

# Nicole O. Mattocks, MSW

## EDUCATION

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University of Maryland, Baltimore September 2019  
Doctor of Philosophy in Social Work

University of Maryland, Baltimore May 2010  
Master of Social Work  
Concentration: Management and Community Organizing

University of North Carolina Wilmington May 2007  
Bachelor of Social Work

## RESEARCH EXPERIENCE

---

**University of Maryland, School of Social Work** June 2017 – August 2019  
Baltimore, MD

*Graduate Research Assistant: UMB-UMBC Research and Innovation Partnership Grant*

- Conduct advanced statistical analysis using Stata and Mplus to model causal pathways between the neighborhood environment and clinical outcomes
- Perform data management (merging, recoding, variable creation) for a multi-level, geocoded dataset
- Contribute to R01 development for NIH Research Grant by conducting bivariate and multivariate analyses
- Serve as primary data analyst on a collaborative, multidisciplinary research team
- Co-author manuscripts for publication in peer-reviewed journals

*Principal Investigators: Amanda Lehning, PhD & Christine Mair, PhD*

**University of Maryland, School of Social Work** June 2017 – August 2019  
Baltimore, MD

*Graduate Research Assistant – National Health and Aging Trends Study (NHATS)*

- Manage a restricted, secondary dataset from a nationally representative study of health and aging trends among older adults
- Conduct advanced statistical analysis using Stata to examine predictors of older adults' health and well-being outcomes over time
- Perform all responsibilities required to use and protect a restricted dataset
- Work collaboratively as part of a research team

*Principal Investigators:* Amanda Lehning, PhD; Richard Smith, PhD, Kyeongmo Kim, PhD

**University of Maryland, School of Social Work**

June 2016 – May 2019

Baltimore, MD

*Graduate Research Assistant – Environmental Social Work Practice: A Global Perspective*

- Traveled to Kochi, India to conduct needs assessment about environmental issues and environmental social work practice in Southern India
- Developed semi-structured interview guide for interviews with Indian social work faculty, students, and practitioners
- Visited environmentally-focused non-governmental organizations
- Information gathered was used to inform curriculum development for a pilot course on environmental social work practice for students in India and the U.S.
- Facilitated a 4-minute “Mat Chat” presentation to campus administrators regarding the experience

*Principal Investigators:* Caroline Burry, PhD & Carolyn Tyce, PhD

**University of Maryland, School of Social Work**

August 2014 – May 2017

Baltimore, MD

*Graduate Research Assistant – Target Neighborhood Initiative*

- Performed statistical analysis and data management (input, cleaning, merging, creating and recoding variables) with SPSS
- Conducted qualitative data analysis of in-depth interview and focus group transcripts, using NVivo.
- Employed Community-Based Participatory Research (CBPR) methods to develop survey, in collaboration with community and academic partners
- Used Qualtrics to develop online survey and extract results for data management
- Contributed to quarterly and annual reports for funders
- Supervised, trained, and supported MSW research scholars in data collection and entry procedures
- Co-facilitated presentations of research findings to funders and board members
- Co-authored manuscripts and conference presentations on place-based community-building strategies for local non-profits

*Principal Investigator:* Amy Cohen-Callow, PhD

**University of Maryland, School of Social Work**

August 2014 – May 2017

Baltimore, MD

*Graduate Research Assistant – Expanding the Bench in Performance Management*

- Participated in program development and evaluation for project training human service professionals of color in Results-Based Accountability and Performance Management
- Assisted with program promotion, recruitment, and general administration
- Developed and administered survey using Qualtrics online software
- Managed data and conducted all data analysis with SPSS

*Principal Investigator:* Karen Hopkins, PhD

**EMPLOYMENT HISTORY**

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**University of Maryland School of Social Work**

August 2014 – August 2019

Baltimore, MD

*Graduate Research Assistant*

- Primary data analyst on numerous collaborative, interdisciplinary research teams
- Conduct advanced statistical analysis using Stata, SPSS, and MPlus
- Manage data (e.g. input, clean, merge, recode) for multiple research projects, including large, secondary nationally representative datasets
- Conduct qualitative data analysis using NVivo software
- Design and carry out data collection for numerous studies
- Participate in survey development with community and academic partners
- Build and manage datasets using Stata and SPSS
- Develop and co-facilitate presentations of research findings to funders, community stakeholders, and academic audiences
- Co-author reports and manuscripts
- Prepare and manage IRB protocols for numerous research studies

**Society for Social Work and Research (SSWR)**

November 2014 – January 2018

*Volunteer Coordinator, SSWR Annual Meeting*

- Manage and coordinate 130+ student volunteers for 4 consecutive SSWR Annual Meetings
- Recruit, hire, train, and supervise Volunteer Coordinators
- Collaborate with SSWR Board Member, SSWR staff and Travelink to ensure smooth integration of services
- Create and manage scheduling for all student volunteers
- Develop and facilitate orientations to all volunteers at conference

**University of North Carolina Wilmington**

October 2012 – August 2014

Onslow Extension Site – Jacksonville, NC

*Assistant BSW Program Coordinator & Lecturer*

- Managed and processed all BSW student admissions for the Onslow Extension Site
- Taught three courses in the BSW program each semester
- Coordinated and facilitated advising for all BSW Extension students
- Developed and facilitated transfer student orientations for incoming students each semester
- Coordinated professional development workshops for students, such as MSW Information Sessions, professional writing skills, and resume development
- Conducted recruitment of prospective students through classroom presentations, campus visits, and outreach events
- Facilitated collaboration between Onslow and Main Campus BSW programs
- Supported Director of Field Education by establishing new field placements for senior year field practicum
- Supervised Graduate Assistant from MSW program
- Faculty Advisor for Student Social Work Organization, 2012 - 2014
- Faculty Advisor for Phi Alpha Honors Society, 2012 - 2013

**Coastal Community Action, Inc.**

August 2011 – September 2012

Newport, NC

*Family and Community Partnership Specialist – Head Start*

- Monitored family partnership activities to ensure effective relationship-building between Head Start parents and staff
- Coordinated all Head Start outreach and recruitment activities
- Designed, developed and coordinated distribution of all Head Start promotional materials
- Provided technical assistance and one-on-one support to staff regarding family partnerships and community resources
- Developed and facilitated trainings to Head Start staff and parents
- Served as indirect supervisor for intern from Family Services baccalaureate program by designing project and providing support in meeting field work requirements

**University of Maryland School of Social Work**

October 2010 – July 2011

Baltimore, MD

*Community School Coordinator – August Fells Savage Institute of Visual Arts*

- Managed a caseload of high risk students with home visits, re-engagement techniques, mentoring and motivational interviewing
- Established and brokered partnerships between the school and outside agencies to leverage community resources, resulting in seven new partnerships, and expansion of three existing partnerships

- Developed, implemented and monitored programs such as a school food pantry and an after school supper program
- Served as task supervisor for three MSW interns from UMB School of Social Work
- Administered all family and community engagement and outreach activities, including development of the school's first Parent Teacher Association
- Planned, coordinated and marketed special events and educational workshops for students, families and the community

**Neighborhoods of Greater Lauraville, Inc.**

June 2009 – June 2010

Baltimore, MD

*Community Outreach Coordinator*

- Served as Healthy Neighborhoods organizer for seven Baltimore neighborhoods
- Managed capital improvement project by bridging private and public funding
- Built resident leadership through facilitation of block improvement projects and other volunteer activities
- Collaborated with citywide environmental initiative to develop series of educational workshops for residents
- Organized large-scale community events to promote environmental responsibility
- Coordinated outreach to residents regarding loan programs and block improvement grant opportunities
- Maintained website and designed monthly e-newsletters sent to 4,000+ residents and realtors

