Michigan (Schulz, et al., 2005). The University of Michigan Institutional Review Board for Protection of Human Subjects approved the HEP study in January 2001.

The HEP survey uses a stratified 2-stage probability sample of occupied housing units designed for 1,000 completed interviews with adults ages  $\geq 25$  years across Detroit. This design allows for comparisons of residents of similar demographics across three distinct geographical areas (Eastside, Northside, and Southwest) of the city of Detroit (Schulz, et al., 2005). The survey sample was designed to achieve adequate variation in socioeconomic position within each of the three predominant racial and ethnic groups in Detroit: African-Americans, Latinos, and

Whites in order to conduct analyses of socioeconomic status within and across racial and ethnic groups. Data were imputed to account for missing values. The final sample consisted of 919 face-to-face interviews: interviews were completed with 75% of households in which an eligible respondent was identified (Schulz, et al., 2005). The 919 respondents were nested within 69 census block groups throughout the Eastside, Southwest, and Northwest Detroit study areas. Of the total multiethnic sample, analysis for this study focuses on the 377 individuals who have hypertension.

## **Measures**

### **Dependent Variables**

Hypertension awareness. Hypertension awareness is an individual level variable measuring whether individuals with hypertension have been told by a health care provider that they have hypertension (yes=1 no=0).

Hypertension treatment. Hypertension treatment is an individual level variable measuring whether individuals who are aware of their hypertension are currently being treated for hypertension (yes=1 no=0).

Hypertension control treated. Hypertension control treated is an individual level variable measuring whether individuals who are treated for hypertension have SBP <140mmHg and DBP<90mmHg (yes=1 no=0).

### **Individual-Level Variables**

To measure moderation, individual-level acute unfair treatment must be modeled at Level-1. In this paper, I measure perceived discrimination with a 7-item version of acute unfair treatment. *Acute unfair treatment* (Williams et al., 1997) is a continuous variable indicating whether the respondent reported any of 7 experiences with acute unfair treatment in the past year: “First, at any time in your life, have you ever been unfairly treated concerning work. This

includes not being hired for a job you were qualified for, not receiving a promotion that you deserved, being fired from a job unfairly, or being treated unfairly in some other way,” “Were you ever unfairly treated by the police or immigration officials? This includes being unfairly stopped, searched, questioned, physically threatened, or abused,” “Were you ever unfairly treated at school? This includes being given a much lower grade than you deserved, being discouraged by a teacher from seeking higher education, or being unfairly treated in some other way,” “At any time in your life, were you ever unfairly treated in getting housing or finding a place to live? This includes being prevented from entering or buying a home, or being prevented from staying in a neighborhood because neighbors made life too uncomfortable,” “Have you ever been unfairly treated in getting resources or money? This includes being unfairly denied a bank loan, a credit card, or some other form of credit,” “For unfair reasons, were you ever denied medical care or did you ever receive inferior medical care,” and “At any time in your life, did you ever receive services from someone such as a plumber or car mechanic that were worse than what other people got?”

### **Individual Control Variables**

Several variables were included as control variables, which previous literature have demonstrated correlate with hypertension awareness, treatment, and control (Hajjar & Kotchen, 2003; Hajjar et al., 2006; Hertz & Unger, 2005). These included both individual- and neighborhood-level variables, as described below.

Self-reported *gender* (male or female), *age* (continuous), *education level* (less than high school, high school diploma or GED, and some college or greater), *marital status* (married/in a relationship or not currently married /separated /divorced /widowed) and *employment status* (currently working for pay or not currently working for pay) were controlled for. *Household Poverty* was calculated for the HEP sample using 2002 census estimates for the U.S. poverty

thresholds (organized by family size and number of children) and HEP survey data available for total household income and the total number of adults and children in the household for 2002. Household poverty was modeled as a binary variable of whether household per capita income fell below or above the Federal Poverty Level for 2002.

### **Neighborhood Level Control Variables**

NHB neighborhood racial composition and aggregate acute unfair treatment were modeled as census block group level (Level-2) control variables. NHB neighborhood racial composition was defined as the percent of NHB residents in each census block group. Data for percent NHB measures were generated from Census 2000 data files. NHB neighborhood racial composition for each census block group level was modeled as a continuous measure in the analysis. Aggregate area acute unfair treatment was measured with the same 7-item version of acute unfair treatment at Level-1, aggregated to the census block group level, and grand mean centered in the analyses reported here. This affords the opportunity to examine independent effects at Levels-2 (census block) and Level-1 (individual) in the analysis.

### **Data Analysis**

Several data analytical steps were taken to address the research questions in this chapter. Weighted descriptive statistics and univariate procedures were performed using SAS software, Version [9.3] for Windows. For unequal probabilities of selection within each stratum and to match the sample to Census 2000 population distributions for the study areas, all sample statistics were adjusted for sample weights. Demographic statistics were calculated using proc surveyfreq and proc surveymeans describe commands to estimate weighted means and proportions given the complex sample design.

To distinguish context (area or group properties) and composition (characteristics of individuals living in different areas) effects, multilevel analyses require data sets including

individuals nested within areas or neighborhoods (Rauh et al., 2001; Pearl et al., 2001). By simultaneously including both individual- and neighborhood- level predictors in regression equations with individuals as the units of analysis, these strategies allow examination of neighborhood or area effects after individual-level confounders have been controlled (Diez-Roux, 2001; Rauh et al., 2001; Pearl et al., 2001). Such multilevel analyses also permit examination of individual-level characteristics as modifiers of the area effect (Diez-Roux, 2001; Rauh et al., 2001; Pearl et al., 2001). To these ends, the study hypotheses were estimated as two-level hierarchical regression models for a Bernoulli Outcome using HLM 7 (Scientific Software International, Lincolnwood, IL, 2011). Level-1 varied among survey respondents based on the dependent variable tested: N=250 (Hypertension Awareness), N=216 (Hypertension Treated), and N=111 (Hypertension Control Treated) and Level-2 were the 69 census block groups.

The first hypothesis tested individual-level acute unfair treatment as a moderator between NHB neighborhood racial composition and hypertension awareness after accounting for known covariates such as age, gender, education, marital status, and household poverty (Level-1) which is depicted in Model 3 (Table 4.2). To test this relationship, NHB neighborhood racial composition, individual-level acute unfair treatment and the interaction term were entered into a simultaneous regression model (Model 3, Table 4.2). Model 3 (Table 4.3) tested individual-level acute unfair treatment as a main correlate of hypertension treatment after accounting for known covariates such as age, gender, education, marital status, and household poverty (Level-1). Model 3 (Table 4.4) tested individual-level acute unfair treatment as a main correlate of hypertension control after accounting for known covariates such as age, gender, education, marital status, and household poverty (Level-1).

## **Results**

Sociodemographic characteristics and descriptions of hypertension awareness, treatment, and control, the main dependent variables at the individual-level (Level-1) for this study, are described in Tables 2.1 and 2.1.1 of Chapter 2. Table 4.1, shows the distribution of participants across hypertension prevalence, awareness, treatment, and control along with the distribution of individual-level acute unfair treatment and aggregated acute unfair treatment. Of the total sample, individuals reported a mean (SE) acute unfair treatment of 1.20(0.7). Among those with hypertension, individuals reported a mean of 1.20(0.09). Individuals who were aware and treated (among aware) reported a mean acute unfair treatment of 1.19(0.10). Among controlled treated, individuals reported a mean acute unfair treatment of 1.12(0.09). Aggregated (neighborhood) acute unfair treatment among the total sample was a mean of 1.22(0.03). The aggregated acute unfair treatment was the same for those who were aware, treated (among aware), and controlled while treated at a mean of 0.20(0.02).

### **Hypertension Awareness**

Models 1 and 2 in Table 4.2 were initially reported in Chapter 2, and are included in Table 4.2 to aid in the interpretation of the new models presented here. Model 1 is a fully unconditional model that depicts 52% of the variance was between census block group levels. Model 2 (Figure 2.2) shows NHB neighborhood racial composition was positively associated with hypertension awareness (OR=1.01, 95% CI [1.00, 1.02],  $p=0.05$ ) after adjusting for individual-level characteristics including race and ethnicity.

