

ABSTRACT

Title of Thesis: PERCEIVED NEIGHBORHOOD
COHESION, HOMEOWNERSHIP, AND
RACE/ETHNICITY: IMPLICATIONS FOR
ADULT MENTAL HEALTH

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This study utilized 2013-2017 data from the National Health Interview Survey to evaluate the association between perceived neighborhood cohesion and mental health outcomes (serious psychological distress, anxiety, and depression) and how this association varies by race/ethnicity. This study also evaluated perceived neighborhood cohesion as a mediator of the relationship between homeownership and mental health. Results indicated that residing in a cohesive neighborhood is associated with reductions in risk ($p < .01$) for adverse mental health outcomes. Individuals living in cohesive neighborhoods had a reduced risk of 1.30 percentage points of serious psychological distress, a 4.10 percentage point reduced risk of anxiety symptoms, and a 3.80 percentage point reduced risk of depression symptoms. This study found a statistically significant reduction in risk of adverse mental health outcomes for those that own vs. rent their home and this relationship is partially mediated by neighborhood cohesion. These findings suggest that neighborhood cohesion provides a protective benefit against adverse mental health outcomes.

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RACE/ETHNICITY: IMPLICATIONS FOR ADULT MENTAL HEALTH

by

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List of Abbreviations

1. CI – Confidence Interval
2. CVH – Cardiovascular Health
3. K-6 Scale – Kessler-6 Scale
4. MDD – Major Depressive Disorder
5. MTO – Moving to Opportunity for Fair Housing
6. NHIS – National Health Interview Survey
7. PSU – Primary Sampling Unit
8. REF – Reference Category
9. RD – Risk Difference
10. SE – Standard Error
11. SES – Socioeconomic Status
12. SPD – Serious Psychological Distress
13. US – United States

Chapter 1: Introduction and Research Questions

Introduction

Approximately one in five American adults suffer from a mental illness each year (National Institute of Mental Health, 2019). Mental illnesses including depression, bipolar disorder, schizophrenia, and obsessive-compulsive disorder are among the top ten causes of disability in the United States (National Institute of Health, 2007). Symptoms of mental illness may be so severe that they inhibit a person's ability to thrive in school, work, and social activities (National Institute of Health, 2007).

Physical and social neighborhood characteristics impact mental health outcomes (Diez Roux & Mair, 2010). This project will focus on one particular social dimension of neighborhoods—perceived social cohesion—and its relationship with mental health. Social cohesion refers to the sense of unity and connection that exists among a group of people that know each other (Kawachi, Subramanian, & Kim, 2008). The extent that neighbors cooperatively interact with one another has been cited as a key measure of neighborhood cohesion (Buckner, 1988).

Social cohesion may impact mental health through several mechanisms. For example, cohesion might promote social support. Social support relates to a social network of friends, family, or community residents that provide psychological, financial, or other types of assistance (Ozbay et al., 2007). Social support has been associated with positive health outcomes and may serve as a protective factor by preventing or minimizing negative health effects (Henson et al., 2017; Pearson,

Sadler, & Kruger, 2019). Social support's protective effects may operate through three pathways: the promotion of health information and healthy behaviors via social interaction, galvanizing neighborhood resources by residents (advocating for green spaces, playgrounds, and recreation centers), and the provision of emotional support resulting in less stress and greater self-esteem and mutual respect (Erdem et al., 2016).

The impact of social cohesion on mental health outcomes may vary across subgroups (Echeverria et al., 2008). For example, racial-ethnic subgroups that have historically been excluded from formal institutional resources through systemic racism may be more reliant on their local social networks (Flores et al., 2020) for social support, childcare, and housing (Radley, 2015). However, there is little evidence on the association of neighborhood cohesion and mental health outcomes by race/ethnicity. This project seeks to measure if the association of social cohesion and mental health is moderated by race/ethnicity.

While the literature suggests that racial/ethnic minority populations might have more to gain from cohesive neighborhoods, racial/ethnic minorities report lower scores of neighborhood social cohesion (Yi et al., 2016). Such relationships could reflect *modifiable* policy arrangements such as infrastructure investment and policing that help determine cohesion. Thus, this project seeks to demonstrate one potential mechanism through which neighborhood investments might promote health equity.

This project will also investigate if neighborhood cohesion explains the relationship between homeownership and mental health outcomes. Previous research has indicated that compared to homeowners, renters are more likely to have adverse

mental health outcomes (Park & Seo, 2020). Cohesion might be one potential mechanism for this relationship. Renters, compared to homeowners are more likely to have frequent population turnover and instability (Lee, 2014). Furthermore, holding the neighborhood constant, renters may develop less strong neighborhood ties compared to homeowners (Lee, 2014).

Findings will contribute to our understanding of protective factors for mental illness. Given a recent push to invest in programs that leverage the social determinants of health (Horwitz et al., 2020), my findings will contribute to increased consideration of perceived neighborhood cohesion as a determinant of health.

Research Questions

This project addressed the following research questions:

1. Is there an association between perceived neighborhood cohesion and mental health outcomes (serious psychological distress, anxiety, and depression) among adults in the United States?

Hypothesis: Greater perceived neighborhood cohesion is associated with reduced risk of mental health symptoms.

2. Does this association vary by race/ethnicity?

Hypothesis: The protectiveness of neighborhood cohesion against adverse mental health outcomes will be smaller for non-Hispanic Whites compared to non-Hispanic Blacks, non-Hispanic other or multiple race, and Hispanic populations.

3. Does perceived neighborhood cohesion explain the relationship between homeownership and mental health outcomes?

Hypothesis: Perceived neighborhood cohesion mediates the relationship between homeownership status and mental health status.

Background/Literature Review

Mental Illness

Mental illness has significant impact on chronic disease, mortality, and overall health and well-being. In 2017, nearly 19% of adults and 50% of adolescents experienced mental illness in the United States (National Institute of Mental Health, 2019). These figures reflect a high burden of mental illness in the population and the need for tailored interventions and programs to improve outcomes. Symptoms of mental illness may interfere with a person's ability to effectively function in school, work, and social settings (National Institutes of Health, 2007).

Causes of mental illness may include genetic predisposition, traumatic events, and exposure to negative social factors such as poverty and crime (Dahal, Swahn, & Hayat, 2018). Poverty is associated with higher occurrence of mental illness due to factors such as educational attainment, socioeconomic status, food insecurity, housing and the resulting chronic stress (Lake, 2017). Residing in a low-income neighborhood is associated with adverse mental health outcomes (Leventhal & Brooks-Gunn, 2003).

Mood disorders such as depression and bipolar disorder, anxiety disorders, and alcohol use disorders are among some of the most common mental illnesses (Gustavson et al., 2018). Mental illness can be very expensive to treat and may result in extensive psychological, social, and occupational expenses (Lake, 2017). It is estimated that greater than two-thirds of individuals with depression never receive suitable treatment (Lake, 2017). Consequently, there is a large unmet need for resources and assistance among those suffering from mental illness.

Social determinants of health have been shown to play an integral role in shaping mental health outcomes. Exposure to crime and violence may heavily influence a person's mental health by evoking stress and anxiety (Bateman et al., 2017). However, positive coping resources such as social support and cohesion have been shown to prevent and lessen the negative impact of social stressors (Perreault et al., 2017).

Neighborhoods and Health

Existing research analyzing the role of neighborhoods on health has primarily focused on the impact of negative factors (such as poverty, violence, drug use, noise and air pollution) rather than positive neighborhood factors such as neighborhood social cohesion (Kim & Kawachi, 2017). With some exceptions, another limitation of neighborhood research is the lack of longitudinal studies assessing neighborhood characteristics and health outcomes (Diez Roux & Mair, 2010). Many of these studies are cross-sectional and therefore do not allow for observation of exposures and outcomes over time.

However, existing research supports that neighborhood characteristics play an integral role in selected health outcomes. For example, Mujahid et al. used survey data to assess racial/ethnic variation in ideal CVH (cardiovascular health) and determine whether these differences were changed after adjusting for neighborhood characteristics (2017). Researchers found that, "Whites were 3 times more likely to have ideal CVH compared to Blacks and Hispanics" (Mujahid et al., 2017, p. 61). When adjusting for neighborhood factors, racial and ethnic differences in CVH were modestly lowered (Mujahid et al., 2017). These findings suggest that neighborhood

characteristics (SES, crowding, employment etc.) may be associated with racial/ethnic differences in physical health outcomes such as cardiovascular health.

Less attention has been paid to the impact of neighborhoods on mental health specifically. However, existing research indicates that neighborhood characteristics are associated with symptoms of depression even when controlling for demographic factors (Ivey et al., 2015). For example, a study evaluating neighborhoods and mental health found that the presence of porches and stoops in a neighborhood was associated with lower levels of anxiety and depression and this relationship was mediated by perceived social support (Brown et al., 2009). The presence of other physical neighborhood characteristics, such as green space and parks may also positively affect mental health outcomes (Beyer et al., 2014). These findings suggest that the built environment may influence levels of perceived social support which in turn, impact mental health outcomes.

A study evaluating neighborhood characteristics and mental health outcomes found that that neighborhood residential mobility was associated with higher rates of major depression, schizophrenia, and substance abuse disorder in a community mental health survey (Silver, Mulvey, & Swanson, 2002). Researchers also found that major depression and substance abuse disorder were more prevalent among populations residing in disadvantaged neighborhoods (Silver, Mulvey, & Swanson, 2002). A limitation of this study is that it does not evaluate the impact of disadvantaged neighborhoods and residential mobility in more modest symptoms of mental illness such as depression and anxiety. While the symptoms of depression and anxiety may be very debilitating for some individuals, they may still not meet the

classification for a severe mental illness. By not exploring more common and less severe forms of mental illness, this study lacks insight into how residential mobility and disadvantaged neighborhoods may affect populations with more modest symptoms. However, these findings are helpful in our contributing to our understanding of the role of neighborhood characteristics and the impact on the mental health outcomes.