**TEACHING EXPERIENCE**

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**Widener University**

June 2018 - Present

School of Social Work, Online MSW Program

*Adjunct Instructor*

- Social & Economic Justice II
- Interpersonal Processes
- Human Behavior and the Social Environment II

**Boise State University**

August 2018 - Present

School of Social Work, Online MSW Program

*Adjunct Instructor*

- Foundation Social Work Practice III: Organizations and Communities
- Advanced Research: Program and Practice Evaluation

**University of North Carolina Wilmington**

January 2017 – May 2017

School of Social Work, BSW program

*Part-Time Instructor*

- Introduction to Social Work - Online Format
- Statistics and Research Methods for Social Work Practice– Hybrid Format

**University of Maryland, Baltimore**

January 2016 – May 2016

School of Social Work, MSW program

*Graduate Teaching Assistant*

- Community Organization

**University of North Carolina Wilmington**

October 2012 – August 2014

School of Social Work - Onslow Extension Site

*Assistant BSW Program Coordinator & Lecturer*

- Social Welfare Policies
- Issues for Diversity in Generalist Practice
- Social Work Practice with Groups
- Pre-Field Seminar
- Directed Individual Study – Topic “Dimensions of Eating Disorders”

**PUBLICATIONS**

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Mattocks, N., Hopkins, K., Cohen-Callow, A., & Meyer, M (2019). Clean and green organizing in urban neighborhoods: Measuring perceived and objective outcomes [Special Issue, Ecosocial Work and Social Change]. *Journal of Community Practice*.

Brisson, D., Pena, S., Mattocks, N., & Plassmeyer, M., & McCune, S. (2019). Effects of the Your Family, Your Neighborhood (YFYN) intervention on neighborhood social processes. *Social Work Research*.

Hopkins, K., Meyer, M., Cohen-Callow, A., Mattocks, N. & Afkinich, J. (2019). Implementation and impact of Results-Based Accountability: Successes and challenges with human service professionals and urban agencies [Special Issue, Accountability Matters: Addressing Racial Inequity with Results-Based Accountability]. *Race and Justice*.

Mattocks, N. (2017). Social action among social work practitioners: Examining the micro-macro divide. *Social Work, 63*(1), 7-16.

Cornelius, L.J., Afkinich, J., Hoffler, E., Keyser, D., Klumpner, S., Mattocks, N., & Nam, B. (2015). Reflecting on engaging in social action against social injustice, while developing a survey to study it: Restorative social justice as a lived experience. *Reflections, 21*(3), 26-33.

### **PEER-REVIEWED PRESENTATIONS**

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Mattocks, N., Baik, S., Cheong, J.H., Holmes, S., & Millar, R.J. Identifying pathways from neighborhood environments to hypertension in Baltimore City. NIA Aging Symposium, University of Maryland, Baltimore, *March 2019*.

Mattocks, N., Lehning, A., Mair, C., Kim, K., Baik, S., Zonderman, A., Evans, M., & Waldstein, S. Identifying pathways from neighborhood environments to hypertension in Baltimore City. Society for Social Work and Research (SSWR) Annual Meeting, San Francisco, California, *January 2019*.

Cohen-Callow, A., Hopkins, K., Meyer, M., & Mattocks, N. Keeping it Real: Helping Foundations and Nonprofits Develop Realistic Expectations and Measurable Outcomes for Community Change Initiatives. Society for Social Work and Research (SSWR) Annual Meeting, Washington, DC, *January 2018*.

Cohen-Callow, A., Hopkins, K., Meyer, M., & Mattocks, N. Keeping it Real: Helping Foundations and Nonprofits Develop Realistic Expectations and Measurable Outcomes for Community Change Initiatives. Association for Research on Nonprofit Organization and Voluntary Action (ARNOVA) Conference, Grand Rapids, MI, *November 2017*.

Brisson, D., Pena, S.L., Mattocks, N., & Plassmeyer, M. The Effects of the Your Family, Your Neighborhood (YFYN) Intervention on Neighborhood Social Cohesion and Informal Social Control. Urban Affairs Association Conference, Minneapolis, MN, *April 2017*.

Mattocks, N. Social Workers' Engagement in Social Action: Examining the Micro/Macro Divide. Society for Social Work and Research (SSWR) Annual Meeting, New Orleans, LA, *January 2017*.

Cohen-Callow, A., Goering, E., Mattocks, N., Hopkins, K., & Meyer, M. Social Capital in Community Interventions and Collaborations. Network for Social Work Management Annual Management (NSWM) Conference, Los Angeles, CA, *June 2016*.

Mattocks, N. & Hopkins, K. Predictors of Social Capital in Urban Neighborhoods. Society for Social Work and Research (SSWR) Annual Meeting, Washington, D.C., *January 2016*.

Cohen-Callow, A., Hopkins, K., Meyer, M., Mattocks, N., Denlinger, J., & Goering, E.S. Elusive Outcomes in Community Transformation: The Blending of Rational and Emerging Planning. Network for Social Work Management Annual Management Conference, Washington, D.C., *June 2015*.

Heckman, B., & Mattocks, N. The Family Partnership Agreement. North Carolina Head Start Association Conference. Raleigh, NC, *March 2012*.

Caldwell, R., Hourigan, A., Plyler, K., Mattocks, N., & Dennis, W. Why Gender Matters: Effective Gender-Based Interventions That Address High-Risk Drinking. National Meeting on Alcohol and Other Drug Abuse and Violence Prevention in Higher Education, Washington, D.C., *March 2006*.

### **Awards and Honors**

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- PhD Program Dissertation Grant, \$4,000, University of Maryland, Baltimore, 2018-2019
- Champion of Excellence, University of Maryland, Baltimore, 2017 - 2019
- Travel Award Fellowship, University of Maryland School of Social Work, December 2017
- Global Learning Opportunity (GLO) Program Award, Center for Global Education Initiatives, University of Maryland, Baltimore, June 2016
- Deb Bowen Faculty Service Award, University of North Carolina Wilmington, May 2014
- BSW Graduation Speaker, University of North Carolina Wilmington, May 2013
- Baltimore Healthy Neighborhood Fellowship, University of Maryland School of Social Work, June 2009
- Chancellor's Achievement Award, University of North Carolina Wilmington, May 2006

## **Abstract**

Title of Dissertation: Neighborhood Disorder and Mental Health Outcomes Among a Sample of Baltimore City Residents: The Influence of Urban Parks, Social Cohesion, and Social Control

Nicole Mattocks, Doctor of Philosophy, 2019

Dissertation Directed by: Megan Meyer, Ph.D., Associate Professor, School of Social Work, University of Maryland, Baltimore; Amanda Lehning, Ph.D., Associate Professor, School of Social Work, University of Maryland, Baltimore

The physical and social environments have increasingly received attention as key factors that explain health outcomes and health disparities for individuals. Recent studies have shown that being exposed to high levels of physical and social disorder (i.e., crime, vandalism, vacant buildings, drug activity) in the neighborhood environment can compromise mental health by generating fear, stress, anxiety and depression. Residents of urban disadvantaged neighborhoods are most at risk of exposure to disorder, and also experience higher rates of anxiety and depression, compared to those living in other settings. Some studies suggest green spaces (e.g., parks, gardens, tree canopy) and collective efficacy (i.e., social cohesion and informal social control) provide mental health benefits in the urban neighborhood environment. However, the relationships among these factors, and how they impact mental health in urban environments is complex, and research in this area is limited. The purpose of this study was to elucidate the relationships between these factors by first examining how one indicator of green space, proximity to parks, moderates the relationship between neighborhood disorder and mental health, and second testing whether social cohesion and informal social control mediate this relationship, for a sample of adults living in Baltimore City. Results from multilevel models demonstrated that neighborhood disorder was associated with anxiety

and depression symptoms, consistent with theory and prior research. Proximity to parks did not moderate this relationship; however, social cohesion partially mediated the associations between disorder and both depression and anxiety, while social control partially mediated the association between disorder and anxiety, but not depression. Contrary to expectations, higher levels of perceived social control were linked to higher levels of anxiety symptoms. This study demonstrates that neighborhood conditions matter to individual mental health, and perceptions of the social environment act as an important pathway through which the environment influences mental health for Baltimore residents. More study is needed to understand the relationship between exposure to urban parks and mental health. Findings from this study contribute to our understanding of the social determinants of health, and provide further evidence that the neighborhood context is critical to the mental health of urban residents.