Results for the first research question, examining individual-level acute unfair treatment as a moderator between NHB neighborhood racial composition and hypertension awareness, are shown in Table 4.2 (Figure 4.1). A positive and statistically significant interaction between individual-level of acute unfair treatment and NHB neighborhood racial composition (OR=1.02,

95% CI [1.00, 1.04],  $p = 0.04$ ) was found after adjusting for individual-level characteristics including race and ethnicity. In other words, at any given level of NHB neighborhood racial composition, individuals who experience higher levels of individual-level acute unfair treatment were more likely to be aware of their hypertension status. This result suggests that the protective association between NHB neighborhood racial composition and hypertension awareness was strengthened as individual-level acute unfair treatment increased. While significant, this finding is inconsistent with this dissertation hypothesis, that the protective association between NHB neighborhood racial composition and hypertension would be weakened as individual-level of acute unfair treatment increase.

### **Hypertension Treatment**

Models 1 and 2 in Table 4.3 were initially reported in Chapter 2 and are presented again here for ease in interpretation of the new models run for this chapter. Model 1 is a fully unconditional model that depicts 67% of the variance was between census block group levels. Model 2 (Figure 2.2) shows NHB neighborhood racial composition was not significantly associated with hypertension treatment (OR=1.01, 95% CI [0.99, 1.02],  $p = 0.33$ ) after adjusting for individual-level characteristics, including race and ethnicity.

Results for the second research question, examining individual-level acute unfair treatment as a main correlate of hypertension treatment, are shown in Table 4.3 (Model 3). Individual-level acute unfair treatment was positively associated with hypertension treatment (OR=9.13, 95% CI [2.38, 35.04],  $p = 0.001$ ) after adjusting for individual-level characteristics, including race and ethnicity. In other words, individuals who experienced more individual-level acute unfair treatment were more likely to be treated for hypertension.

Neighborhood-level (aggregate) acute unfair treatment was a statistically significant and negative correlate of hypertension treatment (OR=-3.81, 95% CI [0.02, 0.29],  $p = 0.004$ ), after

adjusting for individual-level characteristics, including race, ethnicity, and NHB neighborhood racial composition. In other words, individuals who lived in neighborhoods with higher aggregate-levels of acute unfair treatment were less likely to be treated for their hypertension compared to those with lower contextual levels of acute unfair treatment.

### **Hypertension Control**

Models 1 and 2 in Table 4.4 were initially reported in Chapter 2, and are included here to facilitate interpretation of the new models run in this analysis. Model 1 is a fully unconditional model that depicts 8% of the variance was between census block groups levels. Model 2 (Figure 2.2) shows NHB neighborhood racial composition was not significantly associated with hypertension control (OR=1.00, 95% CI [0.99, 1.02],  $p=0.73$ ) after adjusting for individual-level characteristics including race and ethnicity.

Results for the third research question, examining individual-level acute unfair treatment as a main predictor of hypertension control while treated, are shown in Table 4.4 (Model 3). Individual-level acute unfair treatment was not significantly associated with hypertension control (OR=1.30, 95% CI [0.46, 3.70],  $p=0.61$ ) after adjusting for individual-level characteristics including race and ethnicity. Similarly, neighborhood level (aggregate) acute unfair treatment (OR=0.24, 95% CI [0.44, 1.58],  $p=0.14$ ) was not associated with hypertension control. In other words, in this sample, individual-level acute unfair treatment does not influence the likelihood of being controlled after adjusting for individual-level characteristics, including race and ethnicity.

**TABLE 4.1. Weighted Descriptive Statistics\* for Individual and Census Block Group Variables by Hypertension Prevalence, Awareness, Treatment, and Control in the 2002 HEP Sample**

	<b>HYPERTENSION</b>					
	<b>Total Sample N=919</b>	<b>Prevalence N=377</b>	<b>Awareness N=250</b>	<b>Treatment N=216</b>	<b>Control N=111</b>	<b>ANOVA** F-value</b>
	Values reported as Mean(SE) or Percent					
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>						
Age (years)	46.28(0.84)	54.25(1.28)	57.74(1.69)	59.57(1.71)	60.23(1.79)	<0.0001
Female	52.26	50.61	55.61	60.48	56.07	0.14
Race						
Hispanic***	22.17	15.05	11.31	10.62	12.97	<0.0001
Black	56.83	64.34	70.28	72.80	70.64	
White	18.70	19.29	17.74	16.57	16.39	
Education <12 years	37.01	39.47	39.52	39.64	47.08	0.63
Marital Status	26.36	24.59	24.66	24.42	41.97	0.08
Households with incomes above the Federal Poverty Level, FPL	36.36	40.95	43.01	42.72	30.34	0.03
Acute Unfair Treatment	1.20(0.7)	1.20(0.09)	1.19(0.10)	1.19(0.10)	1.12(0.09)	
<b>LEVEL-2: Census Block Group</b>						
Mean Non-Hispanic Black	55.45(1.83)	62.90(2.52)	68.82 (2.01)	70.39(2.24)	68.98(2.97)	0.004
Acute Unfair Treatment (Aggregate)	0.22(0.03)	0.20(0.02)	0.20(0.02)	0.20(0.02)	0.20(.02)	
*All Level1 summary statistics were weighted.						
** p<0.05.						
*** Others are omitted in these analyses.						

<b>Table 4.2. Hypertension Awareness Regressed on NHB Neighborhood Racial Composition and Acute Unfair Treatment</b>									
	<b>MODEL 1: Fully Unconditional</b>			<b>MODEL 2: NHB neighborhood racial composition and Individual Covariates</b>			<b>MODEL 3: Individual level acute unfair treatment moderates NHB neighborhood racial composition and hypertension awareness</b>		
	Odds Ratio	Confidence Interval 95%	<i>P</i>	Odds Ratio	Confidence Interval 95%	<i>p</i>	Odds Ratio	Confidence Interval 95%	<i>P</i>
<b>LEVEL 1: Individual Level Predictors and Covariates</b>									
Intercept	1.90	(1.26, 2.85)	0.003	1.52	(0.78, 2.97)	0.21	1.42	(0.79,2.52)	0.24
Age(years)*				1.05	(1.02, 1.08)	<0.001	1.05	(1.02,1.07)	<0.001
Gender (reference: male)				1.60	(0.85, 3.03)	0.15	1.61	(0.89, 2.91)	0.12
Race(reference: Black)				0.72	(0.26, 2.04)	0.54	0.74	(0.27, 2.00)	0.56
Hispanics				0.70	(0.34, 1.48)	0.35	0.82	(0.43, 1.57)	0.55
Whites									
Marital status (reference: married)				1.78	(0.82, 3.89)	0.14	1.72	(0.91, 3.22)	0.09
Education < High School (reference: at least some college)				0.84	(0.43, 1.66)	0.61	0.95	(0.54, 1.74)	0.88
Household Poverty (reference: households with incomes above the Federal Poverty Level, FPL)				1.50	(0.82, 2.75)	0.18	1.29	(0.72, 2.33)	0.39
Acute Unfair Treatment							1.08	(0.90, 4.58)	0.09
MODERATOR*(Acute unfair treatment X Mean Percent NHB)							1.02	(1.00, 1.04)	0.04
<b>LEVEL 2: Census Block Group Level <math>\xi</math></b>									
Mean Percent NHB*				1.01	(1.00,1.02)	0.05	1.01	(1.00, 1.02)	0.03
Mean Acute Unfair Treatment*							0.18	(0.03, 1.10)	0.06
Sigma Squared, $\sigma^2$			0.89			0.92			1.00
Tau Beta, $T\beta$			0.98			0.75			0.12
*Variables were grand-mean centered.									
$\xi$ Census block level variables were entered separately in the model.									
All models were adjusted at the individual level for age, gender, education, marital status, and household poverty. All models were adjusted at the block group level for % Poverty and % African American.									