The strongest evidence to date on the impact of neighborhood conditions and health comes from a randomized trial. In 1994, a randomized control trial, the Moving to Opportunity for Fair Housing Demonstration (MTO) was started in five major U.S. cities (Leventhal & Brooks-Gunn, 2003). This study randomly moved some families from high-poverty neighborhoods to low-poverty or nonpoor neighborhoods, with some families remaining in public housing (Leventhal & Brooks-Gunn, 2003). Participants that moved from high-poverty neighborhoods to low-poverty neighborhoods had significantly less depressive and stress symptoms compared to the control group that remained in high-poverty neighborhoods (Leventhal & Brooks-Gunn, 2003). The primary reason that participants took part in this study was the desire to escape exposure to neighborhood gangs and drug activity (Leventhal & Brooks-Gunn, 2003). The findings from this study suggest that neighborhood conditions play a role in mental health outcomes with residing in high-poverty neighborhoods being a potential risk factor for stressors and depressive symptoms (Leventhal & Brooks-Gunn, 2003). These effects may be mitigated by moving families into lower-poverty neighborhoods.

Perceived Neighborhood Cohesion

The neighborhoods literature has paid less attention to the interpersonal networks that form the social dynamic of neighborhoods. Neighborhood cohesion is defined as the perceived level of inter-connection among neighbors, and a willingness to intervene for the common good (Kawachi, Subramanian, & Kim, 2008; Kim & Kawachi, 2017). This concept also revolves around a sense of belonging and attachment to a person's community. Social cohesion has also been described as a component of social capital which relates to, "...group membership that exists at psychological, individual, meso-, and macro-levels, including social relationships that are beneficial to individuals and communities" (Cain, Wallace, & Pone, 2018, pg. 18). Social cohesion is a mechanism of support that enables individuals to integrate healthy behaviors (Cain, Wallace, & Pone, 2018).

In a study assessing neighborhood cohesion and physical activity, researchers found that being older, non-Hispanic White, having a high level of education, and high socioeconomic status were associated with higher self-reported scores of neighborhood cohesion (Yi et al., 2016). This may be influenced by the fact that higher income neighborhoods usually have greater access to facilities like parks and green space which may promote socialization. In this study, neighborhood cohesion was measured by summing four variables measuring trust and dependability of neighborhoods. Residents that lived in the same neighborhood for over 20 years were also more likely to report higher scores measuring neighborhood cohesion (Yi et al., 2016). This result suggests that residents form stronger bonds over time and therefore

trust and depend on their neighbors more than those living in the neighborhood for less time.

Perceived neighborhood cohesion has been shown to play an important role in mental health outcomes, especially in depression and anxiety. For example, higher neighborhood social cohesion has been associated to fewer symptoms of depression in both cross-sectional and longitudinal studies (Sharifian, Spivey, Zaheed, & Zahodne, 2020). Also, there is evidence to support that the protective nature of neighborhood cohesion is stronger among adults aged 65 years and older (Elliot et al., 2014). Research suggests that this is because neighborhood attachment and belonging may aide an older person in developing an identity which in turn, promotes a greater sense of well-being (Elliot et al., 2014).

The racial composition of a neighborhood has implications for mental health outcomes. For example, a study analyzing racial identify beliefs among Black adults, found that neighborhood racial composition may moderate the relationship between racial identity beliefs and depression symptoms (Hurd et al., 2013). Researchers found that participants who lived in neighborhoods with less Blacks appeared to have benefited from believing that individuals of other races have lower public regard (less positive perception) for Blacks (Hurd et al., 2013). The researchers argue that Blacks living in predominately White neighborhoods may be more likely to experience and therefore prepare for interactions involving bias and discrimination (Hurd et al., 2013). Consequently, anticipating this type of treatment may impact psychological distress (Hurd et. al., 2013). These findings suggest neighborhood race/ethnicity composition influences indicators of mental health status such as psychological stress

and depressive symptoms. Additionally, they suggest differences in the neighborhood experiences based on an individual's race/ethnicity.

Race and Ethnicity

Health disparities are differences in health outcomes that negatively affect disadvantaged groups (Alvidrez et al., 2019). These differences may exist across various racial/ethnic groups, genders, socioeconomic classes, and geographic locations. Racial and ethnic disparities are persistent in the United States and have not changed significantly over time (Williams, Priest, & Anderson, 2016). Racial differences in health outcomes have been observed even after adjusting for socioeconomic status and education level (Williams, Priest, & Anderson, 2016). For example, low-birthweight infants and high infant death rates are more frequent among African American women compared to other racial/ethnic groups (Baciu et al., 2017). These differences cannot be explained by any biological or socioeconomic factors (Baciu et al., 2017).

Many researchers theorize that chronic stress associated with experiencing racism and discrimination is to blame for these stark differences in health outcomes (Baciu et al., 2017). More generally, social scientists conceptualize racism as a fundamental cause of health. The fundamental cause theory suggests that racial health disparities are not only explained by SES, but also by racism and the structural, economic, and social advantages that have enabled better health outcomes for Whites (Phelan & Link, 2015). More specifically, these advantages include the fact that Whites are disproportionately represented in government and commercial settings (Phelan & Link, 2015). Conscious and unconscious beliefs in white superiority

among these elites result in systemic racism and discrimination (Phelan & Link, 2015). Importantly, fundamental cause theory suggests that while the proximate causes of racial disparity might shift over time and across context, race remains a fundamental determinant of health because of the pervasive and consistent influence of racism.

The advantages afforded to Whites through systemic racism have allowed disparities by race to perpetuate despite interventions aimed at addressing SES related inequities (Phelan & Link, 2015). This is because race is independently associated with inequities in health outcomes and therefore, addressing SES alone is not effective in sustaining long-term solutions in racial health disparities (Phelan & Link, 2015). The researchers argue that racial disparities in health can only effectively be addressed by focusing on racism specifically as a primary cause of these differences in outcomes (Phelan & Link, 2015).

A clear example of racism shaping access to resources is housing. The United States has a history of discriminatory housing policies that have limited access to quality and affordable housing for racial and ethnic minorities. African Americans have been limited in wealth accumulation opportunities due to discriminatory lending policies and housing covenants that barred them from buying homes in predominantly white neighborhoods (Thomas, Moye, Henderson, and Horton, 2018). Redlining was introduced in the 1930s and discouraged mortgage lending to residents in neighborhoods of color (Krieger et al., 2020). While redlining was outlawed in the 1970s, the effects of these policies have significantly impacted subsequent generations and their ability to accumulate wealth (Pearcy, 2020; Woods, 2018).

Studies have indicated that banks still avoid lending for communities that were previously redlined (Percy, 2020). Also, African Americans are more likely to have higher risk and higher cost loans compared to Whites even when adjusting for credit scores and other loan eligibility factors (Burd-Sharps & Rasch, 2015).

The impact of discriminatory housing policies is evidenced by racial and ethnic differences in homeownership rates in the United States. According to the 2020 Census, homeownership rates remain highest among non-Hispanic Whites (75.8%), followed by Asian (61%), Hispanic (50.9%), and Black (46.4%) (US Census Bureau, 2020). The 2008 financial crisis compounded existing inequities in homeownership among racial and ethnic minorities. For example, Hispanic and African American families experienced greater mean wealth losses compared to non-Hispanic White families in the 2008 financial crisis with Hispanics experiences the greatest wealth losses (McKernan et al., 2014).

Such evidence suggests a plausible set of modifiable policy arrangements that explain why racial/ethnic minorities tend to have lower perceptions of neighborhood cohesion. In this project I will develop evidence on whether increasing investments in neighborhoods might have differential effects by race and therefore promote health equity.

Racial/Ethnic Disparities in Mental Health

Certain populations such as racial/ethnic minorities, women, children, older adults, refugees, and the incarcerated experience unique mental health burdens (Safran et al., 2009). However, diagnosed MDD (major depressive disorder) occurs

most frequently among non-Hispanic Whites (15.4%), followed by Asian Americans (7.6%), and Hispanics (7.0%) (Shao, Richie, & Bailey, 2015).

Scholars have suggested several explanations for the apparent paradox of the distribution in mental illness across race/ethnicity. Higher rates of diagnosed MDD among Whites is thought to reflect underdiagnosis among other racial groups. Underdiagnosis of MDD in racial and ethnic minority populations including differences in SES, health insurance coverage, differences in help-seeking behaviors for mental illness due to differing cultural norms and stigma, mistrust of the health system, racism, and access barriers related to cultural competence (Shao, Richie, & Bailey, 2015).

This perspective is supported by research that has observed differences in symptom presentation based on race/ethnicity. For example, a study evaluating anxiety symptoms by race/ethnicity found greater somatic symptoms of anxiety among Hispanic populations which was attributed to high levels of mental health stigma among Hispanics (Cabassa et al., 2008; Lewis-Fernandez et al., 2005). In another study evaluating MDD in African Americans and Whites, researchers found that while prevalence of MDD was highest among Whites, African Americans were more likely (56.5%) than Whites to report their symptoms as severe and disabling (Williams et al., 2007). This may suggest a higher burden of disease among African Americans and other racial and ethnic minorities despite higher frequency of reported mental illnesses in Whites (Williams et al., 2007). Thus, rates of diagnosed disorders might not reflect disparities in underlying disease prevalence.