Neighborhood Disorder and Mental Health Outcomes Among a Sample of Baltimore  
City Residents: The Influence of Urban Parks, Social Cohesion, and Social Control

by  
Nicole Mattocks

Dissertation submitted to the Faculty of the Graduate School of the  
University of Maryland, Baltimore in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy  
2019

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## **CHAPTER 1: INTRODUCTION AND BACKGROUND**

The physical and social environments of communities have increasingly received attention from scholars as key factors that explain health outcomes and health disparities for individuals (“Social determinants of health”, 2018). Recent studies have shown that being exposed to high levels of physical and social disorder (i.e., crime, vandalism, vacant buildings, drug activity) in the neighborhood environment can compromise an individual’s mental health by generating fear, stress, anxiety and depression (Mair, Diez Roux & Morenoff, 2010). Residents of urban disadvantaged neighborhoods are most at risk of exposure to disorder (Sampson & Groves, 1989), and also experience higher rates of anxiety and depression, compared to those living in rural and suburban settings (Greubner et al., 2017). Some studies suggest green spaces (e.g., parks, gardens, tree canopy) and the social environment (i.e., social cohesion and informal social control) provide mental health benefits in the urban neighborhood environment (Echeverria et. al., 2008; Sturm & Cohen, 2014). However, the relationships among these factors, and how they impact mental health in urban environments is complex, and research in this area is limited. The purpose of this study is to elucidate the relationships between these factors by examining how proximity to parks, social cohesion and informal social control influence the relationship between neighborhood disorder and mental health outcomes for a sample of adults living in Baltimore City. Findings from this study will contribute to the social determinants of health evidence base by providing a more detailed understanding of the potential protective effects of certain social and physical environmental factors on mental health outcomes for urban residents.

## **Problem Statement**

According to the National Institute of Mental Health, in 2017 approximately 46.6 million adults, or 18.9% of the U.S. adult population, had some form of mental illness within the past year (National Institute of Mental Health, 2019). More specifically, 7.1% of the U.S. adult population experienced at least one major depressive episode in 2017 (National Institute of Mental Health, 2019), and in 2007 approximately 19.1% of U.S. adults had an anxiety disorder within the past year (Harvard Medical School, 2007). Such high prevalence has widespread impact on individuals, communities, and the larger society. Individuals with mental health challenges face obstacles to everyday life, resulting in missed work, low educational attainment, and reduced income earnings, making them more vulnerable to poverty (Kessler & Frank, 1997). Mental illnesses cost the nation at least \$89 billion in public mental health expenditures in 2013 (Kamal, 2017).

Mental illness impacts individuals of all cultures and sociodemographic backgrounds, however lower-income individuals disproportionately experience mental health problems at higher rates than higher income earners (Ochodo et al., 2014). Data from the Healthcare for Communities Survey demonstrated that the probability of mental disorder increases continuously from the highest to lowest quintiles of income (Gresenz, Sturm, & Tang, 2001). Additionally, one longitudinal study with a large, nationally representative sample showed that a decrease in income was associated with an increased likelihood of mental health problems, such as anxiety and substance abuse (Sareen, Afifi, McMillan, & Asmundson, 2011).

In addition to establishing an association between income and mental health, research examining the social determinants of health has demonstrated that one's

surrounding environment significantly influences mental health and well-being. Some studies, for instance, indicate that living in an urban environment puts individuals at elevated risk for poor mental health outcomes (Peen, Schoevers, Beekman, & Dekker, 2009), and consequently rates of anxiety and mood disorders are higher in cities compared to rural areas (Greubner et al., 2017). Other studies suggest that exposure to signs of social and physical disorder, such as crime, physical hazards and other issues of safety (common in high poverty neighborhoods), generates stress, mistrust, anxiety and fear (Cutrona, Wallace, & Wesner, 2006; Kuo & Sullivan, 2001; Sampson & Groves, 1989), ultimately leading to poor mental health.

While urban environments characterized by poverty and disorder may have a deleterious effect on mental health, research also indicates that exposure to green spaces can have a protective effect on mental health by offering a place for relaxation, physical activity, or social gathering (Cohen-Cline, Turkheimer & Duncan, 2015; Dalgard & Tambs, 1997; Evans, 2003; Parsons et al., 1998). Similarly, neighborhood social environments characterized by high collective efficacy, including strong social ties, mutual trust, and a capacity for collective action, can promote a sense of purpose and belonging (Kawachi & Berkman, 2000), and buffer against the harmful effects of neighborhood disorder on mental health (Echeverria et. al., 2008; Mair, Roux & Morenoff, 2010). Therefore, as urban population growth continues to outpace the nation's overall growth rate (U.S. Census Bureau, 2012), it becomes increasingly important to understand how modifiable conditions, both harmful and protective, within urban environments interact to influence individual mental health. Indeed, such research

is needed in order to develop targeted interventions and prevention efforts to promote mental health for urban residents.

### **Baltimore City**

Baltimore City was selected as the study site for a number of reasons. First, the theoretical framework for this study pertains specifically to the urban neighborhood environment, necessitating a sample of urban residents. Second, Baltimore is a distressed city, in need of interventions at all levels to improve living and working conditions. In 2014, Baltimore City residents earned a median household income of \$41,819 and 23% of households lived below the poverty line, compared to the national median household income of \$53,657 and a 14.5% national poverty rate (U.S. Census Bureau, 2014). Additionally, the city has a long history of residential segregation, and health disparities across neighborhoods are well documented (Ames, et. al., 2011).

Baltimore City is also facing environmental challenges commonly found in distressed urban communities, such as high rates of toxin exposure (Boone et al., 2014), large numbers of vacant lots and homes (American Forests, 2012), and inadequate green spaces (Baltimore Office of Sustainability, 2013). In response to former Governor O'Malley's Greenhouse Gas Emissions Reduction Act of 2009, Baltimore City officials began implementing a Climate Action Plan in 2012 to reduce the city's greenhouse gas emissions by 15% by 2020 through a range of citywide greening initiatives. This ambitious plan entails numerous greening efforts, such as planting trees to increase the tree canopy, replacing concrete and pavement with urban vegetation, and providing safe and well-maintained public green spaces within a quarter mile of all residents' homes (Baltimore Office of Sustainability, 2013). The city's commitment to achieving such

goals indicates a prioritization of urban greening, suggesting that the timing is optimal to inform current and future strategies for urban revitalization and greening projects.

### **Neighborhood Disorder and Mental Health**

Neighborhood disorder is a construct used in the empirical literature to characterize the physical and social conditions of the urban neighborhood environment (Elo et. al., 2010). Physical conditions of neighborhood disorder include abandoned or dilapidated buildings, vandalism, litter, and graffiti, while social conditions include public drunkenness, gang activity, drug trade, and loitering (Sampson & Groves, 1989; Wandersman & Nation, 1998).

The concept of neighborhood disorder has its roots in Social Disorganization Theory (SDT), a highly influential sociological theory which posits that neighborhood social conditions substantially influence the likelihood that a child or adolescent will become involved in criminal activities later in life (Shaw and McKay, 1942). This theory defines social disorganization as the inability of a community to maintain effective social control over its residents, which can lead to increased crime and disorder and subsequent criminal behavior among children and adolescents (Sampson & Groves, 1989). The Neighborhood Disorder and Mental Health Model extends this theory, proposing that physical and social signs of neighborhood disorder elicit both crime and a fear of crime, which in turn has a negative influence on individual mental health for residents of all ages (Wandersman & Nation, 1998).