**Table 4.3. Hypertension Treatment Regressed on NHB Neighborhood Racial Composition and Acute Unfair Treatment**

	MODEL 1: Fully Unconditional			MODEL 2: NHB Neighborhood Racial Composition and Individual Covariates			MODEL 3: NHB Neighborhood Racial Composition, Acute Unfair Treatment, Hypertension Treatment, and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	<i>p</i>	Odds Ratio	Confidence Interval 95%	<i>p</i>	Odds Ratio	Confidence Interval 95%	<i>P</i>
<b>LEVEL-1: Individual-Level Correlates and Covariates</b>									
Intercept	5.06	(3.42,9.15)	<0.001	3.46	(1.43, 8.41)	0.01	2.71	(1.11, 6.66)	0.03
Age(years)*				1.06	(1.03, 1.10)	<0.001	1.07	(1.03, 1.11)	0.001
Gender (reference: male)				3.88	(1.71, 8.81 )	0.001	5.57	(1.93, 16.12)	0.002
Race(reference: Black)									
Hispanics				1.72	(0.21, 14.01)	0.61	2.10	(0.24,18.33)	0.50
Whites				0.75	(0.20, 2.84)	0.67	1.03	(0.25, 4.19)	0.97
Marital status (reference: married)				0.98	(0.33, 2.91)	0.97	1.18	(0.40, 3.45)	0.76
Education < High School (ref: at least some college)				0.90	(0.38, 2.12)	0.81	0.88	(0.39, 1.97)	0.75
Household Poverty (ref: households with incomes above the Federal Poverty Level, FPL)				1.05	(0.45, 2.48)	0.90	1.08	(0.43, 2.76)	0.87
Acute Unfair Treatment							9.13	(2.38, 35.04)	0.001
<b>LEVEL-2: Census Block Group <sup>E</sup></b>									
Mean Percent NHB*				1.01	(0.99,1.02)	0.33	1.01	(0.99, 1.03)	0.22
Mean Acute Unfair Treatment*							-3.81	(0.002, 0.29)	0.004
Sigma Squared, $\sigma^2$			0.68			1.36			2.33
Tau Beta, $T\beta$			1.39			0.01			0.01
*Variables were grand-mean centered.									
** $p < 0.05$ .									
<sup>E</sup> Census block level variables were entered one at a time in the model.									
All models were adjusted at the individual-level for age, gender, education, marital status, and household poverty.									

**Table 4.4. Hypertension Control Regressed on NHB Neighborhood Racial Composition and Acute Unfair Treatment**

	MODEL 1: Fully Unconditional			MODEL 2: NHB neighborhood racial composition, and Individual Covariates			MODEL 3: NHB Neighborhood Racial Composition, Acute Unfair Treatment, Hypertension Control, and Individual Covariates		
	Odds Ratio	Confidence Interval 95%	<i>p</i>	Odds Ratio	Confidence Interval 95%	<i>p</i>	Odds Ratio	Confidence Interval 95%	<i>P</i>
<b>LEVEL-1: Individual-Level Predictors and Covariates</b>									
Intercept	1.14	(0.85, 1.53)	0.36	0.78	(0.30, 2.00)	0.59	0.68	(0.28, 1.65)	0.39
Age(years)*				1.00	(0.98, 1.03)	0.73	1.003	0.99, 1.03)	0.82
Gender (reference: male)				0.87	(0.42, 1.82)	0.74	0.98	(0.48, 2.00)	0.96
Race(reference: Black)									
Hispanics				1.84	(0.40, 8.46)	0.43	1.77	(0.37, 8.60)	0.48
Whites				1.00	(0.37, 2.74)	1.00	1.02	(0.37,2.81)	0.97
Marital status (reference: married)								(0.88, 5.02)	0.09
				1.99	(0.84, 4.71)	0.12	2.12		
Education < High School (reference: at least some college)				1.84	(0.86, 3.96)	0.12	1.90	(0.89, 4.05)	0.10
Household Poverty (reference: households with incomes above the Federal Poverty Level, FPL)									
				0.99	(0.49, 2.00)	0.97	0.95	(0.46, 1.95)	0.88
Acute Unfair Treatment							1.30	(0.46, 3.70)	0.61
<b>LEVEL-2: Census Block Group</b>									
Mean Percent NHB*				1.00	(0.98, 1.03)	0.73	1.002	(0.99, 1.02)	0.71
Mean Acute Unfair Treatment*							0.24	(0.04, 1.58)	0.14
Sigma Squared, $\sigma^2$			0.98			0.98			1.00
Tau Beta, $T\beta$			0.09			0.06			0.06
*Variables were grand-mean centered.									
**p<0.05.									
†Census block level variables were entered separately in the model.									

## **Discussion**

The findings suggest that individual-level (Level-1) and neighborhood-level (Level-2) acute unfair treatment are associated with hypertension awareness and treatment in different ways, important steps along the pathway to effective control of hypertension. This research demonstrated two main findings which I discuss in more details in the paragraphs below. The findings are organized according to the three dependent variables: awareness, treatment and control.

### **Hypertension Awareness**

The protective association between NHB neighborhood racial composition and hypertension awareness was strengthened as individual-level acute unfair treatment increased. This statistically significant finding was inconsistent with this dissertation's hypotheses. I hypothesized that the protective association between NHB neighborhood racial composition and hypertension awareness would weaken as individual-level acute unfair treatment increased. A study by Krieger and Sidney (1996) concluded that Black professionals, in general, who are conscious of instances of discrimination and who challenge unjust or unequal treatment and who talked to others appear to be at lower risk of elevated blood pressure than Black working class men and women who may be less aware of discriminatory acts and less likely to challenge them (Krieger & Sidney, 1996). While this dissertation did not examine hypertension prevalence, a similar association may hold true for the moderating effects of individual acute unfair treatment on the relationship between NHB neighborhood racial composition and hypertension awareness. NHBs who are conscious of and challenge instances of acute unfair treatment and talk to others about unfair treatment may also be more likely to discuss potential effects of discrimination on health, which may lead to an increase in awareness of hypertension. Such discussions may also

encourage heightened hypertension awareness and social support for addressing such unfair treatment, offering another protective mechanism. Through my literature search, I was unable to identify other studies that have examined or explained the moderating effects of acute unfair treatment between NHB neighborhood racial composition and hypertension awareness. The results presented in this dissertation may suggest one plausible pathway by which moderating effects of individual-level acute unfair treatment affects hypertension awareness. Additional research is warranted to investigate other ways by which individual acute unfair treatment may influence hypertension awareness. Similarly, additional research is warranted to disentangle the marginally significant association between aggregate-level acute unfair treatment and hypertension awareness. For future research, studies should assess the relationship between internalized effects of acute unfair treatment and hypertension awareness and these effects within class and gender strata.

### **Hypertension Treatment**

Controlling for aggregated acute unfair treatment, in a model with individual-level acute unfair treatment and covariates, allows for the distinction between composition and contextual effects when examining social effects on health. Similarly, the findings in this dissertation demonstrate various outcomes when acute unfair treatment is modeled at Level-1 (individual) and Level-2 (neighborhood). While individual-level acute unfair treatment is positively associated with hypertension treatment, neighborhood-level (aggregate) hypertension treatment is inversely associated with hypertension treatment (Level-2). In other words, perceptions of discrimination were positively associated with the probability that those who were aware of their hypertension were currently being treated. Similarly, when comparing two individuals with the same level of individual experiences of aggregate area acute unfair treatment but living in neighborhoods with different levels of aggregate area acute unfair treatment, living in the

neighborhood with higher aggregate area acute unfair treatment was associated with reduced likelihood of receiving treatment. One plausible explanation for this difference in outcomes is that individual acute unfair treatment, a form of psychosocial stress, may lead to greater utilization of health care, which may suggest those who use health care are more likely to report unfair treatment. For instance, multiple studies have shown that emotional stresses — especially anger — can trigger heart attacks, arrhythmias and even sudden death (Krantz et al., 2002). Although these episodes usually only happen mostly in people who already have heart disease, some people don't know they have a problem until acute stress causes a heart attack or even lead to hypertension (Krantz et al., 2002).

Ultimately, aggregate area acute unfair treatment indicated an inverse association with hypertension treatment. To date, there have been few explanations if any proposed for this particular patterning of results. However, some scholars have suggested that neighborhood effects (Davis et al., 2005; Williams et al., 2003; Fiscella et al., 2000), such as access to health care and environmental exposures may partly explain why Blacks with hypertension have poorer hypertension control than Whites (Nesbitt and Victor, 2004). Aggregate area acute unfair treatment may serve as an indicator of the challenges people face, for example, in neighborhoods where there are higher average levels of acute unfair treatment. For instance, Williams & Collins (2001) established that individuals residing in highly segregated areas may face more challenges especially in accessing necessary health care. Health care facilities are nested in neighborhoods and neighborhoods are nested in communities. Individuals are more likely to utilize the health care facilities in the neighborhoods or communities they reside.