Such patterns are consistent with a lack of access to affordable and quality mental health care. For example, racial and ethnic minority groups have less access to mental health resources compared to Whites, are less likely to receive necessary resources, and are more likely to have lower quality treatment for mental illness (McGuire & Miranda, 2008). Whites are more likely than racial and ethnic minorities to receive the best mental health treatments (McGuire & Miranda, 2008). These access and quality disparities are influenced by provider bias, discrimination, and assumptions about patient adherence to treatment (McGuire & Miranda, 2008). Therefore, it is imperative to conduct more research that evaluates associations between race/ethnicity and mental health outcomes to address inequities in mental health care. Many racial and ethnic health disparities are deeply rooted in discriminatory practices and institutionalized racism.

The effect of perceived neighborhood cohesion on mental health outcomes may vary across racial and ethnic groups. There are unique characteristics related to immigrant status, cultural attitudes and beliefs, and social networks that may influence this effect. Furthermore, Whites might be more able to compensate for a lack of cohesion than other groups by turning to broad-based societal resources that racial minorities are often excluded from. As a result, neighborhood cohesion being more protective against mental illness for some races given a lack of other compensating resources.

Homeownership Status

The final aim of this study will be to investigate if neighborhood cohesion explains the association between home ownership and mental health. Housing is recognized as a determinant of health and poor housing conditions have been associated with chronic disease, injury, and mental illness (Krieger & Higgins, 2002). Substandard housing conditions may be characterized by the presence of lead paint or water, mold, or pest infestations (Ortiz & Zimmerman, 2013). While these conditions may be present in homes occupied by renters or homeowners, these issues may be more difficult to fix in rental homes due to unresponsive landlords (Ortiz & Zimmerman, 2013). As a result, renters may be more likely than homeowners to suffer adverse health outcomes due to persistent housing hazards. Also, housing hazards may be a source of stress which can influence overall well-being and mental health (Finnegan, 2014). Homeownership has also been linked to greater investment in social and physical neighborhood factors resulting in benefits to schools, safety, and social cohesion (Mehdipanah et al., 2017).

Research suggests that homeownership is associated with better mental health outcomes (Finnigan, 2014). These studies suggest that owning a home promotes feelings of control, security, and autonomy which are linked to better mental health (Courtin, Dowd, & Avendano, 2018; Finnigan, 2014). Wealth accumulation is also an integral component of homeownership that plays an important role in health outcomes. Individuals with high income and socioeconomic status are more likely to have better mental health (Pollack et al., 2007). Wealthier persons may suffer less from stressors such as the experience of poverty and financial difficulties (Carter et

al., 2009). Homeownership is also linked to better quality housing compared to renters. As mentioned previously, higher quality of housing is associated with lower levels of psychological stress (Finnegan, 2014). Long-term stress is associated with a risk of mental illnesses and adverse effects including anxiety, depression, and substance use disorders (National Institute of Mental Health, n.d.).

Renting versus owning likely leads residents to assess the cohesion of the same neighborhood differently. A study evaluating neighborhood attachment found that homeowners are more likely to know their neighbors compared to renters (Oh, 2004; Ortiz et al., 2013). This research suggests that homeowners may be more likely to build relationships with their neighbors than renters. These relationships are likely conducive to social cohesion and increased trust among neighbors. Studies have indicated that homeowners are more likely to report satisfaction with their neighborhood, participate in community activities, and remain in their residences for longer (Grinstein-Weiss et al., 2011). Social engagement has been shown to be an indicator for neighborhood satisfaction (Grinstein-Weiss et al., 2011). Homeowners are also more likely to spend a longer amount of time in a neighborhood compared to renters. This time may allow for social bonding, civic engagement, and increased investment in the neighborhood (Ortiz et al., 2013).

Based on existing research, homeownership is a likely mechanism that significantly contributes to higher levels of perceived neighborhood cohesion compared to renters, which in turn, leads to better mental health outcomes. This is supported by research indicating that homeowners are more likely to stay in their neighborhoods for a longer amount of time and are more likely to know their

neighbors (Oh, 2004; Grinstein-Weiss et al., 2011). These characteristics contribute to higher levels of perceived neighborhood cohesion. For example, living in a neighborhood for a longer amount of time is associated with higher levels of social cohesion (Yi, 2016). Additionally, communities dominated by renters are more likely to experience frequent turnover and instability (Lee, 2014). As a result, renters may be less likely than homeowners to participate in social activities and interaction with their neighbors thereby reducing their level of perceived neighborhood cohesion and potentially increasing their risk for adverse mental health outcomes. Based on this explanation, neighborhood cohesion is a possible mechanism that explains the relationship between homeownership and mental health outcomes.

Chapter 3: Conceptual Model

The review above motivates the conceptual model described in Figure 1. The figure is also motivated by the NIH's health disparities framework which emphasizes that disparities arise from a dynamic multi-level, multi-domain process (Alvidrez, 2019).

Figure 1 suggests cohesion is associated with mental health symptoms (Aim 1) and that race/ethnicity moderates the strength of the association between perceived neighborhood cohesion and adult mental outcomes (Aim 2). Aim 3 explores the mediating effect of perceived neighborhood cohesion on the impact of homeownership status and mental health outcomes.

Cohesion, ownership, race/ethnicity, and mental health are also correlated with other variables that may confound the relationships of interest. Control variables for this study include age, gender, educational attainment, income level, and length of time spent in a neighborhood. Previous research suggests that these factors are predictive of mental health symptoms (Albert, 2015; Wang & Geng, 2019; World Health Organization, 2017; Yi et al., 2016).

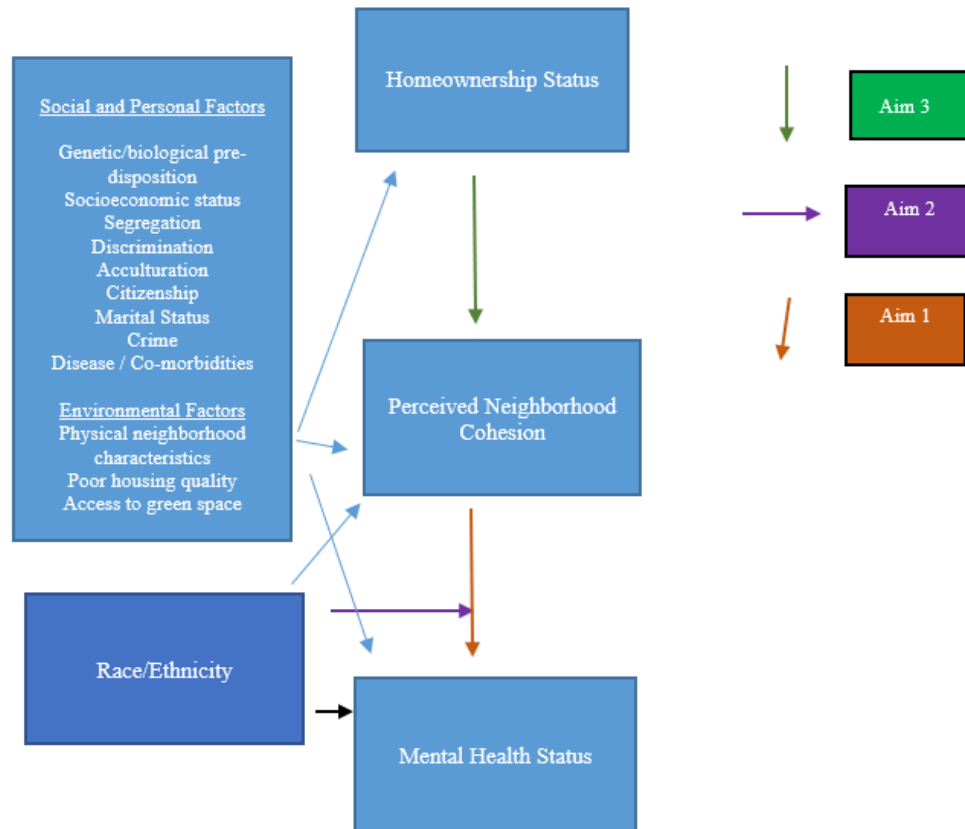
There are other important covariates that are not observed in this analysis. For example, the physical and social (i.e. crime) neighborhood characteristics. These characteristics may influence levels of perceived neighborhood cohesion and mental health outcomes. I did not observe the impact of variables such as the amount of segregation and discrimination in a neighborhood. I also did not observe rural and urban status. Individuals that live in cities may be more likely to rent their home or apartment compared to individuals living in more rural areas. Additionally,

individuals living in rural areas may be more physically isolated which may explain lower levels of perceived neighborhood cohesion. This research will not allow us to account for the impact of these variables on the primary variables of interest.

Reverse Causality

While my conceptual model suggests that cohesion *causes* mental health outcomes, it is likely that mental health determines neighborhood exposures. A fuller discussion of the limitations of my analysis are provided in the “Discussion” section.

Figure 1 – Conceptual Model



Chapter 4: Data and Methods

Summary of Aims

This study had 3 goals: 1. Describe the relationship between perceived neighborhood cohesion and mental health; 2. Determine if the association between perceived neighborhood cohesion and mental health varies by race/ethnicity; and 3. Investigate if perceived neighborhood cohesion mediates the observed association between home ownership and mental health outcomes.