There is a well-established body of empirical literature supporting SDT's proposed negative relationship between neighborhood disorder and a variety of health outcomes. Increased neighborhood disorder has been linked to risky health behaviors

including alcohol abuse (Hill & Angel, 2005; Kuipers et al., 2012) and drug use (Milam, et al., 2012; Reboussin, et al., 2015), maternal psychological distress, children's mental and physical health (Christie-Mizell, Steelman, & Stewart, 2003; Coley, Lynch, & Kull, 2015), psychological well-being among racial minorities (Alamilla, Scott, & Hughes, 2016), as well as expression of PTSD symptoms (Gapen et al., 2011) and depression (Latkin & Curry, 2003; Ross, 2000). However, there is limited evidence of the ways in which the presence of park space and the social environment in urban neighborhoods may influence the relationship between neighborhood disorder and mental health.

### **Green Space and Mental Health**

In the empirical literature, green spaces refer to natural elements found in the living environment, such as parks, street trees, urban forests, community gardens, community-managed open spaces, playgrounds, recreational fields, and in some cases waterways (Gascon et. Al., 2015; Wolch, Byrne, & Newell, 2014). Exposure to green spaces can have a positive effect on mental health through several key pathways, including promoting social ties, reducing mental fatigue, and providing opportunities for physical activity (Cohen-Cline, Turkheimer, & Duncan, 2015). Attention Restoration Theory (ART) and Stress Recovery Theory (SRT) explain how contact with nature promotes stress recovery, improving mental health and well-being (Gatersleben & Andrew, 2013; Kaplan, 1995). SRT suggests that humans have evolved in natural settings for centuries, and have physiologically and psychologically adapted to living in natural versus urban settings (Ulrich et al., 1991). ART proposes that the capacity to stay focused fatigues over time, which can lead to irritability and anxiety (Kaplan, 1995), and

that exposure to natural settings can aid in recharging the capacity for directed attention, leading to improved mental health and overall well-being (Gatersleben & Andrew, 2013)

A wealth of empirical findings supports these theories, demonstrating a positive relationship between access to green spaces and a variety of mental health outcomes (Van den Berg et al., 2015). Cross-sectional, longitudinal, and experimental studies consistently provide evidence that access to green or natural environments leads to improved mental health (Kinnafick & Thogersen-Ntoumani, 2014; Sugiyama, Leslie, Giles-Corti, & Owen, 2008; Wang et al., 2016; White et al., 2013). Among this literature are a few studies specifically linking proximity or access to urban parks with improved mental health outcomes for urban residents (Nutsford, Pearson & Kingham, 2013; Sturm & Cohen, 2014). A study with a sample of Auckland, New Zealand residents found that residential proximity to parks was associated with lower counts of anxiety and mood disorder treatment recorded by healthcare facilities (i.e., hospitals, mental health services, primary care, pharmacies, and laboratories) at the block level (Nutsford, Pearson & Kingham, 2013). Another study using data from a program evaluation of park improvements in Los Angeles, California revealed a similar pattern (Sturm & Cohen, 2014), where increasing distance from neighborhood parks was associated with significant declines in mental health.

However, more recent studies indicate a complex relationship between neighborhood disorder and green spaces. Some studies have revealed that the mere presence of green spaces might not always lead to positive outcomes for residents (Donovan & Prestemon, 2012), depending on the social and physical conditions of the neighborhood. A recent qualitative study of Baltimore residents living in neighborhoods

with high crime (Battaglia et al., 2014) found that some respondents were concerned about the link between trees and increased opportunities for drug trade. Another study in Portland, Oregon found that trees obstructing visibility are associated with increased rates of burglary (Donovan & Prestemon, 2012). However, more study is needed to untangle the relationship between neighborhood disorder and green spaces, and understand how these two constructs interact to influence mental health outcomes.

### **Collective Efficacy and Mental Health**

Collective efficacy is the capacity of a neighborhood's residents to maintain public order (Sampson, 2003). The concept of collective efficacy is comprised of social cohesion, or shared trust and values among neighbors, and social control, or a group's ability to regulate its members behaviors according to common goals (Sampson, Raudenbush & Earls, 1997). Because collective efficacy reflects individuals' feelings of connectedness and purpose (Kawachi & Berkman, 2000), researchers have examined the relationship between collective efficacy (and its components, social cohesion and social control) and mental health outcomes and found that higher levels of social cohesion are associated with reduced depressive symptoms (Echeverria et. al., 2008; Mair, Roux & Morenoff, 2010). Additionally, at least one study (Kim, 2010) revealed that perceived social ties mediated the association between neighborhood disorder and mental health. These findings indicate that components of collective efficacy may have a protective effect on mental health, particularly in neighborhoods of disadvantage, which likely contain high levels of neighborhood disorder

### **Purpose of the Study**

The purpose of this study is to elucidate the relationship between the urban neighborhood environment and mental health outcomes for a racially and socioeconomically diverse sample of Baltimore City residents. More specifically, this study will examine how access to neighborhood parks, as well as perceived social cohesion and social control influence the relationship between neighborhood disorder and mental health. The aims of this study are to: (1) Examine the relationship between neighborhood disorder and two mental health outcomes (i.e., depression and anxiety); (2) Assess the moderating role of proximity to park space on the relationship between neighborhood disorder and mental health; and (3) Examine whether social cohesion and informal social control mediate the relationship between neighborhood disorder and mental health.

### **Relevance to Social Work**

This study will contribute to social work practice, policy, and research. The “person-in-environment” perspective, which is central to the field of social work, emphasizes the importance of understanding the client within the context of their environment (Weick, Rapp, Sullivan, & Kisthardt, 1989). Drawing from Bronfenbrenner’s Ecological Systems Theory, the client’s environment includes a variety of systems, from the home and family, to the local neighborhood environment, and outwards to societal and cultural norms (Bronfenbrenner, 1979). The proposed study is an investigation of the influence of neighborhood environmental factors on mental health outcomes for urban residents. Findings from this study will contribute to the social work profession by adding to our understanding of the ways in which the social and physical conditions of urban neighborhoods influence mental health outcomes for residents,

particularly in distressed communities. Gaining clarity about the modifiable factors that buffer or exacerbate the influence of neighborhood disorder on depression and anxiety for individuals enables social workers to support the development of resilient communities.

This study will have important implications for social workers practicing at the micro, mezzo and macro levels. Clinicians and other mental health practitioners serving clients in urban settings will benefit from gaining a more nuanced understanding of the ways in which neighborhood environmental conditions influence their clients' mental health. These findings can also be used to inform policy makers, elected officials, urban planners, and community practitioners on effective strategies for designing and implementing neighborhood revitalization plans that maximize benefits to individual mental health. Decisions about financial and community investment in interventions to improve disenfranchised communities, such as park space development and urban design or community organizing to build social cohesion and informal social control, should be based on a deeper understanding of the interplay between these factors, in order to maximize the potential benefits of limited urban redevelopment funding.

## **CHAPTER 2: THEORY AND LITERATURE REVIEW**

This chapter will provide a summary of the theoretical frameworks and prior research that informed this study. First, I review the literature pertaining to neighborhood disorder, green spaces (and parks more specifically), collective efficacy, and mental health outcomes in an urban context. I conclude the literature review with a summary of the gaps in the current literature, including the ways this proposed study will begin to address these gaps. Then I introduce several theories and models from public health and the social sciences, and discuss how each of these applies to my study by providing terminology, as well as guidance on study design, construct measurement, and analytic approaches. I conclude by describing the conceptual model guiding this study, specifically a modified version of the Neighborhood Disorder and Mental Health Model.