### **Hypertension Control**

Individual-level acute unfair treatment is not a correlate of hypertension control. This finding is inconsistent with this dissertation's hypothesis. I hypothesized that individual-level

acute unfair treatment inversely correlated with hypertension control. However, the lack of statistical significance may be attributable to the fact that individual-level (nor neighborhood-level) acute unfair treatment does not affect control once individuals are treated. That is, acute unfair treatment really matters in obtaining treatment and once treatment is obtained, there is not a further, significant effect of acute unfair treatment. As previously postulated, hypertension control maybe a greater function of access to quality health care than merely social factors. More so, while not statistically significant, the trends between acute unfair treatment and hypertension control were in the expected direction and too little statistical power may also be another reason that statistical significance may not have been demonstrated.

For instant, studies have found that perceived disrespect and discrimination affected how often an individual utilized the health care system; were suggested diagnostic screenings such as blood pressure screenings; and were less likely to follow a doctor's advice (Griffith et al., 2007). Racial and ethnic differences in the quality of health care violate health providers' conscious commitment to equitable health care and the commitment to do no harm (Geiger, 2006). Thus, it is essential to recognize the existence of race-based inequities in health care delivery and to identify how racism operates throughout the health care system. Ultimately, health care inequities are rooted in institutional racism (Nelson, 2003).

Further research is warranted to investigate a combination of social and clinical factors that may potentially explain racial and ethnic differences in hypertension control.

### **Study Limitations**

As with most studies, these analyses have several limitations. Due to a lack of residential segregation measures, NHB neighborhood racial composition was used. NHB neighborhood racial composition is not a true reflection of a metropolitan-area or RBRS. The use of NHB neighborhood racial composition may not provide a complete indication of the degree to which

groups interact with one another and may not capture the complex process of residential segregation (White & Borrell, 2011). Subsequently, this underestimation of interaction could potentially lead to an underestimation of the contribution of residential segregation to health and health disparities. Moreover, it may be hypothesized that the mechanisms by which a formal measure of segregation operates is different from a proxy measure of segregation. The racial composition of geographic units is not linked to the spatial organization or the broader process of racial and spatial inequality of a geographic area (Morello-Frosch & Lopez, 2006). RBRS is usually measured using the dissimilarity index, and RBRS reflects the dynamics of racial inequality (Wong, 2002). Unlike RBRS, NHB neighborhood racial composition measures the composition of a particular race/ethnicity in a neighborhood and not necessarily the area's spatial organization (Wong, 2002). More so, a formal measure of race-based residential segregation recognizes the degree to which neighborhood processes are affected by interconnections across more or less permeable boundaries, greater or lesser physical distance from similar and dissimilar local areas, and differential situations of groups within society (White, 2008). Another limitation is the sample size. Because of the small subsample size for individuals with hypertension, each subsequent subsample, hypertension awareness, treatment, and control became increasingly smaller, which affected the power of the sample and the precision of each sample. The reliance of cross-sectional data limits our ability to establish directionality, to test the order of associations between variables, and to examine exposures over the life course. Additional research using longitudinal data will help establish the order of associations, examine implications of duration of exposure to neighborhood poverty and racial composition and associated psychosocial stress, and explore lagged effects.

## **Strengths**

In addition to the limitations described above, this study had a number of strengths. Use of the 2002 HEP Community Survey provided a number of indicators (e.g., aggregate acute unfair treatment) with which to examine factors associated with hypertension awareness, treatment and control. Doing so allowed me to account for the unique aspects of the social environments in which individuals reside and their associations. This research contributes to the growing body of literature examining features of the social environment to explain racial and ethnic differences in hypertension awareness, treatment, and control. Specifically, this research is one of few that have examined the role of aggregate area acute unfair treatment, NHB neighborhood racial composition, and hypertension awareness, treatment, and control.

## **Implications**

While racial integration is associated with numerous positive social and economic benefits to minorities, racism and discrimination are prevalent in the day-to day lives of many individuals, despite federal mandates prohibiting such acts. The protective effects of neighborhoods with higher percentage of NHBs require further elucidating and the protective effects in terms of hypertension awareness are enhanced for those who report higher levels of racial discrimination. Neighborhood levels of acute unfair treatment may have important adverse effects on treatment, above and beyond the beneficial effects at the individual-level. Future research is warranted to investigate neighborhood levels of acute unfair treatment by class. Similarly, future studies should examine the moderating effects of individual acute unfair treatment by class.

## **Conclusion**

Individual-level acute unfair treatment and aggregate-level acute unfair treatment are important correlates of hypertension awareness and treatment. While paradoxical in nature, individual-level acute unfair treatment seem to yield atypical but protective benefits for both

hypertension awareness and treatment in this sample. Although protective at the individual level, this is not an endorsement of acute unfair treatment because acute unfair treatment can yield harmful effects as in the case of aggregate-level acute unfair treatment on hypertension treatment. Future studies are warranted to further elucidate the complex association between NHB neighborhood racial composition, acute unfair treatment (at Level-1 and Level-2) and hypertension awareness and treatment.

While, acute unfair treatment did not correlate with hypertension control in this sample, further investigation should examine plausible associations between acute unfair treatment and health care measures such as frequency and place of health care as potential explanations for racial and ethnic differences in hypertension control.

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## CHAPTER 5

### **NHB neighborhood racial composition: What are the implications for hypertension awareness, treatment and control?**

#### **Summary of Goals, Aims, and Purpose**

The primary goal of this dissertation was to examine the relationships between NHB neighborhood racial composition and social factors that contribute to racial and ethnic differences in hypertension awareness, treatment, and control (Figure 1.1). Overall, this dissertation has pursued three major gaps in the literature: 1) understanding associations between NHB neighborhood racial composition and hypertension beyond prevalence by considering its association with hypertension awareness, treatment, and control; 2) understanding the role of individual social connectedness as it may influence hypertension awareness, treatment, and control, yet through ways; and 3) understanding the role of acute unfair treatment as it may explain racial and ethnic differences across hypertension awareness, treatment, and control, yet through different ways, as depicted in the conceptual model in Figure 1.1. To that end, a key aim of this dissertation has been to elucidate pathways through which race, neighborhood racial composition, neighborhood poverty, social connectedness, and perceived discrimination contribute to racial and ethnic patterns across hypertension outcomes. Specifically, I examined the main effects of race, NHB neighborhood racial composition, and neighborhood poverty on hypertension awareness, treatment, and control (Chapter 2). Next, I examined the combined effects of NHB neighborhood racial composition and neighborhood poverty on hypertension awareness, treatment, and control (Chapter 2).

In Chapter 3, I examined social connectedness (while controlling for aggregate social connectedness) as a mediator between NHB neighborhood racial composition and hypertension awareness; and as a correlate (while controlling for aggregate social connectedness) of hypertension treatment among those who were aware, and hypertension control among those who were being treated. In Chapter 4, I examined individual level acute unfair treatment as a moderator (while controlling for aggregate (Level 2) acute unfair treatment) of associations between NHB neighborhood racial composition hypertension awareness, and examined individual acute unfair treatment (while controlling for aggregate (Level 2) acute unfair treatment) as a correlate of hypertension treatment and control

Figure 1.1 conceptualized institutional racism as a complex process in which social environmental conditions yield inequitable life opportunities that greatly influence hypertension awareness, treatment, and control. This process is influenced by compositional and contextual effects as well as racialized historical events, which are not explicit in the model but will be discussed in greater details in a later section. Moreover, Figure 1.1 distinguishes between macro and micro level factors, recognizing that both may influence hypertension awareness, treatment, and control. These factors act as forces that perpetuate and maintain racial and social inequities. Even though macro level factors, such as NHB neighborhood racial composition and neighborhood poverty, are more distant sources of uncontrolled hypertension, they directly contribute to hypertension risk markers (micro level factors) (Morenoff et al. 2007). Thus, an improved understanding of the role that these neighborhood level factors play in shaping racial and ethnic differences across hypertension awareness, treatment, and control is critical (Hertz & Unger, 2005).