IRB Review

This study was reviewed and determined exempt by the University of Maryland Institutional Review Board.

Data

This study is a secondary data analysis of the 2013-2017 National Health Interview Survey (NHIS). The NHIS is a cross-sectional survey that is coordinated by the National Center for Health Statistics (NCHS). The NHIS collects data annually from randomly selected households in the United States on health conditions, health care access, and health behaviors (Blewett, 2019).

Households included in the survey are representative of the civilian and non-institutionalized population (Blewett, 2019). Eligible households are identified by field listing operations through the decennial census and the U.S. population is divided into roughly 1,700 PSUs (Primary Sampling Units) defined by geography (Blewett, 2019). Clusters of addresses are sampled within each PSU and are stratified by demographic characteristics (Blewett, 2019).

NHIS interviews occur in-person and are led by trained interviewers who collect demographic and basic health information on all members of the household (NCHS, 2019). This is followed by additional questions from one adult and one child (if applicable) in the household (NCHS, 2019). Responses are entered by the interviewer into a computer while the interview is being conducted. The response rate for the NHIS is approximately 70% (NCHS, 2019).

Inclusion and Exclusion Criteria

Within each household, one adult is selected to receive an additional questionnaire – this respondent is referred to as the “sample adult”. Some sample adults received additional condition or symptom specific questions (referred to as the supplement sample). This project will focus on sample adults and the Adult Functioning and Disability supplement.

I used NHIS data disseminated by IPUMS, a harmonized version of the data (Blewett, 2019). Data for aim 3 excluded individuals under the age of 30.

Measures

Perceived Neighborhood Cohesion

The main variable of interest in this study was perceived neighborhood cohesion. Perceived neighborhood cohesion was measured by four survey questions that ask sample adult respondents about trust and dependability among neighbors. These questions were, 1. How much do you agree that this is a close-knit neighborhood?, 2. How much do you agree that there are people you can count on in this neighborhood?, 3. How much do you agree that people in this neighborhood can

be trusted?, and 4. How much do you agree that people in this neighborhood help each other out?

I combined these questions into an index of cohesion following Quinn et al (2019). Responses were combined into two categories for each of the four questions. The options of “definitely agree” and “somewhat agree” were combined to signal a high level of perceived neighborhood cohesion (coded to 1). The options of “somewhat disagree” and “definitely disagree” were combined to signal a low level of neighborhood cohesion (coded to 0). These four variables were then added together and each respondent’s total score (ranging from 4 – 16) was compared against a threshold to identify high vs low levels of perceived neighborhood cohesion (Quinn et al., 2019). The threshold was the median score with scores above the median signaling the presence of neighborhood cohesion and scores below the median signaling no/low perceived neighborhood cohesion.

The dichotomized perceived neighborhood cohesion variable was the main independent variable of interest in Aims 1 and 2 and as a mediator in Aim 3.

Mental Health Status

The outcome of interest was mental health symptoms (see Table 2A in the Appendix below for survey questions and responses assessing mental health status). I assessed three separate mental health symptom measures.

The first mental health variable was derived from the Kessler scale (K-6 scale) which consisted of six questions that were asked of all sample adults (Cohen & Zammitti, 2016). The questions asked about how often a person felt hopeless, restless, sad, worthless, that everything was an effort, and that their feelings interfered with

their life in the last 30 days. Responses were recoded to combine the response options into three categories ranging from 1 to 3. The responses of “none of the time” and “a little of the time” will were coded into one level. “Some of the time” were recoded to another level and the responses of “most of the time” and “all of the time” were recoded to a separate level. This recoding was done for each of the six questions. The six variables were summed to create an overall K-6 score. Scores greater than or equal to 13 indicated the presence of severe mental illness and a score less than 13 indicated that the respondent is not severely mentally ill (Prochaska, 2012). Analyses using the K-6 were conducted for all sample adults.

Since the K-6 is designed to identify serious psychological distress, two additional questions were utilized to assess more moderate symptoms of depression and anxiety. These questions asked how often a person feels worried, nervous, or anxious. The depression question asked how often a person feels depressed. For the depression and anxiety questions (1 question each), response options of “daily”, “weekly”, and “monthly” were recoded to one level signifying frequent symptoms of anxiety/depression. The response options of “a few times a year” and “never” were recoded to one level signifying rare or no symptoms of anxiety/depression. Each variable was coded as a 0/1 indicator.

During the study period, the depression and anxiety variables were drawn from the Adult Functioning and Disability supplement (fielded to 1 in 4 sample adults) (Blewett et al., 2019). Analyses utilizing the depression and anxiety variables were limited to the universe of adults that received the pertinent questions.

Race/Ethnicity

Race is the moderator that was explored in Aim 2. Self-reported race and ethnicity were recoded into four categories including non-Hispanic White, non-Hispanic Black, non-Hispanic other or multiple races, and Hispanic. These categories were derived from a two question (on race and Hispanic origin), OMB consistent format that allows multiple responses.

Homeownership Status

Homeownership was the independent variable for aim 3. Homeownership was recoded into two categories including owned/being bought and rented. Aim 3 analyzed the impact of homeownership on mental health outcomes and how this relationship was mediated by perceived neighborhood cohesion. Adults under 30 years of age were omitted from the sample for aim 3 due to the lack of individuals under 30 that own a home (U.S. Census Bureau, 2020).

Control Variables

The control variables included age, gender, socioeconomic status, the length of time spent in a neighborhood. These variables are potential confounders.

Age was recoded into three categories. The age categories are 18-44, 45-64, and 65 and up. For aim 3, age categories were 30 – 44, 45 – 64, and 65 and up. Gender was defined by male and female. Educational attainment and income level were used to assess socioeconomic status. Educational attainment was recoded into four levels consisting of less than high school, high school, some college, and college and above. Income will be measured using the federal poverty level with classifications including <100%, 100 – 399%, and 400% and up. The length of time

spent in a neighborhood was recoded into five categories including, less than 1 year, 1-3 years, 4-10 years, 11-20 years, and more than 20 years.

Other control variables in this research include marital status, sexual orientation, household size, employment status, health insurance status, type of living quarters, language of the interview, geographic region, the number of years spent in the U.S., citizenship, history of cancer, history of diabetes, history of heart disease/condition, history of hypertension, and self-reported health status.

Marital status was classified by not married and married. Sexual orientation was classified by straight and not straight. Household size was coded into four categories. The categories include a size of 1, 2-3, 4-5, and 6 and above. Employment status was categorized by two categories – not employed and employed. Health insurance status was coded into three categories. These categories include uninsured, public insurance, and private insurance. The type of living quarters was controlled for. These categories are not house (or apt, flat, condo) and house (apt, flat, condo). The language of the interview was classified by not English and English. Geographic region was coded into four categories including the northeast, north central/midwest, the south, and the west. The number of years in the U.S. and citizenship variables was combined to result in three categories. The first category was not a U.S. citizen and residing in the U.S. for less than five years. The second category was not a U.S. citizen and residing the U.S. for more than five years. The third category was U.S. citizens. This research controlled for a medical history of four separate chronic conditions including cancer, diabetes, heart disease/condition, and hypertension. Each disease has a category for yes (having a history of the disease) and no (not having a

history of the disease). Self-reported health status was classified by two categories – poor/fair health status and good, very good, and excellent health status.

Data Analysis

In aims 1 and 2 I used multiple logistic regression. Log odds coefficients were transformed into risk differences for ease of interpretation. Aim 3 used linear regression for ease of interpretation. Each regression for aims 1 and 2 was weighted and standard error was calculated using Taylor Series with Stata version 16. My approach to statistical inference in Aim 3 is discussed below. Statistical significance was determined by p-values less than 0.05. Details for each aim are provided below.

Aims 1 & 2

Multiple logistic regression was used to estimate the association of perceived neighborhood cohesion and mental health status and how this association varied by race/ethnicity. For Aim 1, each dichotomous outcome (serious psychological distress, anxiety symptoms, depression symptoms) were regressed on the cohesion variable (as described above), race/ethnicity, home ownership and the set of covariates described in the previous section. Coefficients are presented as risk differences.

In sensitivity analyses I explored if I came to different conclusions using different measures of cohesion. For example, if I used the total score as a continuous variable or if I included score variables for each of the cohesion variables. This allowed me to observe possible variation based on how the variable was coded.

In Aim 2, I modified the regression described above by interacting race/ethnicity and the dichotomous cohesion variable. The coefficients on this

interaction term measured how different the association between cohesion and the outcomes is for each racial/ethnic group compared to the reference. By transforming log odds coefficients into adjusted risk differences, I overcome the known problems with interactions in logit models (Norton & Dowd, 2018).

Aim 3

Aim 3 was based on a mediation analysis using a multiple regression framework. The mediation analysis method came from Vanderweele & Vansteelandt (2009) and is an extension of the Baron and Kenney (1986) approach which allows for interaction of the independent variable and mediator. It was implemented with Stata's *paramed* package. Models included the same set of covariates as described above. Results for each mental health outcome (serious psychological distress, anxiety, and depression symptoms) were assessed separately.

Intuitively, the method first established if the independent variable of interest (home ownership) had an association with the mediator (cohesion). This association is assumed to reflect the causal effect of the independent variable on the mediator after conditioning on covariates.