### **Literature Review**

#### **Neighborhood Disorder and Mental Health**

Neighborhood disorder is a construct used to characterize the physical and social conditions of the urban neighborhood environment, and is measured by various indicators of physical and social deterioration found in public spaces. Signs of social disorder refer to public behaviors typically considered threatening, such as public drinking and drug use, crime, loitering adults, gang activity, selling drugs, and prostitution (Sampson & Raudenbush, 1999). Physical disorder refers to deterioration of the urban physical environment; indicators include graffiti, litter, abandoned buildings and cars, and broken windows (Elo et. al., 2009; Mair, Diez Roux & Morenoff, 2010; Sampson & Raudenbush, 1999). There is a well-established body of literature supporting the connection between neighborhood disorder and a variety of health outcomes. Increased

neighborhood disorder has been linked to risky health behaviors including alcohol abuse (Hill & Angel, 2005; Kuipers et al., 2012) and drug use (Milam, et al., 2012; Reboussin, et al., 2015), as well as maternal psychological distress, children's mental and physical health (Christie-Mizell, Steelman, & Stewart, 2003; Coley, Lynch, & Kull, 2015), psychological well-being among racial minorities (Alamilla, Scott, & Hughes, 2016), expression of PTSD symptoms (Gapen et al., 2011), and depression (Latkin & Curry, 2003; Mair, Roux & Morenoff, 2010).

A number of studies have focused on the ways in which the presence of neighborhood disorder leads residents to perceive their environment as unsafe, which increases feelings of distress and development of depressive symptoms (Latkin & Curry, 2003; Mair, Diez Roux & Morenoff, 2010; Ross, 2000). Ross (2000) used a probability sample of adults in Illinois to examine whether perceived neighborhood disorder (e.g., graffiti, noise, vandalism, abandoned buildings, loitering, crime) mediated the association between neighborhood socioeconomic disadvantage and depression. Her findings indicated that perceived signs of disorder is a key pathway through which residents of socioeconomically disadvantaged neighborhoods experience depression. Building from the work of Ross and others, Latkin and Curry (2003) used data collected from baseline and follow-up interviews (conducted 9 months later) with a sample of Baltimore residents living in high drug-use areas to assess the relationship between perceived neighborhood disorder (e.g., vandalism, litter, vacant housing, groups of teenagers loitering, burglary) and depressive symptoms. The study found a strong association between perceived neighborhood disorder and depressive symptoms at follow-up interviews, even after adjusting for baseline depression scores.

Another cross-sectional study (Mair, Diez Roux & Morenoff, 2010) with a population-based sample of adults in Chicago examined the association between neighborhood disorder and depressive symptoms, using a variety of subjective and objective neighborhood measures including systematic observation, census data, and perceptions gathered through surveys. Perceived disorder was measured with a previously used five-item scale on the survey (Sampson et. al., 1999), while objective neighborhood-level measures were developed through systematic social observation, resulting in a nine-item physical disorder scale assessing the presence of graffiti, litter, abandoned cars, broken glass, and other signs of disorganization. Using multilevel models, findings indicated that both perceived and objective neighborhood disorder measures were positively associated with depression, but after adjusting for individual factors only perceived disorder remained significant, and only among men. The objective disorder measure did not remain significant after adjusting for individual factors. This finding suggests that individual perceptions of disorder might have a stronger association with depressive symptoms than objective measures of disorder. However, Elo and colleagues (2009) conducted a study to investigate the relationship between individual-level measures of perceived disorder and objective neighborhood-level indicators, and found that the two were very closely related to one another. The authors advised that perceptions of neighborhood conditions could serve as a useful proxy or supplement when researchers have limited or no access to objective indicators of neighborhood conditions. Both of these studies support the added benefit in measuring neighborhood disorder with objective and subjective indicators, whenever possible.

It is critical to note that much of the empirical evidence for the relationship between neighborhood conditions and mental health is based on cross-sectional studies, preventing establishment of the causal direction between these variables. However, one experimental study, Moving to Opportunity, helped to clarify that the conditions within disadvantaged neighborhood environments can negatively influence mental health. Moving to Opportunity is a multi-site randomized controlled trial that relocated 794 low-income families to more affluent neighborhoods, beginning in 1994. At the New York City site, follow-up evaluations were conducted three years after baseline interviews; results from follow-up interviews revealed that relocated families reported fewer depressive symptoms than those who remained in high poverty neighborhoods (Leventhal & Brooks-Gunn, 2003). This study also assessed for differences in perceived neighborhood disorder (e.g., trash, graffiti, public drinking, public drug use or dealing, and abandoned buildings) and found that adults who relocated reported significantly lower neighborhood disorder compared with control participants who did not relocate. These findings provide some support for causality, suggesting that residing in a neighborhood with lower disorder reduces depressive symptoms.

### **Urban Green Space and Mental Health**

The empirical literature consistently demonstrates a positive association between access to green space, such as parks, tree canopies, and community gardens, and mental health outcomes (Cohen-Cline et al., 2015; Hazer et al., 2018; Van den Berg et al., 2015). Numerous systematic reviews on the various health benefits of urban green spaces found evidence of this relationship, for a variety of mental health and well-being indicators, including self-report mental health status, stress, depression, anxiety,

psychological distress, mood, mental fatigue, quality of life, and happiness (Gascon et. al., 2015; Kabisch et. al., 2015; Lee & Maheswaran, 2011; Tzoulas et. al., 2007; van den Berg et. al., 2015).

The last decade has seen a surge of research demonstrating a causal relationship between green space and mental health through the use of experimental and longitudinal designs. A number of experimental studies comparing the effect of exposure to natural versus urban environments reveal that natural environments are associated with improvements in mood (Kinnafick & Thogersen-Ntoumani, 2014; Van den Berg, Jorgensen, & Wilson, 2014), affect (Kinnafick & Thogersen-Ntoumani, 2014; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009) and stress recovery (Wang et al., 2016). Mood and affect were assessed with the Positive and Negative Affect Schedule (Kinnafick & Thogersen-Ntoumani, 2014; Mayer et. al., 2009) or the Profile of Mood States (Van den Berg, Jorgensen, & Wilson, 2014), both of which are self-report measures of positive and negative emotional states. Two longitudinal studies using British Household Panel Survey data (Alcock et. al., 2013; White et. al., 2013) demonstrated the positive association between green space exposure and mental health (measured with the 12-item General Health Questionnaire) across multiple time points with a random sample of English urban residents. In one study (White et al., 2013), residents living in greener urban areas had better mental health than those in less green urban areas over time. The other study (Alcock et. al., 2013) revealed that those who moved to greener urban areas showed significant improvements in mental health for the three years following the relocation compared to those moving to a less green urban area. This body of literature provides some evidence of a causal relationship, whereby

exposure to green space improves mood, affect, and overall mental health, and promotes stress recovery.

Although there is consistent evidence of an association between access to green spaces and mental health generally, there is not yet a well-established evidence base, as relations with specific mental health outcomes are less consistent across studies. A comparison of hair cortisol concentration (HCC) levels demonstrated that chronic stress was higher among UK residents living in less natural environments than residents of areas with more dense natural environments (Gidlow et al., 2016). An Australian study revealed that residents' perceptions of greenness in their communities positively predicted better mental health, as indicated by mental component scores on the 12-item short-form health survey (SF-12) (Sugiyama, Leslie, Giles-Corti, & Owen, 2008). A study using population-level data from the Survey of the Health of Wisconsin (SHOW) examined the association between three objective measures of green space and three mental health measures (i.e., depression, anxiety, and stress) in a series of regression models (Beyer et. al., 2014). The authors found that higher levels of green space were associated with better mental health outcomes, after controlling for a variety of individual- and census tract-level covariates. These findings were consistent across all measures of green space and mental health, but depression showed the strongest association. Another study (Cohen-Cline, Turkheimer & Duncan, 2015) also examining depression, anxiety, and stress with a sample of adult twin pairs revealed similar findings. There was an inverse association between access to green space and all three outcomes, but after adjusting for covariates and assessing within-pair effects, only depression remained significant. These findings point to differences in the ways that green space

and various mental health outcomes relate, warranting the need for further investigation using multiple mental health outcomes in the same study.