Below, I describe the results from Chapters 2-4. More specifically, I address aims and gaps outlined and how these findings contribute to explanations for associations between NHB neighborhood racial composition and hypertension awareness, treatment and control in the following overview.

### **Summary of the Results of Each Chapter**

*Chapter 2.* Chapter 2 analyzed the relationships between race and hypertension awareness, treatment, and control; between NHB neighborhood racial composition and hypertension awareness, treatment, and control; between neighborhood poverty and hypertension awareness, treatment, and control; as well as the joint effects of NHB neighborhood racial composition and neighborhood poverty and hypertension awareness, treatment, and control. Hypertension literature shows that racial and ethnic differences persist across hypertension outcomes, yet the underlying mechanisms behind these pathways are not clearly understood (Hajjar & Kotchen, 2003; Hertz & Unger, 2005). However, research shows that NHBs, NHWs, and Hispanics often live in different neighborhoods, which consequently may expose them to different neighborhood effects (Acevedo-Garcia & Lochner, 2003). Furthermore, we know that RBRS tends to lead to high concentrations of poverty (Williams & Collins, 2001). For these reasons, I hypothesized that race is a correlate of hypertension awareness, treatment, and control; that NHB neighborhood racial composition is a correlate of hypertension awareness, treatment, and control above and beyond race and individual-level factors; that neighborhood poverty is a correlate of hypertension awareness, treatment, and control above and beyond race and individual-level factors; and that the combined effects of NHB neighborhood racial composition and neighborhood poverty are correlates of hypertension awareness, treatment, and control above and beyond race and individual-level factors.

Findings reported in Chapter 2 were both consistent and inconsistent with these hypotheses. Race and NHB neighborhood racial composition were significant correlates of hypertension awareness. The positive association between race and hypertension awareness are consistent with previous research that found NHBs are more likely to be aware of their hypertension compared to NHWs and Hispanics (AHA, 2013; Hertz & Unger, 2005; Morenoff et al., 2007). More so, significant racial and ethnic differences in hypertension awareness were attenuated once NHB neighborhood racial composition was included in the model, which suggests that the NHB neighborhood racial composition may account for initial protective effects of NHB race. These relationships were robust and remained significant after adjusting for individual level characteristics (Models 2 and 5, Table 2.2).

Similarly for NHBs, Morenoff and colleagues (2007) found a positive association between increased hypertension awareness and residence in neighborhoods with high proportions of NHBs and poverty. However, in this dissertation, neighborhood poverty did not prove to be an independent correlate of hypertension awareness, treatment, or control. This may be in part due to the manner in which the 2002 HEP data were collected, which allowed for the independent examination of NHB neighborhood racial composition and neighborhood poverty. While the Chicago Community Adult Health Study (CCAHS 2002-2003) is a groundbreaking study that examined the impact of social inequalities, such as social context, socioeconomic position, race and ethnicity, psychosocial factors, and biological markers of stress among a variety of health outcomes in a sample of 4000 adults in a major American city, this study did not distinctly separate neighborhoods with a greater proportion of NHBs and neighborhood poverty into independent categories, which may sometime conflate the effects of one or both variables and make it unclear which of the two is the greatest correlate. In the CCAHS,

neighborhood poverty and percent of NHBs in a neighborhood were collectively treated as *disadvantaged neighborhoods*.

Furthermore, neither race, NHB neighborhood racial composition nor neighborhood poverty were correlated with hypertension treatment or control in this dissertation. These findings were inconsistent with this dissertation's hypotheses. Race, NHB neighborhood racial composition and neighborhood poverty were hypothesized to explain racial and ethnic differences in hypertension awareness, treatment, and control. Unlike in other studies that reported NHBs to be *more* likely than NHWs and Hispanics to be treated for hypertension (AHA, 2013; Hertz & Unger, 2005; Morenoff et al., 2007), NHBs, in this dissertation, were *as* likely to be treated for hypertension compared with NHWs and Hispanics. The protective effect of NHB neighborhood racial composition on hypertension awareness was not observed for either hypertension treatment or control in this dissertation, which may be attributable to the contexts of the neighborhoods that participants resided.

It is important to note that the social contexts of Detroit, Michigan may not be generalizable to other cities because of the exponential economic disinvestment that has plagued the city for the past five decades or more. Detroit is plagued with high disinvestment, high concentration of poverty, lack of transportation, high crime, lack of access to fresh fruit and vegetables, White-flight, increased toxins and exposures, which collectively have made it more difficult for individuals to achieve and maintain healthy outcomes (Frey, 1979; Crowder, 2000). In Detroit, neighborhoods vary widely, with some being quite vibrant and others more challenged. Similarly, the HEP dataset is not representative of all neighborhoods in Detroit, and may have less variation than is seen in the city as a whole. Thus, observing racial and ethnic differences in hypertension treatment and control maybe more difficult in this sample. For

instance, health care facilities and access to quality health care are part of the built environment of neighborhoods and are crucial to controlling hypertension (Hajjar et al., 2006). The inequitable distribution of social, political, and economic resources across racially segregated neighborhoods dictates opportunity structures, mediates access to quality job opportunities, and influences the distribution of access to quality health care (Dickerson, 2005; CSDOH, 2007). As a result, health facilities and businesses in poor racially segregated neighborhoods experience similar social, political, environmental, and economic inequalities as residents (Kirby & Kaneda, 2005). Pointedly, access to quality health care opportunities and resources needed to ensure quality health care is greatly reduced or nonexistent in neighborhoods with fewer economic resources (Evans et al., 2007; Kirby & Kaneda, 2005). Thus, establishing cause-effects links between residing in a neighborhood with high percentage of NHBs and increased hypertension awareness has been extremely difficult.

*Chapter 3.* Chapter 3 analyzed the relationships between social connectedness and hypertension awareness, treatment, and control. Hypertension literature shows that racial and ethnic differences persist across hypertension outcomes, yet the underlying mechanisms behind these pathways are not clearly understood (Hajjar & Kotchen 2003; Hajjar et al., 2006; Hertz & Unger, 2005). However, research has established that NHBs, NHWs, and Hispanics often live in different neighborhoods, which consequently may expose racial and ethnic groups to different neighborhood effects, such as RBRS and high concentrations of poverty (Williams & Collins, 2001).

For the purpose of this dissertation, social connectedness was comprised of four distinct measures (scales): sense of community, neighborhood satisfaction, neighborhood participation, and social support. In addition, a composite measure was created that encompassed all of these

measures of social connectedness. These measures were selected because of their health promoting benefits on health outcomes as outlined in the literature (Wilder Research, 2010), and their potential to increase hypertension awareness, treatment, and control. For these reasons I hypothesized that social connectedness mediated the relationship between NHB neighborhood racial composition and hypertension awareness. I also hypothesized that social connectedness was a correlate of hypertension treatment and control after adjusting for individual-level characteristics including race, ethnicity, and NHB neighborhood racial composition.

Findings reported in Chapter 3 were largely inconsistent with these hypotheses. Sense of community, neighborhood satisfaction, neighborhood participation, and social support (measures of social connectedness) did not mediate the relationships between NHB neighborhood racial composition and hypertension awareness at Level 1 or Level 2 in this sample. Similarly, neither the individual- nor aggregate- level social connectedness index mediated the relationship between NHB neighborhood racial composition and hypertension awareness. While the individual-level social connectedness index nor the respective measures of social connectedness mediated the relationship between NHB neighborhood racial composition and hypertension awareness in this sample, further investigation of the social connectedness index but with different measures of social connectedness should be investigated, which may help to explain the marginal significance of the aggregate social connectedness index at Level 2.