Second, the method then measured different pathways connecting the independent variable (home ownership) to the outcome (mental health). The *direct effect* measured the effect of the independent variable controlling for the mediator (thus blocking the mediator's effect on the outcome). The *indirect effect* measured the effect of the independent variable on the outcome via the mediating variable. This pathway was measured as the association of the independent variable of interest and the mediator (see the first step above) multiplied by the association between the

mediator and the outcome, controlling for the independent variable and other covariates (Valeri and VanderWeele 2013). Finally, the *total effect* represented the total association across all pathways and was measured in a regression of the outcome on the independent variable and covariates (and not including the mediator). Linear regression was used to in aim 3 for ease of interpretation of the results. However, in sensitivity analyses I confirmed similar results using a logit model and a log-linear model.

Aim 3 utilized a mediation analysis that did not account for the complex sample design of the NHIS. However, a bootstrap was used to estimate standard errors and p-values for the direct, indirect, and total effect estimates.

Chapter 5: Results

Descriptive Statistics – Neighborhood Cohesion and Mental Health

Table 1 shows that people living in cohesive neighborhoods are more likely to be non-Hispanic White, older, married, have higher education, higher income, not employed, have health insurance, own their home, have their survey interview in English, live in a midwestern or southern US region, a US citizen, and live in the neighborhood for 11-20 plus years. For example, in cohesive neighborhoods, 73.96% were Non-Hispanic White compared to 56.75% in non-cohesive neighborhoods. Racial and ethnic minorities were more likely to live in non-cohesive neighborhoods.

People living in cohesive neighborhoods are also more likely to have a history of cancer, have a history of a heart condition, have a history of hypertension, have no history of diabetes, report better health.

Table 1. Characteristics of U.S. Adults Classified by Perceived Neighborhood Cohesion, 2013 – 2017, NHIS

Variables	Total		Neighborhood Cohesion - No		Neighborhood Cohesion - Yes		P - Value
	% or Mean	S.E.	% or Mean	S.E.	% or Mean	S.E.	
Cohesive Score	12.43	0.02	9.79	0.02	14.94	0.01	<.01
Race /Ethnicity							<.01
Non-Hispanic White	65.56	0.43	56.75	0.54	73.96	0.45	
Non-Hispanic Black	11.24	0.24	14.43	0.34	8.20	0.26	
Non-Hispanic other or multiple race	7.70	0.19	8.58	0.25	6.86	0.22	
Hispanic	15.50	0.35	20.24	0.45	10.97	0.34	
Age							<.01
18-29	20.88	0.26	25.36	0.37	16.60	0.32	
30-44	25.38	0.23	27.26	0.33	23.59	0.32	
45-64	34.25	0.26	32.61	0.34	35.82	0.36	
65 and up	19.48	0.22	14.76	0.24	23.99	0.31	
Sex							0.07
Male	48.42	0.24	48.86	0.36	48.00	0.33	
Female	51.58	0.24	51.54	0.36	52.00	0.33	
Sexual Orientation							<.01
Not straight	3.42	0.09	3.89	0.14	2.97	0.13	
Straight	96.58	0.09	96.11	0.14	97.03	0.13	
Legal Marital Status							<.01
Not married	46.48	0.29	52.76	0.39	40.48	0.37	
Married	53.52	0.29	47.24	0.39	59.52	0.37	
Education Level							<.01
Less than high school	11.59	0.32	12.85	0.44	10.17	0.39	
High school	10.87	0.27	12.15	0.38	9.44	0.35	
Some college	68.84	0.43	65.24	0.58	72.87	0.58	
College and higher	8.70	0.24	9.76	0.36	7.52	0.31	
Poverty Level							<.01
<100	12.52	0.20	16.11	0.28	9.10	0.23	
100 - 399	47.60	0.31	51.08	0.41	44.27	0.40	
400 and up	39.88	0.37	32.81	0.45	46.63	0.44	

Household Size					<.01	
1	17.72	0.21	18.43	0.27	17.03	0.25
2 -3	52.25	0.27	50.65	0.37	53.77	0.37
4-5	24.57	0.27	24.74	0.35	24.40	0.36
6+	5.47	0.14	6.19	0.21	4.79	0.20
Employment						<.01
Not employed / not working	38.61	0.28	37.33	0.37	39.84	0.37
Employed / working	61.39	0.28	62.67	0.37	60.16	0.37
Health Insurance						<.01
Uninsured	25.33	0.27	27.56	0.36	23.22	0.33
Public	12.09	0.20	15.42	0.30	8.92	0.22
Private	62.58	0.33	57.02	0.43	67.86	0.38
Homeownership						<.01
Owned	66.48	0.35	56.00	0.46	76.48	0.37
Rented or other arrangement	33.52	0.35	44.00	0.46	23.52	0.37
Type of Living Quarters						<.01
Not house, apt, flat, condo	5.19	0.19	5.13	0.23	5.24	0.23
House, apt, flat, condo	94.81	0.19	94.87	0.23	94.76	0.23
Language of Interview						<.01
Not English	6.11	0.22	8.50	0.30	3.85	0.20
English	93.88	0.22	91.50	0.30	96.16	0.20
Geographic Region						<.01
Northeast	17.86	0.39	18.44	0.49	17.30	0.45
North Central/Midwest	22.44	0.38	20.58	0.45	24.20	0.49
South	36.62	0.54	36.20	0.62	37.01	0.63
West	23.09	0.48	24.77	0.59	21.48	0.52
Number of Years in U.S. / Citizenship						<.01
Not citizen, < 5 years	1.52	0.07	2.08	0.12	0.99	0.07
Not citizen, > 5 years	6.41	0.15	8.41	0.23	4.50	0.17
Citizen	92.08	0.17	89.52	0.26	94.51	0.18
Length of Time Spent in Neighborhood						<.01
0 - 3 years	32.21	0.32	38.26	0.42	26.43	0.36
4 -10 years	25.68	0.23	26.51	0.32	24.89	0.32
11 -20 years	20.07	0.22	18.01	0.30	22.03	0.31
More than 20 years	22.04	0.27	17.21	0.31	26.65	0.37

Cancer History					<.01	
No	90.99	0.15	92.54	0.19	89.51	0.21
Yes	9.00	0.15	7.46	0.19	10.49	0.21
Diabetes History					<.01	
No	88.59	0.15	88.08	0.22	89.08	0.20
Yes	11.41	0.15	11.92	0.22	10.92	0.20
Heart Condition/Disease					<.01	
No	92.33	0.14	92.89	0.18	91.80	0.19
Yes	7.67	0.14	7.11	0.18	8.20	0.19
Hypertension History					<.01	
No	68.86	0.25	70.39	0.34	67.40	0.33
Yes	31.14	0.25	29.61	0.34	32.60	0.33
Health Status					<.01	
Poor/Fair	12.70	0.17	14.93	0.25	10.56	0.21
Good / Very Good / Excellent	87.30	0.17	85.07	0.25	89.44	0.21
Mental Health - SPD					<.01	
SPD not present (score < 13)	96.42	0.10	95.20	0.16	97.58	0.12
SPD present (score >=13)	3.58	0.10	4.80	0.16	2.42	0.12
Mental Health - Anxiety					<.01	
Rare or never feel anxious	71.79	0.29	68.79	0.38	74.65	0.36
Frequent feelings of anxiety	28.21	0.29	31.21	0.38	25.35	0.36
Mental Health - Depression					<.01	
Rare or never feel depressed	85.93	0.19	82.90	0.29	88.80	0.23
Frequently feel depressed	14.07	0.19	17.10	0.29	11.20	0.23
Sample Size	75,966		36,935		39,031	

Source: National Health Interview Survey (NHIS), 2013-2017

Notes: Self-reported race (post-1997 OMB standards)

Standard error (SE) is calculated using Taylor Series with Stata version 16

SPD - Serious Psychological Distress

Risk Differences in Mental Health in Cohesive vs. Non-Cohesive Neighborhoods

Table 2 below shows that cohesive neighborhoods have a protective effect across each mental health variable considered – serious psychological distress, anxiety, and depression symptoms. On an unadjusted basis, people in cohesive neighborhoods have a reduced risk of 2.40 percentage points (P<.01) for having serious psychological distress as measured by the K-6 scale. This represents a 50% reduction compared to the unadjusted prevalence in non-cohesive neighborhoods.

Adjusting for covariates attenuates the results, but still suggests statistically significant associations. People in cohesive neighborhoods have a reduced risk of 1.30 (adjusted) percentage points ($P < 0.01$) for having psychological distress as measured by the K-6 scale. This represents a 27% reduction compared to the unadjusted prevalence in non-cohesive neighborhoods. People in cohesive neighborhoods have an adjusted risk reduction of 4.10 percentage points ($P < 0.01$) for reporting frequent anxiety symptoms (a 13% reduction versus non-cohesive neighborhoods) and a reduction of 3.80 percentage points ($P < 0.01$) for reporting frequent depression symptoms (a 22% reduction).

Table 2. Risk Differences in Mental Health in Neighborhoods Classified by Cohesion, NHIS, 2013 -2017

Dependent Variables	Unadjusted			Adjusted		
	Risk Difference	SE	P-Value	Risk Difference	SE	P-Value
K-6 Scale (Severe Psychological Distress)	-2.40	0.18	<.01	-1.30	0.18	<.01
Prevalence in Non-Cohesive Neighborhoods	4.80			4.80		
Sample Size	75,005			75,005		
Anxiety	-5.87	0.47	<.01	-4.10	0.46	<.01
Prevalence in Non-Cohesive Neighborhoods	31.21			31.21		
Sample Size	74,192			74,192		
Depression	-5.90	0.35	<.01	-3.80	0.35	<.01
Prevalence in Non-Cohesive Neighborhoods	17.10			17.10		
Sample Size	74,129			74,129		

Source: National Health Interview Survey (NHIS), 2013-2017 person files

Notes: All estimates are recorded as percentage points

RD - Risk Difference

Standard error (SE) is calculated using Taylor Series with Stata version 16

The adjusted model controls for age, sex, sexual orientation, marital status, education level, poverty threshold, household size, employment status, health insurance, homeownership, type of living quarters, language of interview, region, citizenship, time spent in neighborhood, cancer history, diabetes history, heart condition history, hypertension history, and self-reported health status.