In the current literature, the concept of urban green space encompasses numerous natural elements, including parks, tree canopies, publicly managed open spaces, community gardens, and in some cases waterways (also referred to as blue spaces). Researchers have used a wide variety of objective and subjective indicators to measure access to green space. Objective indicators include the Normalized Difference Vegetation Index (NDVI), which uses remote sensing technology to measure vegetation density (Beyer et. al. 2014; Cohen-Cline, Turkheimer & Duncan, 2015), percent tree canopy cover using satellite imagery data (Beyer et. al., 2014), GIS techniques to map distance to the nearest park or other green space (Nutsford, Pearson & Kingham, 2013), and various auditing tools to measure quantity of greenery within a given area (de Vries et. al., 2013). Less commonly used, subjective indicators include survey questions assessing respondents' perceived access to parks, tree canopy cover, and other natural features (Sugiyama, Giles-Corti & Owen, 2008), as well as respondents' assessments of quality of surrounding green space (de Vries et. al. 2013).

For the present study, I have chosen to focus on proximity to parks, measured with both objective and subjective indicators. I selected parks because there is evidence that parks facilitate physical activity and social interaction, both of which are associated with improvements in mental health (Kawachi & Berkam, 2001). Additionally, data on urban park space is quantifiable and often available through administrative or public sources.

A review of the literature specific to parks and mental health yields findings similar to that of the broader green space and mental health literature; there is generally a positive association between proximity to park space and mental health outcomes, however these findings are not entirely consistent. A study among an adult sample in Auckland, New Zealand (Nutsford, Pearson & Kingham, 2013) used GIS techniques to examine the spatial relationship between distance to total green space as well as distance to parks, with counts of anxiety/mood disorder treatment (measured as either receiving secondary mental health treatment for serious and complex psychiatric disorders, receiving subsidy for anxiety/mood disorder treatment, or having three or more lab tests for lithium over the previous year). Results of negative binomial regression models indicated that living near parks is associated with lower anxiety/mood disorder treatment count, but this is not the case for total green space. This finding suggests that being able to use green space, rather than simply observe it, may be important for benefitting mental health.

A secondary analysis of data from an evaluation of parks improvements in Los Angeles, California (Sturm & Cohen, 2009) grouped residential distance from parks into four categories (< 400 m, 400-800 m, 800-1600 m, and > 1600 m), and assessed how varying proximity to urban parks was associated with mental health status (measured with the 5-item Mental Health Inventory or MHI-5). The authors found that mental health declines significantly with increasing distance from neighborhood parks. Another study measuring park proximity (Sugiyama et al., 2016) examined whether the association between mental health and area-level SES is moderated by the size and quality of green space, with cross-sectional data from a random sample of Western

Australian residents. Interestingly, similar buffers were used to map park space (i.e., < 400 m, 400-800 m, 800-1200 m, and 1200-1600 m), and three variables were tested – total park area, mean attractiveness score using an auditing tool, and attractiveness score for the most attractive park in each buffer. Multinomial logistic regression models found no significant interaction between total park area and SES. However, there was a significant interaction between park attractiveness and SES for the 800 m buffer, such that higher mean attractiveness was associated with higher levels of psychological distress, which was contrary to expectations.

Overall, findings indicate that closer proximity to parks is associated with reduced psychological distress (Sturm & Cohen, 2014) and counts of anxiety/mood disorder treatment (Nutsford, Pearson & Kingham, 2013), but one study found no significant association (Sugiyama et. al., 2016). While the broader green space and mental health literature offers more consistency across findings, the literature on proximity to parks is less clear, warranting further investigation with additional samples and mental health measures.

### **Subjective and objective indicators of park proximity.**

#### **Green Space as a Moderator.**

In order to shed some light on this complex relationship between green space and issues of crime and safety, Bogar and Beyer (2016) conducted a systematic review and evaluated 10 articles that explored the relationship between green space and crime. They noted that among the numerous relationships tested between varying types of green space and criminal offenses, there were 19 findings reporting green spaces were associated with reductions in crime, and nine cases in which measures of green space were associated

with increases in crime. This systematic review highlights the inconsistency across studies, and the need for further investigation into the ways in which green spaces relate to crime, violence, and other issues of safety in neighborhoods.

After a thorough literature search of studies that have examined the complex relationship between park space, neighborhood environments, and mental health, I found one study with a design and analytic approach similar to this study. Sugiyama and colleagues (2016) tested the moderating role of objective park proximity and perceived park attractiveness on the relationship between neighborhood SES and psychological distress, with a random sample of residents from two metropolitan areas in Western Australia. Although their results indicated no significant interaction effect between proximity to parks and SES, the authors noted that this finding might be at least partially due to the absence of key variables relevant to mental health, such as indicators of safety, crime, and maintenance. They recommended that future research in this area include these key variables in order to test a more comprehensive model, and untangle the relationship between neighborhood conditions, green spaces, and mental health outcomes. Thus, my study will examine how perceived and objective proximity to parks influences the relationship between neighborhood disorder (e.g., crime and maintenance) and mental health.

### **Collective Efficacy and Mental Health**

Collective efficacy is the capacity of a neighborhood's residents to maintain social control and facilitate collective action for the common good (Sampson, 2003). The concept of collective efficacy is comprised of two key constructs – social cohesion and informal social control. Social cohesion reflects shared trust and values among

neighbors, and social control refers to a group's ability to regulate its members' behaviors according to agreed-upon principles and goals (Sampson, Raudenbush & Earls, 1997). Much of the theoretical and empirical literature on collective efficacy pertains to its relationship with neighborhood crime and violence (Morenoff, Sampson & Raudenbush, 2001; Sampson, Raudenbush & Earls, 1997), as the construct was originally developed to examine the neighborhood spatial dynamics associated with incidents of crime (Sampson, Morenoff & Earls, 1999). However, a number of studies have also tested a direct relationship between social cohesion and mental health outcomes (Echeverria et. al., 2008; Fone et. al., 2014; Kawachi & Berkman, 2001), because social cohesion is thought to provide individuals with feelings of connectedness and a sense of purpose (Kawachi & Berkman, 2000).

A U.S. study using prospective cohort data from the Multi-Ethnic Study of Atherosclerosis (Echeverria et. al., 2008) examined the associations between self-reported neighborhood problems (i.e., noise, traffic, inadequate access to food, shopping, parks or playgrounds, trash, and violence) and social cohesion (using a scale developed by Sampson, Raudenbush and Earls in 1997) with depression (measured by CES-D). Results from linear regression models revealed that individuals living in neighborhoods with the lowest social cohesion reported more depressive symptoms than those in more socially cohesive neighborhoods, even after controlling for neighborhood problems. Mair, Diez Roux, and Morenoff's previously cited study (2010) used a population-based sample of adults in Chicago to examine the association between a series of social support variables, including social cohesion, and depressive symptoms. Their results from multilevel models demonstrated that among women only, social cohesion was negatively

associated with depression, even after controlling for individual factors. In their study with a community-based sample of adolescents in Los Angeles, California, Aneshensel and Sucoff (1996) investigated the aspects of the neighborhood context (e.g., environmental hazards and social cohesion) that might influence symptoms of anxiety and depression. Results from their analyses indicated that social cohesion was inversely related with depression, but not anxiety; however they noted that their social cohesion measure had modest reliability, as it was a single item. Using a more comprehensive and reliable measure, such as the widely cited Perceived Social Cohesion scale (Sampson, Raudenbush & Earls, 1997) may have yielded different findings.