Unlike the other measures of social connectedness, neighborhood satisfaction was statistically correlated with hypertension awareness at Levels 1 and 2 but in different directions. At Level-1, neighborhood satisfaction is inversely associated with hypertension awareness and at Level- 2, hypertension awareness increases as aggregate neighborhood satisfaction increased. One plausible hypothesis for the difference in levels may be attributable to the fact that

neighborhood satisfaction captures more than the neighborhood's attractiveness. Potentially, neighborhood satisfaction is an indicator of neighborhood stability: that is, people who are more satisfied with their neighborhoods may have fewer neighbors who turn over (Rohe, 1996). While neighborhood stability was not measured in this dissertation, a few studies have suggested that neighborhood stability can have negative effects on residents' well-being in economically disadvantaged neighborhoods (Ross, 2000). In part this may occur because residents of poor, stable neighborhoods face high levels of disorder in their neighborhoods (Ross, 2000). In Ross's study, stability did not reduce perceived disorder under conditions of poverty, perhaps leaving residents feeling powerless to leave a dangerous place (Ross, 2000). Finally, the negative effects of poor, stable neighborhoods on residents' well-being do not stem from a lack of social ties among neighbors (Ross, 2000). No known empirical studies have tested the relationship between neighborhood satisfaction and hypertension awareness but one prior study tested individual-level social support and neighborhood-level social ties as potential mediators of the relationship between segregation and emotional well-being and suggested a beneficial effect of residence in segregated neighborhoods (Yuan, 2008).

Measures of social connectedness: sense of community, neighborhood satisfaction, neighborhood participation, and social support did not correlate with hypertension treatment or control. Similarly, individual-level social connectedness index did not correlate with hypertension treatment or control. The lack of statistical significance may suggest the need to investigate other correlates that may largely influence hypertension treatment and control such as health care/clinical measures.

In conclusion, the analyses presented in the dissertation are the first efforts at examining the association between measures of social connectedness and hypertension awareness,

treatment, and control. This population-based study provided empirical evidence that satisfaction with the neighborhood was directly associated with hypertension awareness at Level-1 and Level -2 of residents in Detroit, Michigan. These findings also support the need to develop area-based programs and strategies related to the built and physical environments. Therefore, the ways in which individuals perceive their neighborhoods may be beneficial to their health and well-being. Additionally, despite the lack of other similar studies with which to make a direct comparison with this finding, the results are also in accordance with previous literature demonstrating association between neighborhood satisfaction and health (Luz et al., 2011). The mechanisms through which the neighborhood influences their health have yet to be elucidated. The uniqueness of this study was the simultaneous analyses of social connectedness as individual and neighborhood mediators and correlates of hypertension awareness and hypertension treatment and control, respectively.

*Chapter 4.* Chapter 4 examined the effects of individual-level acute unfair treatment as a moderator between NHB neighborhood racial composition and hypertension awareness. Similarly, Chapter 4 examined individual acute unfair treatment as a correlate of hypertension treatment and control. No studies of which I am aware have examined individual-level acute unfair treatment as a moderator of associations between NHB neighborhood racial composition and hypertension awareness, and no known studies have investigated aggregate-level acute unfair treatment as a correlate of hypertension treatment and control. Most studies examining the relationship between acute unfair treatment and hypertension have restricted the focus to changes in systolic and diastolic blood pressures (Lewis et al., 2009). Consequently, heightening the understanding of the pathways linking NHB neighborhood racial composition to racial and ethnic differences in hypertension awareness, treatment, and control requires empirically testing

various associations. To these ends, I hypothesized that individual-level acute unfair treatment weakened the relationship between NHB neighborhood racial composition and hypertension awareness and individual-level acute unfair treatment inversely correlated with hypertension treatment and control.

Findings reported in Chapter 4 were inconsistent with these hypotheses. The protective association between NHB neighborhood racial composition and hypertension awareness was strengthened as individual-level acute unfair treatment increased. While statistically significant, this finding is inconsistent with this dissertation's hypothesis that the protective association between NHB neighborhood racial composition and hypertension awareness would be weakened as individual-level acute unfair treatment increased. Explaining this atypical result is not easy. A study conducted by researchers from the Harvard School of Public Health in Boston and the Kaiser Foundation Research Institute of Oakland, California concluded that racial discrimination and reactions to it made a substantial contribution to the differences in blood pressure between Blacks and Whites (Krieger & Sidney, 1996). Researchers from this study further concluded that Black professionals, in general, who are conscious of instances of discrimination and who challenge unjust or unequal treatment and talk to others appear to be at lower risk of elevated blood pressure than Black working class men and women who may be less aware of discriminatory acts and less likely to challenge them (Krieger & Sidney, 1996). While this dissertation does not examine hypertension prevalence, a similar association may hold true for the moderating effects of individual-level acute unfair treatment on the association between NHB neighborhood racial composition and hypertension awareness. NHB who are conscious of and challenge instances of acute unfair treatment and talk to others about unfair treatment may also be more likely to discuss potential effects of discrimination on health, which may lead to higher

awareness of hypertension status. However, additional research is warranted to disentangle the moderating effects of individual-level acute unfair treatment on the relationship between NHB neighborhood racial composition and hypertension awareness. Similarly, additional research is warranted to disentangle the marginally significant association between aggregate-level acute unfair treatment and hypertension awareness. For future research, studies should assess the internalized effects of acute unfair treatment on hypertension awareness and the effects of acute unfair treatment on hypertension awareness within class and gender strata.

As with hypertension awareness, associations between acute unfair treatment and hypertension treatment yielded mixed findings at Level-1 and Level-2. Individual-level (Level-1) and aggregate-level (Level-2) acute unfair treatment were correlates of hypertension treatment but in different directions. This is the first analysis of which I am aware of to examine this association, and to report this finding. Moreover, individual-level perceptions of discrimination were positively associated with the probability that those who were aware of their hypertension were currently being treated. This atypical result may be attributable to the fact that individual acute unfair treatment, a form of psychosocial stress, may lead to greater utilization of health care. For instance, multiple studies have shown that anger, a form of emotional stress, may lead to heart attacks, arrhythmias and even sudden death (Krantz et al., 2002). While these episodes may only present in individuals with a history of heart disease, acute stress can cause a heart attack or hypertension (Krantz et al., 2002). However, greater utilization of health care may also lead to greater awareness of hypertension and the potential effects of discrimination on health.

Similarly, in some cases, those who use health care are more likely to report unfair treatment. The IOM's *Unequal Treatment* report discussed the shameful legacy of discrimination and racism that has plagued our nation's health care system (Nelson, 2003). Past segregation of

the health care delivery system, inclusive of hospitals, neighborhood and community facilities and small physician practices, has persisted and is evidenced in how minorities view the health care system (Nelson, 2003). Minority patients are more likely than Whites to perceive racism in the health care system, and they are more prone to delay care because of distrust (Nelson, 2003).

Aggregate-level perceptions of discrimination were inversely associated with the probability that those who were aware of their hypertension were currently being treated. When comparing two individuals with the same level of individual experiences of aggregate area acute unfair treatment but living in neighborhoods with different levels of aggregate area acute unfair treatment, living in the neighborhood with higher aggregate area acute unfair treatment reduced the likelihood of being treated. This finding suggests that the contextual effects of neighborhood could possibly be a negative correlate of health outcomes but more specifically, hypertension treatment. While no known research has analyzed similar relationships and few explanations have been offered for this type of patterning, it is plausible to hypothesize that individuals who live in neighborhoods with high contextual effects of acute unfair treatment may face more challenges in accessing necessary health care such as hypertension treatment. Moreover, some literature suggests health care facilities in impoverished and underserved area may not offer the same quality of care as health care facilities in more affluent areas (Nelson, 2003), which may partly explain why Blacks with hypertension have poorer hypertension control than Whites (Nesbitt and Victor, 2004). Ultimately, health care facilities are nested in neighborhoods and neighborhoods are nested in communities. Thus, individuals are more likely to utilize the health care facilities in the neighborhoods or communities they reside. Similarly, the paradoxical differences between Level -1 and 2 may be affected by other variables not measured in this dissertation.

Individual- and aggregate-perceptions of discrimination were not statistically associated with the probability that those who were treated for their hypertension were currently controlled. This may be due in part to the fact that hypertension control is largely predicted by clinical factors such as utilization of health care facilities. Researchers have found that RBRS adversely affects minority access to affordable and quality health care which create a problem of access and timely use (Williams & Collins, 2001; Mays et al., 2007). The availability and variation of health care providers within African American, Hispanic and White neighborhoods varies greatly (Gaskin et al., 2012). Hargraves and Hadley (2003) found that community-level characteristics accounted for some racial and ethnic disparities in having a regular provider and seeing a doctor within the past year. Namely, these challenges maybe the result of physical distance; lack of insurance; restriction to acute medical care, which is more likely to be offered in segregated areas; and/or dissimilar quality of health care as offered to Whites once inside the health system (Williams & Collins, 2001; Mays et al., 2007). Ultimately, if individuals are less likely to be treated, they are less likely to be controlled.