Association of Neighborhood Cohesion and Mental Health

Table 3 (please see 5A in appendix) shows the association of neighborhood cohesion and mental health. The control variables have the expected magnitude and significance level based on existing literature (Shao, Richie, & Bailey, 2016; Yi et al., 2016). Non-Hispanic Whites report mental illness at higher rates compared to other racial and ethnic groups. Similarly, people that are older, married, straight, have higher income, are employed, live in a home (or apt), reside in their neighborhood for more than 20 years, report positive health status, and are at a statistically significant reduced risk of having mental illness as measured by the three outcomes (serious psychological distress, anxiety, and depression symptoms).

Sensitivity Analysis of Cohesion Measure

Table 4 presents a sensitivity analysis that examines how robust my results are to measuring cohesion as above or below the median cohesion score. I came to similar results using a continuous index or using quartiles. For example, using a continuous measure suggests that a one-point increase in the cohesion score is associated with a .28 percentage point decline in psychological distress. Similar effects were observed with anxiety and depression using a continuous measure. These results suggested that marginal increases in cohesion were associated with increased protectiveness. I preferred the main median threshold measure because of its ease of interpretation.

Table 4. Sensitivity Analysis of Cohesion Measure

	SPD			Anxiety			Depression		
	RD	SE	P-Value	RD	SE	P-Value	RD	SE	P-Value
Continuous Index	-0.28	0.03	<.01	-0.91	0.07	<.01	-0.74	0.05	<.01
Quartiles									
Q1 (Least Cohesive)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Q2	-1.98	0.25	<.01	-3.60	0.63	<.01	-3.62	0.50	<.01
Q3	-2.19	0.27	<.01	-3.55	0.67	<.01	-4.47	0.52	<.01
Q4 (Most Cohesive)	-2.35	0.26	<.01	-9.33	0.64	<.01	-7.25	0.51	<.01

Source: National Health Interview Survey (NHIS), 2013-2017 person files

Note: Standard error (SE) is calculated using Taylor Series with Stata version 16

RD – Risk Difference

SPD - Serious Psychological Distress

The adjusted model controls for age, sex, sexual orientation, marital status, education level, poverty threshold, household size, employment status, health insurance, homeownership, type of living quarters, language of interview, region, citizenship, time spent in neighborhood, cancer history, diabetes history, heart condition history, hypertension history, and self-reported health status.

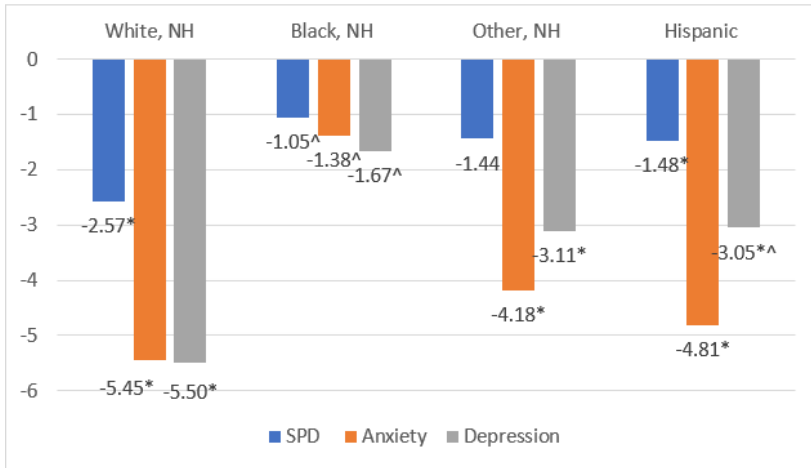
Risk Differences in Mental Illness by Race/Ethnicity

Moderation by Race/Ethnicity

Figure 2 shows adjusted risk-differences for each mental health outcome, stratified by race/ethnicity. Statistically significant effects within a racial/ethnic group are denoted with an asterisk (*). Differences in cohesive effect for racial/ethnic groups when compared to the association among non-Hispanic Whites, are denoted with a caret (^). Among the racial/ethnic groups, cohesion had a protective effect, but results were not statistically significant for non-Hispanic Blacks. The difference in the association of neighborhood cohesion and mental health outcomes was statistically significant ($p < .01$) for non-Hispanic Blacks when compared to non-Hispanic Whites (-1.05 for SPD, -1.38 for anxiety, and -1.67 for depression). The difference in the

association of neighborhood cohesion and depression was statistically significant ($p < .01$) for Hispanic when compared to non-Hispanic Whites.

Figure 2. Risk Differences in Mental Illness by Race/Ethnicity, NHIS, 2013-2017



Source: National Health Interview Survey (NHIS), 2013-2017 person files

Notes:

NH – Non-Hispanic

SPD – serious psychological distress

*Indicates a statistically significant result for a given race/ethnic group

^Indicates a statistically significant difference for a given racial/ethnic group compared to non-Hispanic White

Descriptive Statistics – US Adults Classified by Homeownership

Table 5 below displays descriptive statistics of adults classified by homeownership status. Most homeowners were White (78.85%), followed by other/multiple race (63.71%), Hispanic (52.35%), and Black (51.05%). Among renters, the majority were Black (48.95%), Hispanic (47.65%), other/multiple race (36.29%), and White (21.15%). 81.24% of homeowners were ages 65 and over compared to just 18.76% of renters being in this age group. Homeowners were more likely to be married (80.25%) compared to 19.75% of married renters. Homeowners were also more likely to higher income. Homeowners accounted for 85.28% of those

in the 400% of the federal poverty level. Renters accounted for 14.72% of the same category (400% and up). Homeowners were more likely to report their health status as good, very good, or excellent at 72.76% compared to 27.24% of renters reporting their health status as good, very good, or excellent. Homeowners were more likely to report a larger household size with homeowners accounting for 63.80% of households consisting of six members or more compared to 36.20% of renters in this category. Homeowners were also more likely to have resided in the neighborhood for longer periods of time compared to renters. For example, renters were more likely to have only lived in their neighborhood for 0-3 years (56.80%) compared to 43.20% of homeowners. Conversely, homeowners were more likely to live in their neighborhood for greater than 20 years compared to renters (70.94% and 8.63% respectively).

Table 5. Characteristics of US Adults Aged 30 and Above Classified by Homeownership, 2013-2017, NHIS

Variables	Rent	Own	P-Value
Race			<.01
White	21.15	78.85	
Black	48.95	51.05	
Other	36.29	63.71	
Hispanic	47.65	52.35	
Age			<.01
30-44	42.27	57.73	
45-64	25.27	74.73	
65 and up	18.76	81.24	
Region			<.01
Northeast	30.77	69.23	
North Central/Midwest	24.36	75.64	
South	27.67	72.33	
West	34.99	65.01	
Marital Status			<.01
Not married	44.05	55.95	
Married	19.75	80.25	
Poverty Level			<.01
<100	65.50	34.50	
100-399	34.21	65.79	
400 and up	14.72	85.28	
Health Status			<.01
Poor/Fair	40.03	59.97	
Good/Very Good/Excellent	27.24	72.76	
Household Size			<.01
1	43.91	56.09	
2 -3	23.57	76.43	
4-5	28.26	71.74	
6+	36.20	63.80	

Type of Living Quarters			0.83
Not house, apt, flat, condo	28.86	71.14	
House, apt, flat, condo	29.17	70.83	
Number of Years in U.S. / Citizenship			<.01
Not citizen, < 5 years	79.46	20.54	
Not citizen, > 5 years	57.07	42.93	
Citizen	26.44	73.56	
Length of Time Spent in Neighborhood			<.01
0-3 years	56.80	43.20	
4-10 years	31.90	68.10	
11-20 years	14.16	85.84	
>20 years	8.63	70.94	

Source: National Health Interview Survey (NHIS), 2013-2017 person files

Notes: Self-reported race (post-1997 OMB standards)

Standard error (SE) is calculated using Taylor Series with Stata version 16

Adjusted Risk Differences of Mental Health Based on Outcome and Mediator

Regressions

Table 6 below displays the adjusted risk differences of mental health outcomes based on outcome and mediator regressions. The risk of severe psychological distress was reduced by approximately 1.19 percentage points [95% CI (-.015, -.009)] if you own your home compared to renting your home when controlling for level of neighborhood cohesion. The risk of anxiety and depression was reduced by 2.12 [95% CI (-.03, -.01)] and 2.31 [95% CI (-.03, -.02)] percentage points respectively for those that own their home vs. rent their home when controlling for neighborhood cohesion. Similar findings were observed for mental health outcomes based on level of cohesion.

The mediator regression measures the association between ownership status and cohesion. Results suggest that owning your home is associated with a 10.82 percentage point increase in living in a cohesive neighborhood [95% CI (.10, .12)].