There is limited evidence of a relationship between the full construct of collective efficacy and mental health, because much of the empirical literature on collective efficacy pertains to either crime or physical health outcomes (Browning & Cagney, 2002; Cagney, Browning & Wen, 2005; Morenoff, Sampson & Raudenbush, 2001). For example, one cross-sectional study (Araya et. al., 2006) tested associations between social cohesion and informal social control (separately) and mental health, as measured by the General Health Questionnaire (GHQ-12), and found that only social cohesion was significantly associated with mental health after adjusting for individual-level factors. This finding highlights the need for further investigation into the connection between mental health and the sub-constructs of collective efficacy, social cohesion and informal social control.

A few studies have revealed that collective efficacy (or its components – social cohesion and social control) might mediate the influence of neighborhood socioeconomic disadvantage on mental health outcomes; neighborhood socioeconomic disadvantage is

linked to levels of neighborhood disorder, making it a comparable concept to neighborhood disorder. A study with a probability sample of 2,482 adults in Illinois used structural equation models to demonstrate that levels of social support and neighborhood social ties partially accounted for the negative effect of neighborhood disorder on depression (Kim, 2010). A longitudinal cohort study using a probability sample of children in Chicago (Xue et. al., 2005) found similar patterns. Children living in disadvantaged neighborhoods had significantly poorer mental health compared to children in more advantaged neighborhoods, and collective efficacy accounted for 35% of the effect of neighborhood disadvantage on mental health, indicating a mediating effect. As neighborhood disorder is often highest in disadvantaged neighborhoods, these findings suggest that collective efficacy and its components may be a key pathway through which neighborhood disorder influences mental health outcomes.

### **Gaps in the Literature**

There are a number of gaps in the literature that this study is designed to address. I have been unable to locate any quantitative studies that have tested the moderating role of proximity to parks on the relationship between neighborhood disorder and mental health. A few recent studies have shed light on the complexities of the green space and mental health relationship, particularly in regard to green spaces potentially exacerbating issues of crime and perceived safety in some instances, while buffering them in others (Battaglia, et. al., 2014; Bogar & Beyer, 2016; Donovan & Prestemon, 2012). It is important to untangle the linkages between these factors, in order to gain a clearer understanding of the optimal neighborhood conditions to promote mental health for urban residents. Another key gap I address relates to our understanding of the influence of

collective efficacy, as there is some evidence that social cohesion mediates the effect of neighborhood disorder on mental health (Kim, 2010; Ross & Mirowsky, 2009), but I was unable to find any studies that examined informal social control as a mediating pathway.

The evidence linking green space with mental health is generally consistent; however there is room for further development in understanding how proximity to parks specifically relates to depression and anxiety. Additionally, no reviewed studies tested the green space-mental health relationship using both objective and subjective measures of proximity to parks. The linked HANDLS-BNIA dataset offers me the unique opportunity to assess both subjective and objective indicators of neighborhood conditions. This study will also address the scant literature on the relationships between neighborhood conditions and both subconstructs of collective efficacy, social cohesion and social control, to further explain the pathways through which neighborhood disorder influences mental health. Lastly, much of the reviewed literature treated depression as the primary mental health outcome, however anxiety is a key mental health construct that is conceptually linked to neighborhood environmental factors. I will include a measure of anxiety (PDSQ-GAD) as an outcome, in addition to depression, in order to determine whether findings are consistent across these two key mental health outcomes.

## **Theoretical Frameworks**

### **Social Determinants of Health Framework**

The social determinants of health is a concept that encompasses all of the conditions in which humans live and work. The World Health Organization asserts that exposure to such vastly different conditions is largely responsible for health inequities within and between countries (“Social determinants of health”, 2018). The Social

Determinants of Health (SDOH) provides the overarching conceptual framework for this study, by articulating the ways in which the physical and social environments influence health and other quality-of-life outcomes for individuals (Office of Disease Prevention and Health Promotion, 2018). While there are numerous approaches to conceptualizing the social determinants of health, I am using the framework developed by the U.S. Department of Health and Human Services (DHHS).

The DHHS framework posits that a variety of factors related to an individual's living and working conditions influence health outcomes, and largely explain disparities in health across individuals and groups (U.S. Department of Health and Human Services, 2010). These factors include access to education, economic stability, and health care, as well as the social and physical characteristics of the neighborhood environment, referred to in the SDOH as the "social and community context" and the "neighborhood and built environment", respectively. Through the lens of the SDOH framework, reducing inequities in the social and physical environment can improve health behaviors, functioning, and overall well-being for individuals (U.S. Department of Health and Human Services, 2010).

This proposed study will be focusing on some of the social and physical characteristics outlined in the SDOH, such as exposure to crime, violence, and other forms of social and physical disorder; access to parks; and social cohesion in the neighborhood environment.

According to the U.S. Department of Health and Human Services Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2020 (2010), "[t]he social environment is the aggregate of social and cultural norms,

patterns, beliefs, and processes that influence the life of an individual or community” (“What are ‘Social Determinants of Health’?”, para. 2). This encompasses social relationships, socioeconomic conditions, policies, social institutions (e.g., law enforcement), exposure to crime, and social disorder. The level of resources and opportunities within a community, as well as the ability of individuals to interact with the community, impact the quality of the social environment. All of these factors together influence an individual’s health and well-being.

The physical environment consists of the natural and built environment, in settings such as homes, worksites, and neighborhoods, and includes environmental features such as vegetation, weather, buildings, and transportation systems. According to the SDOH model, the physical environment is harmful to human health when it exposes individuals to toxic substances, pollutants, and stress-inducing factors (e.g., noise and overcrowding and other hazards). It is beneficial to health when, for example, neighborhoods are infused with elements that promote healthy behaviors, such as parks and sidewalks that enable physical activity.

### **Social Disorganization Theory**

Social Disorganization Theory is used to understand the neighborhood dynamics that influence crime and delinquency in urban neighborhoods (Sampson & Groves, 1989). Social disorganization is when a community is unable to maintain social order and realize the common values of its residents, because of a breakdown in a community’s social institutions (Shaw & McKay, 1942). Social Disorganization Theory was developed out of Shaw and McKay’s (1949) research in Chicago that revealed spatial patterns in crime. Their research found that these spatial patterns could be explained by

three neighborhood characteristics - socioeconomic status, ethnic heterogeneity, and residential mobility - which lead to disruptions in social organization, and influence the occurrence of crime beyond individual factors (Shaw & McKay, 1942). They discovered that in high poverty urban areas, there was commonly a lack of consensus on value systems, such as what would be considered appropriate means for achieving status or economic gains, and more importantly, how to deal with community problems (Sampson & Groves, 1989). They explained that this lack of consensus leads to a breakdown in social control and social ties, resulting in criminal behavior.

These seminal studies (Sampson & Groves, 1989; Shaw & McKay, 1942) laid the foundation for much of the current neighborhood effects literature by providing a detailed and complex model and key constructs for understanding neighborhood effects on crime in urban communities. Although SDT was originally developed to study the ecological factors influencing neighborhood crime, the theory also lends itself to explaining potential pathways to other outcomes, such as mental health, especially when approached through the SDOH framework.