In summary, the main findings of this dissertation are: 1) race, NHB neighborhood racial composition, neighborhood poverty, social connectedness and perceived discrimination influenced hypertension awareness, treatment, and control in various ways; 2) hypertension awareness varies by race; 3) NHB neighborhood racial composition is a significant yet protective determinant of hypertension awareness; 4) moderating effects of individual acute unfair treatment between NHB neighborhood racial composition and hypertension awareness were positively association with likelihood of becoming aware of hypertension; 5) perceptions of discrimination were positively associated with the probability that those who were aware of their hypertension were currently being treated and 5) aggregate-level area acute unfair treatment is a

harmful determinant for both hypertension treatment. Below, I discuss the findings for hypertension awareness, treatment and control separately, and implications for future research and for public health policy.

### **Limitations**

There were several limitations associated with research for this dissertation. One primary issue is that the 2002 HEP data are cross-sectional data, which makes it difficult to establish temporality and essentially covers the dynamic relationships between social contexts of neighborhoods and hypertension awareness, treatment, and control. For some individuals, living in poor and highly segregated neighborhoods may not be a time-varying exposure but rather a life-long constant, which suggest longitudinal comparisons could be meaningful. More specifically, it is possible that longitudinal studies could disentangle the relationship between frequency and duration of residence in segregated neighborhoods and the lag time between the exposure and onset of hypertension (Collins & Williams, 1999; Grady & McLafferty, 2007). The cumulative impact of residence in a segregated neighborhood may better explain the specific features of the social environment that may yield higher rates of awareness among individuals who resided in racially segregated neighborhoods. For example, social connections, neighborhood satisfaction, the degree of hope and optimism people have, the location of doctors and hospitals, and access to and treatment by the health care system may all influence awareness. Similarly, causal-effects may be determined. Longitudinal data will be beneficial in exploring clinical and social factors in explaining racial and ethnic differences in hypertension treatment and control. Likewise, longitudinal data may aid in understanding the relationship between NHB neighborhood racial composition and health status and outcomes, especially in Detroit, Michigan because of the progressive decay that has occurred over time and may be a model for

understanding how such processes might unfold in other post- industrial cities whose residents might experience similar conditions.

Another limitation of this research is the sample lack of generalizability. The HEP s Community Survey does not have a nationally representative sample of NHBs, NHWs, or Hispanics. While other metropolitan areas and cities in the United States have high rates of race-based residential segregation, Detroit, Michigan has been named the most highly segregated city in the country according to the 2010 Census Reports using the Dissimilarity and Isolations indexes (Logan & Stults, 2011). In addition to being the most highly segregated city in the country, Detroit is plagued by high concentrations of poverty (Zenk et al., 2005) and unemployment (White & Borrell, 2011). Thus, results from this dissertation suggest social patterning of hypertension awareness, treatment, and control by neighborhood characteristics, specifically racial composition.

The lack of a health care utilization measure is a limitation of this study. Health care utilization measures would provide additional insight into the frequency of care, the type of care, and the presence of comorbidities, which have all been shown to influence hypertension treatment and control (Wong et al., 2002). Moreover, racial differences in hypertension control suggest that prevalence and management are not the same for Blacks and Whites (Hertz & Unger, 2005; Hajjar & Kotchen., 2003). Hypertension research continues to show that control varies greatly among populations based on race and geographical locations (Lloyd-Jones et al., 2002; Hertz & Unger, 2005).

Finally, there may be limitations with the use of NHB neighborhood racial composition as a proxy for RBRS, as a correlate of health outcomes. Future studies should consider use of

measures of RBRS. This may provide more accurate measures of residents associations with other residents (White & Borrell, 2011).

### **Strengths**

Sparse research found to date has examined the relationship among race, NHB neighborhood racial composition, and neighborhood poverty and hypertension awareness, treatment, and control, but these findings expand research conducted by Morenoff et al. (2007). Additionally, findings from this study provide an initial examination at social factors as correlates of racial and ethnic differences in awareness, treatment, and control. Despite the above limitations identified, use of measures derived from census data provided the current dissertation with the environmental conditions (measures of percent non-Hispanic Blacks, percent neighborhood poverty, aggregate social connectedness index, and aggregate perceived discrimination) necessary to examine factors associated with hypertension awareness, treatment and control. By examining these factors, I was able to account for the unique aspects of the social environments in which individuals reside and the associations between social environments and hypertension awareness, treatment, and control.

The results reported in the previous section are complex and varied with respect to providing substantive insight into factors associated with the character of the neighborhood environment inhabited by NHBs, NHWs, and Hispanics in Detroit, Michigan. Differences between NHBs, NHWs, and Hispanics are clearly one major source of variation. Few studies examining sense of community, neighborhood satisfaction, neighborhood participation, and social support have investigated their effects on hypertension awareness, treatment, and control. Individual- and aggregate- levels of neighborhood satisfaction were significantly correlated with hypertension awareness. The mixed findings of neighborhood satisfaction further demonstrate the importance of distinguishing effects of composition and context when investigating sources

of racial and ethnic differences not only in hypertension awareness but possibly hypertension treatment and control as well.

Although the mechanisms by which perceived discrimination operates to influence hypertension prevalence have been aptly postulated, few studies have empirically tested acute unfair treatment as a moderator between NHB neighborhood racial composition and hypertension awareness. The availability of data on NHB neighborhood racial composition and acute unfair treatment offered a unique opportunity to examine how a distal determinant of health like acute unfair treatment influences proximal causes and ultimately hypertension treatment and control, while adjusting for NHB neighborhood racial composition. Thus, this dissertation was able to assess different pathways of acute unfair treatment influencing hypertension awareness and hypertension treatment and control, respectively. Similarly, few studies have examined the composition and contextual effects of acute unfair treatment on hypertension treatment and control.

### **Implications for Future Research**

This dissertation emphasized several complex and diverse relationships among social and economic factors and the pathways of their impact on hypertension awareness, treatment, and control, which all have implications for future research. First, race-based residential segregation (RBRS) may yield both protective effects, such in the case of hypertension awareness, and deleterious outcomes as explained previously in current research. Thus, it is crucial to understand the causes of RBRS and the social and economic consequences of RBRS on society (Boustan, 2013). Therefore, continued exploration of RBRS as both a factor in promoting healthy outcomes and contributing to social and economic inequalities, which may adversely affect health, is clearly warranted. Additional research that focus on segregation as an expression of institutional racism is also warranted and could be strengthened with a multilevel framework and attention to other forms of

urban inequality (Acevedo-Garcia et al., 2003). Second, future studies focusing on RBRS and health should expand beyond the traditional framework that largely concentrates on sociological evidence relating to the formation of extremely different neighborhoods, which restricts socioeconomic opportunities for minorities and investigate the pathways, including metropolitan area, neighborhood, and individual-level factors, through which segregation may influence health. This examination should integrate research into a multilevel framework, which may help place neighborhoods in the context of their metropolitan areas, with the attending implications for social and public health policy (Acevedo-Garcia et al., 2003).

Third, while NHB neighborhood racial composition captures certain aspects of the neighborhood social environments in which NHBs live, this measure does not capture the specific features of RBRB. RBRS refers to segregation in regard to the composition and spatial distribution of the population of an entire metropolitan area across its neighborhoods; thus, residential segregation is a multilevel concept that combines information on 2 geographic scales (Acevedo-Garcia et al., 2003). It is also a multidimensional construct consisting of 5 distinct geographic patterns: dissimilarity, isolation, clustering, centralization, and concentration (Massey, 1988 & 1996). It is worth noting that the dimensions apply equally to other racial and ethnic groups and subgroups as well as to income segregation (e.g., segregation of poor from nonpoor individuals) (Acevedo-Garcia et al., 2003).