Table 6. Risk Differences of Mental Health Based on Outcome and Mediator Regressions

Outcome Regression	SPD		Anxiety		Depression	
	ARD	95% CI	ARD	95% CI	ARD	95% CI
Own vs Rent	-1.19	(-.02) - (-.01)	-2.12	(-.03) - (-.01)	-2.31	(-.03) - (-.02)
Cohesive vs Not	-1.10	(-.01) - (-.01)	-4.11	(-.05) - (-.03)	-3.87	(-.04) - (-.03)
Mediator Regression	ARD	95% CI	ARD	95% CI	ARD	95% CI
Own vs Rent	10.82	(.10) - (.12)	10.82	(.10) - (.12)	12.29	(.12) - (.13)

Source: National Health Interview Survey (NHIS), 2013-2017 person files, adults ages 30 and above

Notes: Standard error (SE) is calculated using Taylor Series with Stata version 16
This model controls for race, age, region, marital status, poverty level, health status, household size, type of living quarters, citizenship, and time in neighborhood

SPD - serious psychological distress

ARD - Adjusted Risk Difference

CI - Confidence Interval

Risk Differences of Mental Health Based on Neighborhood Cohesion as a Mediator

Table 7 displays the risk differences of mental health outcomes based on neighborhood cohesion as a mediator. The results indicate that if homeowners had the same level of cohesion as renters (the direct effect), homeowners would have a 1.19 percentage point decreased risk of severe psychological distress compared to renters. Similar findings were observed for anxiety and depression outcomes. For anxiety, if homeowners had the same level of cohesion as renters, homeowners would have a 2.12 percentage point decrease in self-reported anxiety symptoms. For depression, if homeowners had the same level of cohesion as renters, homeowners would have a

2.31 percentage point decrease in self-reported depression symptoms. All findings were statistically significant.

The indirect effect shows the impact of homeownership on mental health outcomes via neighborhood cohesion. The risk differences come from comparing outcomes when cohesion changes from the value it has for homeowners to the value it has for renters. The reduction of risk for serious psychological distress among homeowners compared to renters was .12 percentage points, .45 percentage points for anxiety, and .42 percentage points for depression.

The proportion of mediation indicates the percentage of the ownership-cohesion relationship that is explained by the cohesion pathway and is defined as the indirect effect/total effect. Approximately, 9.11% of the relationship between homeownership and severe psychological distress was mediated by neighborhood cohesion. About 17.39% of the relationship between homeownership and anxiety was mediated by neighborhood cohesion. For depression, roughly 15.36% of the relationship between homeownership and depressive symptoms was mediated by neighborhood cohesion.

Table 7. Risk Differences of Mental Health Based on Neighborhood Cohesion as a Mediator

	SPD		Anxiety		Depression	
	ARD	95% CI	ARD	95% CI	ARD	95% CI
Direct Effect	-1.19	(-2) - (-1)	-2.12	(-3) - (-1)	-2.31	(-3) - (-1)
Indirect Effect	-0.12	(-.2) - (-.01)	-0.45	(-.5) - (-.4)	-0.42	(-1) - (-.3)
Total Effect	-1.31	(-2) - (-1)	-2.56	(-3) - (-2)	-2.73	(-3) - (-2)
Proportion of Mediation	9.11		17.39		15.36	

Source: National Health Interview Survey (NHIS), 2013-2017 person files, adults ages 30 and above

Notes: Standard error (SE) is calculated using Taylor Series with Stata version 16

This model controls for race, age, geographic region, marital status, poverty level, health status, household size,

type of living quarters, citizenship, and length of time spent in the neighborhood

SPD - serious psychological distress

ARD - Adjusted Risk

Difference

CI - Confidence Interval

Chapter 6: Discussion

The goal of this study was to evaluate the association between perceived neighborhood cohesion and mental health outcomes (serious psychological distress, anxiety, and depression) and how this association varies by race/ethnicity.

Additionally, this study evaluated perceived neighborhood cohesion as a potential mediator of the relationship between homeownership and mental health outcomes.

To my knowledge, this was the first study to evaluate perceived neighborhood cohesion, homeownership, and mental health using this specific measure of perceived neighborhood cohesion. This measure includes four questions asking respondents about trust and dependability of neighbors and is based on a large, nationally representative sample.

I considered three distinct mental health outcomes that represent a range of severity and prevalence. SPD occurs less frequently in the US with less than 4% of the population meeting the SPD classification (CDC, 2015). Conversely, approximately 19% of the population is diagnosed with anxiety each year and approximately 7% of US adults suffered at least one major depressive episode in the past year (National Institute of Mental Health, 2017). Furthermore, outcome measurement was based on symptoms and was not confounded by access limitations as diagnosis measures typically are.

The result of this study showed that people living in cohesive neighborhoods were less likely to have adverse mental health outcomes (serious psychological distress, anxiety, and depression). Cohesion reduced the risk of serious psychological

distress by 1.30 percentage points ($p < .01$), the risk of anxiety by 4.10 percentage points ($p < .01$), and depression by 3.80 ($p < .01$).

This association was observed for each racial/ethnic group. However, results suggesting a protective benefit of neighborhood cohesion against adverse mental health outcomes were only statistically significant for non-Hispanic Whites and Hispanics for all three mental health outcomes.

I also investigated if associations between ownership and mental health are explained by the cohesion of neighborhoods that owners versus renters live in. Results showed that perceived neighborhood cohesion mediates the relationship between homeownership and mental health outcomes.

My findings are consistent with existing data that suggests there is a relationship between social cohesion, neighborhood factors, and mental health outcomes (Ivey et al., 2015; Brown et al., 2009). Mental illnesses such as depression have been shown to be more prevalent in disadvantaged neighborhoods (Silver, Mulvey, & Swanson, 2002). Previous research also suggests that homeownership is associated with better mental health outcomes (Finnegan, 2014). Social cohesion and engagement have been cited as possible contributing factors to the mental health benefits associated with homeownership (Oh, 2004; Ortiz et al., 2013). Homeowners are also more likely to spend a longer time in their neighborhood which may enable increased social interaction and bonds with neighbors thereby increasing perceived neighborhood cohesion (Ortiz et al., 2013). My results contribute to this literature by documenting such associations in a large national sample using a unique measure of perceived neighborhood cohesion.

I hypothesized that the protectiveness of neighborhood cohesion against adverse mental health outcomes would be smaller for Non-Hispanic Whites compared to Non-Hispanic Blacks, other or multiple race, and Hispanics. However, my results suggested that Non-Hispanic Whites had the largest reduction in risk for adverse mental health outcomes compared to the other three racial/ethnic groups. Non-Hispanic Blacks had a statistically significant ($p < .01$) difference in the protective benefit of cohesion compared to Non-Hispanic Whites. This suggests that the protective benefit of cohesion is smaller for Non-Hispanic Blacks compared to Non-Hispanic Whites. These findings may suggest that discriminatory practices (ex. redlining, housing covenants, segregation) have had significant implications for minority populations. For example, research has indicated that being older, Non-Hispanic White, and of high socioeconomic status is associated with higher levels of neighborhood cohesion (Yi et al., 2016). Additionally, the lower rates of homeownership among racial/ethnic minorities have prevented generational wealth accumulation. Homeownership promotes wealth accumulation and individuals with higher income are more likely to have better health outcomes (Pollack et al., 2007).

Limitations

This study has several limitations. Individuals responding about mental health status may underreport symptoms of mental illness due to stigma ((Shao, Richie, & Bailey, 2015). Therefore, the prevalence of severe mental illness, anxiety symptoms, and depression symptoms may be higher than what is observed in this sample.

Also, this analysis relied on self-reported perceptions of neighborhood social cohesion and did not allow for the analysis of contextual neighborhood characteristics

that may directly contribute to mental health outcomes. These characteristics may include access to green space and parks, rural vs. urban settings, housing type, and housing quality. Additional omitted variables include the amount of segregation and discrimination in a neighborhood, level of acculturation, and number of chronic conditions.

This research did not allow me to establish the direction of causality. It is possible that mental health status determines levels of perceived neighborhood cohesion. For example, individuals with severe mental illness may not be able to work and consequently may be more likely to live in a type of neighborhood that they perceive as having lower levels of cohesion (Cutrona, Wallace, & Wesner, 2009). Individuals with adverse mental health outcomes may be less likely to perceive their neighborhood as cohesive due to increased anxiety and depressive symptoms compared to individuals that do not report these symptoms (Cutrona, Wallace, & Wesner, 2009). Similarly, positive mental health status may directly influence the perceived level of neighborhood cohesion. This research will not enable us to evaluate if mental health status determines the level of perceived neighborhood cohesion. However, regardless of the direction of causality these findings provide invaluable insight on the association between neighborhood cohesion, mental health outcomes, race/ethnicity, and homeownership. Such information is useful to practitioners and program designers. For example, primary health providers are increasingly screening for the “social determinants of health” (Andermann, 2018). My results, while not causal, did suggest that primary care providers should be aware of patient’s experience of their neighborhood.

The homeownership variable in this data defined homeownership to include individuals that owned their as well as individuals that owned a home being bought. There may be additional factors specific to individuals that are selling their home that may influence perceived neighborhood cohesion and mental health outcomes. It will be unclear how these factors contribute to any observed associations since they cannot be isolated from this variable.

Aim 3 required the use of bootstrapping which did not directly account for the complex sample design. This may have biased point estimates and statistical inference, but the direction of that bias remains unclear.