Fourth, while literature shows that sense of community, neighborhood satisfaction, neighborhood participation, and social support may promote positive health outcomes, additional measures of social connectedness should be examined as plausible correlates of hypertension awareness, treatment, and control. For example neighborhood stability, the number of social networks, the frequency of interaction, social cohesion, and social capital, just to name a few, are

other plausible untested measures that may explain the positive association between NHB neighborhood racial composition and hypertension awareness and may lend additional insight into the various mechanisms that may correlate with hypertension treatment and control. Similarly, the aforementioned measures or a combination of these measures may also explain increased hypertension awareness among NHBs.

Fifth, while an abundance of literature exist examining the relationship between discrimination and hypertension (prevalence) and changes in systolic and diastolic blood pressures, little is known about the association between acute unfair treatment and hypertension awareness, treatment, and control. The paradoxical findings reported in this dissertation suggests that the analysis of NHB-NHW differences in hypertension awareness, treatment, and control should examine the social construction of race and ethnicity, as embodied in experiences of acute unfair treatment. In addition to further investigating the effects of individual- and aggregate-level acute unfair treatment on hypertension awareness, treatment, and control, social class, gender, and education should be examined as plausible correlates of differential exposure to acute unfair treatment. Race, discrimination, institutional racism, and RBRS are extremely complex relationships, which are very difficult to disentangle and understand. Thus, the findings presented in this dissertation are not easily understood and require further exploration in a larger sample with more racial, ethnic, and economic diversity to better elucidate the specific mechanisms that lead to racial and ethnic difference in hypertension awareness and treatment. While unsubstantiated in this dissertation, it is plausible to consider the way by which acute unfair treatment may impact hypertension control. One plausible pathway maybe internal to the health care system.

## **Implications for Public Health Practice and Policy**

Disentangling the relative importance of the complex processes that lead to disparities in health and disease is extremely challenging, but renewed policy efforts are needed to identify policies that are not usually thought of as health policies but could potentially affect health outcomes. A critical first step is to address distal social policies and arrangements that created health and social inequities in the first place (Link & Phelan). Some plausible immediate steps should include addressing RBRS, income inequality, improving access and affordable health care, and redefining health policies.

## **Race-Based Residential Segregation (RBRS)**

Even if it is postulated that the eradication of RBRS is beyond the reach of policy mandates, strategies that lessen the impact of place in producing racial, ethnic, and socioeconomic disparities should be enacted (LaVeist et al., 2011). This can be done through the adoption of policies that redress the inequitable distribution of power and resources across communities. Adopting a “health in all policies” approach is one such strategy (LaVeist et al., 2011). This approach recognizes that health is affected by policies that do not explicitly address health, including those in the arenas of housing, agriculture, labor, and the environment (LaVeist et al., 2011). Thus, to improve population health, policy makers need to consider sectors outside the strict confines of “health” (LaVeist et al., 2011).

## **Income Inequality**

Over the past fifty years, parallel changes in the Black-White gap in health have been associated with parallel changes in the Black-White gap income (Williams & Jackson, 2005). Income inequality is one of the greatest social inequalities that directly affect health, education, housing (Williams & Jackson, 2005). One percent of the United States controls one third of the country’s total wealth. Even more incredible is that the richest 10 percent of Americans control

75 percent of the country's wealth, leaving approximately 25% of wealth to the other 90% of Americans (Allegretto, 2011). Tax policy has also contributed to this growing inequity. For instance, the sale of stock and other investments are taxed at a lower rate (about 15%) than regular income. One plausible policy reform that may address aid in addressing income inequality is to increase minimum wage. This issue is currently be debated by our federal legislators. A bill, supported by President Barack Obama, to raise the federal minimum hourly wage from \$7.25 to \$10.10 by late 2016, has stalled in Congress due to Republican opposition. Another plausible policy reform is to decrease taxes on low to middle income individuals while raising taxes on the top 1%.

### **Improving Access to Affordable Health Care**

On March 23, 2010, President Barack Obama signed the comprehensive health reform known as the Patient Protection and Affordable Care Act (PPACA) into law. PPACA require most U.S. citizens and legal residents to have health insurance. The enactment of the Patient PPACA (H.R. 3590) is arguably the most significant health care reformation in the United States in nearly 50 years. Two pervasive beliefs undergirded this reformation: (1) greater access to quality and affordable health care yields better health outcomes and well-being, and (2) universal coverage improves the cost-effectiveness of insurance companies which subsequently reduces the burdensome costs and expenditures of health care experienced by individuals and government alike. While this legislation is a formidable step in the right direction, addressing the underlying fundamental causes of health inequities cannot be neglected because access to quality and affordable health care, yet an important contributor to healthy outcomes, is a small portion of the larger problem. The association between socioeconomic status and disease has been remarkably consistent across time and place (Link and Phelan, 2005).

## **Redefining Health Policies**

Understanding and illuminating the social, economic and political policies that play a role in creating and reinforcing residential segregation in the U.S. is critical to designing solutions to eliminate health inequities (Iton, 2006). Thus, public health researchers and policymakers should identify policies that will either reduce inequities in socioeconomic position and resources or develop interventions that will more evenly distribute neighborhood and health promoting resources across SEP group (Phelan et al., 2010). Segregation characterizes the lives of many African Americans, and it is guided by social policies such as housing, land use, and economic development policies that have perpetuated and maintained separate yet unequal institutions and outcomes in a structured manner (Settles, 1996). Most racially segregated neighborhoods have endured long-term systemic economic, political, and social inequities that have stunted upward mobility and have clearly undermined the American ideals of fairness and equity, especially in health outcomes (Schulz et al., 2002 & Prosperity 2050, 2011). Oddly, most social policies don't assess the policies' impacts on health outcomes when the policies are being created and enacted, which can lead to further health inequities.

## **Conclusion**

An attempt to understand racial and ethnic patterns in hypertension awareness, treatment, and control must start with an examination of socioeconomic, historical, and structural factors that produce inequities in living conditions where predominantly minority populations reside (Geronimus, 2000). This dissertation examined selected social determinants of health, including race, NHB neighborhood racial composition, neighborhood poverty, social connectedness and perceived discrimination and their impact on hypertension awareness, treatment, and control. Social determinants of health are social and economic conditions that influence the health of people and communities (CSDOH, 2007), which are shaped by the amount of resources, money,

and power that people have, all of which are influenced by policy choices (CDC, 2013). Tackling the social determinants, the big picture, is somewhat abstract because these pathways are often complex, rather than linear.

The social context of Detroit, Michigan is plagued with exponential economic disinvestment that started approximately five decades ago, and the most devastating economic impact has occurred over the past two decades. Long-standing inequities in income, wealth, and opportunity have steadily worsened—and have now reached unprecedented levels (Policy Link, 2011). While there is no single causal explanation, broad economic and political transformations, including the shift from an economy based on (automobile) manufacturing to one based on services and retail, have certainly played a role (Policy Link, 2011). Neighborhoods with high concentration of poverty, such as Detroit, are typically void of viable businesses, parks, public safety departments, and other health promoting resources. Consequently, escaping health-damaging effects is challenging, because these neighborhoods typically lack employment opportunities and services—including good schools—that can lead to upward social and economic mobility (Policy Link, 2011). Thus, residents who remained in the city, irrespective of race and ethnicity, are likely to reside in conditions that are more similar than those reflected across racial and ethnic groups nationally. Large proportions of Detroit residents live in areas with high concentrations of poverty, high residential segregation, high unemployment rates, lack of fresh fruit and vegetables, poor public infrastructure, limited public transportation, decreased quality housing options, and increased environmental toxins (Policy Link, 2011). Therefore, it is plausible that the expected racial and ethnic differences in hypertension treatment and control in this sample may have been underestimated due to high concentrations of poverty and residential segregation in Detroit. Similarly, in more economically diverse settings, racial and ethnic

differences in hypertension treatment and control may parallel findings of prior studies such as Hajjar and colleagues (2006).

Public health researchers and policymakers should continue to address the health effects of RBRS on NHBs despite the protective association that was demonstrated with hypertension awareness in Chapter 2. Similarly, residents of these areas may experience more racial discrimination due to the depravity of the social, built, and physical environments. For example, in this dissertation, acute unfair treatment appears to operate independently of class, which may also help explain why racial differences in hypertension awareness persist even after controlling for socio-economic status. Similarly, segregation and the cumulative impact of acute unfair treatment place an extra burden on subordinated racial and ethnic groups.

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