Public Health Significance

Mental illness is a public health issue that affects nearly 20% of Americans per year (National Institutes of Health, 2019). Mental illness can have significant impacts on an individual's ability to function and consequently is among one the top causes of disability in the U.S. (National Institutes of Health, 2007). Adverse mental health outcomes may be more frequent in populations that are disproportionately affected by adverse health status. These populations may include racial and ethnic minority populations, low-income populations, and individuals living in poor quality housing. An increased understanding of potential protective factors for adverse health outcomes is essential for the creation of tailored public health interventions. This research contributes to existing research linking perceived neighborhood cohesion and health outcomes. This research provides new insight on the association of neighborhood cohesion and three specific outcome of mental health – serious psychological distress, anxiety, and depression. Also, these findings shed light on the

extent to which perceived neighborhood cohesion mediates the relationship between homeownership and mental health outcomes.

Future public health research and programs should consider race/ethnicity as a factor in mental health outcomes and neighborhood characteristics. For example, this study suggests that racial/ethnic minorities were less likely to live in cohesive neighborhoods. Therefore, they are missing out on some of the protective benefit of neighborhood cohesion against adverse mental health outcomes. Additionally, this study and others have indicated the benefits of homeownership including better mental health and perceived sense of control (Courtin, Dowd, & Avendano, 2018). Homeownership enables wealth accumulation and individuals with higher income are more likely to have better health outcomes (Pollack et al., 2007). Considering that 78.85% of homeowners were Non-Hispanic White in this analysis, racial/ethnic minorities are not receiving as much of the benefits of homeownership. This finding was consistent with U.S. Census data which found that homeownership remains highest among Whites (75.8%) and lowest among Black (46.4%) (US Census Bureau, 2020).

Further research is needed to identify the ways that racism, discriminatory housing practices, and other factors have contributed to inequities in neighborhood cohesion and homeownership. Public health services should be focused on promoting neighborhood cohesion and homeownership as important mechanisms for improving mental health outcomes.

Appendices

Table 1A. Perceived Neighborhood Cohesion		
Variable	Question	Response Options
NBHDCLKT	How much do you agree or disagree with the following statements about your neighborhood? 1. How much do you agree that this is a close-knit neighborhood?	1. Definitely agree 2. Somewhat agree 3. Somewhat disagree 4. Refused 5. Don't know
NBHDCTON	How much do you agree that there are people you can count on in this neighborhood?	1. Definitely agree 2. Somewhat agree 3. Somewhat disagree 4. Refused 5. Don't know
BHDTRUST	How much do you agree that people in this neighborhood can be trusted?	1. Definitely agree 2. Somewhat agree 3. Somewhat disagree 4. Refused 5. Don't know
NBHDHELP	How much do you agree that people in this neighborhood help each other out?	1. Definitely agree 2. Somewhat agree 3. Somewhat disagree 4. Refused 5. Don't know

Table 2A. Mental Health Status Questions and Response Options (K-6, Anxiety, Depression)		
Variable	Question	Response Options
AEFFORT	During the past 30 days, how often did you feel that everything was an effort?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time
AHOPELESS	During the past 30 days, how often did you feel hopeless?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time
ANERVOUS	During the past 30 days, how often did you feel nervous?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time
ARESTLESS	During the past 30 days, how often did you feel restless or fidgety?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time
ASAD	During the past 30 days, how often did you feel so sad that nothing could cheer you up?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time
AWORTHLESS	During the past 30 days, how often did you feel worthless?	<ol style="list-style-type: none"> 1. All of the time 2. Most of the time 3. Some of the time 4. A little of the time 5. None of the time

WORFREQ	How often do you feel worried, nervous, or anxious? Would you say daily, weekly, monthly, a few times a year, or never?	1. Daily 2. Weekly 3. Monthly 4. A few times a year 5. Never
DEPFREQ	How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?	1. Daily 2. Weekly 3. Monthly 4. A few times a year 5. Never

Table 3A. Sample Size for the Functioning and Disability Supplement - Aims 1 & 2

	Total	Cohesion Level	
		High	Low
Total	75,966	39,031	36,935
Non-Hispanic White	49,412	28,734	20,678
Non-Hispanic Black	9,271	3,496	5,775
Non-Hispanic Other	6,025	2,737	3,288
Hispanic	11,258	4,064	7,194

Table 4A. Sample Size for the Functioning and Disability Supplement - Aim 3

	Total	Cohesion Level	
		High	Low
Total	62,934	33,922	29,012
Rented or other arrangement	20,229	7,899	12,330
Owned or being bought	42,705	26,023	16,682

Table 5A. Association of Neighborhood Cohesion and Mental Health, 2013-2017, NHIS

Variables	SPD			Anxiety Symptoms			Depressive Symptoms		
	R.D.	S.E.	P-Value	R.D.	S.E.	P-Value	R.D.	S.E.	P-Value
Cohesive Level									
Cohesive - No	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Cohesive - Yes	-1.30	0.18	<.01	-4.06	0.46	<.01	-3.77	0.35	<.01
Race/Ethnicity									
Non-Hispanic White	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Non-Hispanic Black	-1.74	0.20	<.01	14.78	0.61	<.01	-6.90	0.43	<.01
Non-Hispanic other or multiple	0.17	0.43	0.69	-8.87	0.79	<.01	-4.72	0.65	<.01
Hispanic	-0.41	0.30	0.17	-7.43	0.75	<.01	-4.12	0.53	<.01
Age									
18-29	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
30-44	0.41	0.39	0.29	-1.31	0.75	0.08	1.78	0.59	<.01
45-64	-0.03	0.39	0.94	-6.86	0.82	<.01	0.44	0.60	0.46
65 and up	-2.80	0.38	<.01	19.03	0.92	<.01	-7.13	0.60	<.01
Sex									
Male	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Female	0.75	0.18	<.01	8.64	0.43	<.01	3.85	0.33	<.01
Sexual Orientation									
Not straight	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Straight	-3.21	0.60	<.01	13.20	1.26	<.01	-9.31	1.01	<.01
Legal Marital Status									
Not married	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Married	-1.18	0.23	<.01	-3.35	0.60	<.01	-4.24	0.44	<.01
Education Level									
Less than high school	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
High school	-0.70	0.28	0.01	-1.07	0.78	0.17	-0.66	0.56	0.24
More than high school	-0.99	0.30	<.01	1.65	0.70	0.02	-0.57	0.54	0.29

Poverty Level									
<100	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
100 - 399	-0.74	0.25	0.00	-3.44	0.79	0.00	-1.92	0.54	0.00
400 and up	-1.99	0.33	<.01	-4.05	0.94	<.01	-4.27	0.68	<.01
Household Size									
1	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
2 -3	0.57	0.19	<.01	0.69	0.58	0.23	0.21	0.42	0.61
4-5	0.41	0.31	0.19	0.98	0.80	0.22	-0.54	0.59	0.37
6+	0.55	0.49	0.26	0.34	1.47	0.82	-0.30	1.00	0.77
Employment Status									
Not employed / not working	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Employed / working	-1.90	0.23	<.01	-3.15	0.58	<.01	-4.71	0.46	<.01
Health Insurance									
Uninsured	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Public	0.07	0.29	0.82	0.49	0.83	0.56	0.50	0.58	0.39
Private	-1.35	0.23	<.01	-1.02	0.58	0.08	-2.81	0.41	<.01
Homeownership									
Owned	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Rented or other arrangement	0.54	0.23	0.02	2.80	0.65	<.01	1.73	0.47	<.01
Type of Living Quarters									
Not house, apt, flat, condo	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
House, apt, flat, condo	-0.43	0.31	0.17	-1.71	0.93	0.07	-1.05	0.68	0.12
Language of Interview									
Not English	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
English	0.42	0.36	0.24	7.81	1.25	<.01	2.02	0.86	0.02

Geographic Region									
Northeast	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
North									
Central/Midwest	0.74	0.33	0.03	1.00	0.86	0.25	0.67	0.60	0.26
South	0.49	0.29	0.09	-1.12	0.82	0.17	-0.22	0.59	0.71
West	0.50	0.30	0.10	2.99	0.92	<.01	1.35	0.65	0.04
Years in U.S./Citizenship									
Not citizen, < 5 years	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Not citizen, > 5 years	1.09	0.51	0.03	3.61	1.85	0.05	1.05	1.53	0.49
Citizen	2.15	0.42	<.01	8.05	1.70	<.01	3.54	1.35	<.01
Time in Neighborhood									
0 - 3 years	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
4 -10 years	-0.20	0.22	0.37	-0.79	0.62	0.20	-0.98	0.42	0.02
11 -20 years	0.25	0.31	0.43	-0.52	0.70	0.46	-0.26	0.57	0.65
More than 20 years	-0.03	0.33	0.93	-3.00	0.78	<.01	-1.01	0.57	0.08
Cancer History									
No	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Yes	0.26	0.28	0.35	2.70	0.83	<.01	0.93	0.59	0.11
Diabetes History									
No	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Yes	-0.22	0.23	0.33	-0.13	0.75	0.86	0.92	0.55	0.09
Heart Condition/Disease									
No	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Yes	1.30	0.31	<.01	5.17	0.86	<.01	2.96	0.58	<.01
Hypertension									
No	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Yes	1.34	0.22	<.01	4.69	0.58	<.01	2.85	0.43	<.01
Health Status									
Poor/Fair	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)	(REF)
Good/Very									
Good/Excellent	-6.60	0.45	<.01	20.56	0.80	<.01	16.10	0.71	<.01

Source: National Health Interview Survey (NHIS), 2013-2017 person files

Notes: Self-reported race (post-1997 OMB standards)

Standard error (SE) is calculated using Taylor Series with Stata version 16

RD - Risk difference

REF - Reference category (Non-Hispanic White)

SPD - Serious psychological distress

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