### **Neighborhood Disorder and Mental Health Model**

Wandersman and Nation's (1998) conceptual model, the Neighborhood Disorder and Mental Health Model, extends Social Disorganization Theory beyond crime as the outcome of interest, and explicates how a set of neighborhood characteristics, neighborhood disorder, influences mental health outcomes for urban residents. The Neighborhood Disorder and Mental Health Model proposes that physical and social signs of neighborhood disorder (e.g. public drunkenness, vandalism, dilapidated and abandoned buildings) indicate deterioration of social control and social bonds, which

ultimately promotes more crime, and a fear of crime, both of which lead to elevated levels of depression and anxiety over time (Wandersman & Nation, 1998). According to this model, some of these physical and social disorder indicators are considered “soft crimes” which fall somewhere between acceptable behavior and violations serious enough to involve law enforcement, reducing the likelihood that they will be addressed. Also, because these activities take place in public spaces, they are both everyone’s and no one’s responsibility. This model purports that individual’s exposure to disorder and their resulting fear and anxiety lead to behavior changes, such as avoiding walking at night or alone, or purchasing a gun to increase feelings of safety, which may in turn exacerbate social isolation and affect their mental health.

### **Attention Restoration Theory & Stress Recovery Theory**

Two psycho-evolutionary theories, Stress Recovery Theory (SRT) and Attention Restoration Theory (ART), explain how contact with nature offers restoration from stress, ultimately improving mental health and well-being. Stress Recovery Theory (SRT) suggests that humans have evolved in natural settings for centuries, and have physiologically and psychologically adapted to living in natural versus urban settings. Based on inherent survival instincts, humans are predisposed to respond positively to natural elements (e.g., plants, water, vegetation) and encountering non-natural or urban settings places a greater demand on processing resources, thus requiring more energy for coping efforts. However, exposure to natural environments can support psychological and physiological stress recovery (Ulrich et al., 1991). ART, which complements SRT, proposes that humans use directed attention to stay focused on tasks and avoid distractions, but the capacity to stay focused fatigues over time, which can lead to

feelings of irritability and anxiety (Kaplan, 1995). Exposure to restorative environments, such as natural settings, can aid in recharging one's energy and capacity for directed attention, leading to improved mental health and overall well-being (Gatersleben & Andrew, 2013). Both of these theories provide the theoretical connection between exposure to green spaces, such as parks, and individual mental health. Additionally, SRT in particular explains how natural environments (e.g., parks) assist in recovery from exposure to stressors, such as signs of neighborhood disorder (i.e., gang activity, litter, abandoned buildings). Based on this understanding, having contact with parks may buffer the impact that exposure to such environmental stressors has on mental health.

### **Collective Efficacy Theory**

Collective Efficacy Theory was developed out of Social Disorganization Theory, to explain how neighborhoods can be highly organized, and yet still face issues such as high crime (Kirk, 2010). Sampson, Raudenbush and Earls (1997) suggest that neighborhood residents must have strong social ties and have the capacity to activate those ties to achieve shared goals for the common good, such as maintaining public order. Collective efficacy is made up of two concepts: social cohesion, which reflects mutual trust and a sense of belonging, and informal social control, or the willingness of individuals to intervene for the collective good. Therefore, collective efficacy is the combination of trust and ties between neighbors, shared values, and a willingness to take action based on these values to achieve collective goals, such as maintaining a safe and orderly environment. Although this theory was developed to explain the neighborhood social processes that influence variations in crime rates, it has also been argued that

collective efficacy generates feelings of connectedness and sense of purpose, both of which promote mental health for individuals (Kawachi & Berkman, 2001).

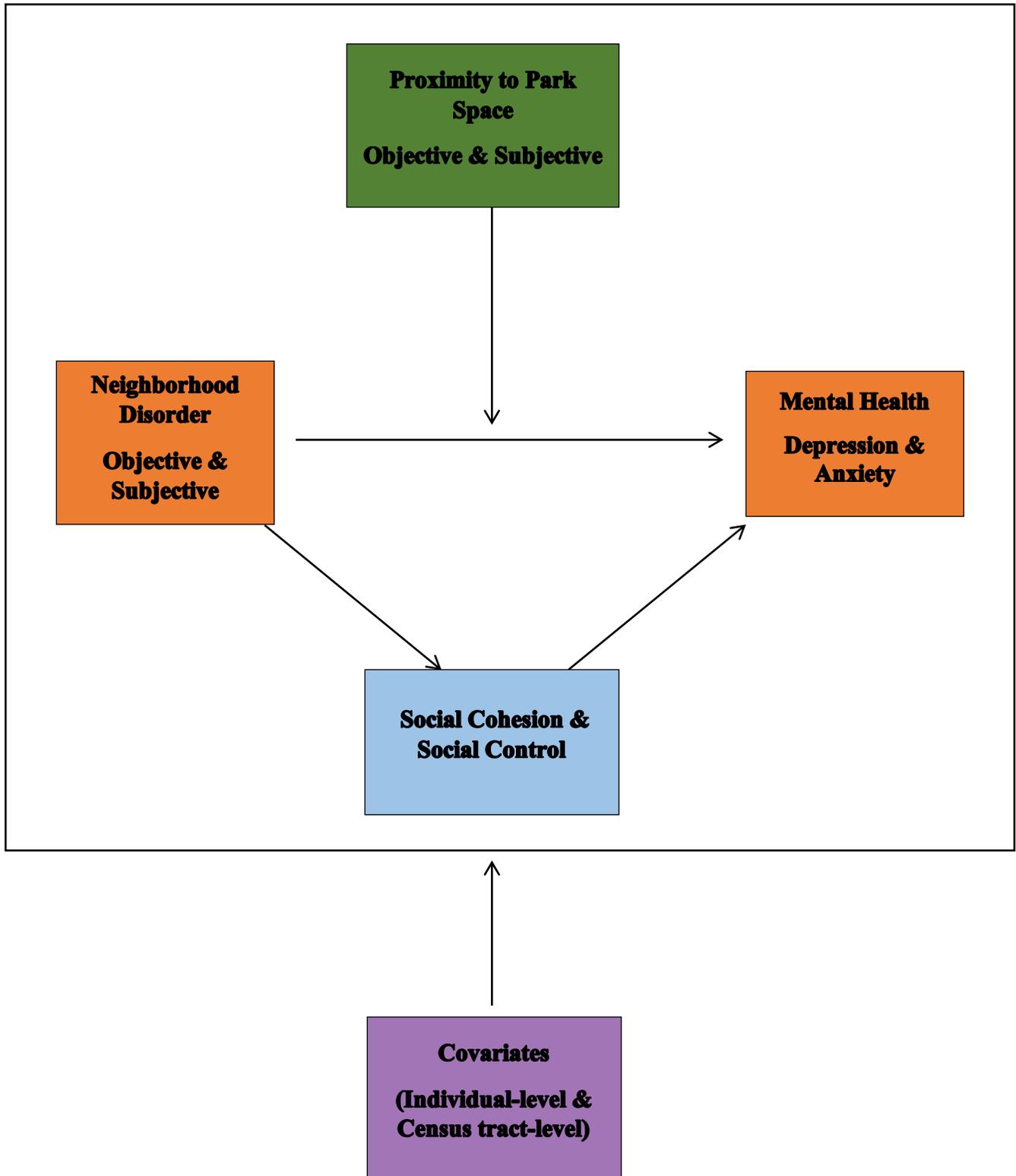
### **Conceptual Model for the Proposed Study**

For this dissertation proposal, I am adapting the Neighborhood Disorder and Mental Health Model (Wandersman & Nation, 1998) to include three additional variables – proximity to urban park space, social cohesion, and informal social control. Proximity to park space is being introduced as a moderator of the relationship between neighborhood disorder and mental health. Social cohesion and informal social control will be included as two separate mediating pathways between neighborhood disorder and mental health. See Figure 1 for a visual representation of the adapted conceptual model. It is important to note that this adapted model will not include the additional mediating pathways of crime and fear of crime hypothesized in the original model; I am only focusing on the direct relationship between neighborhood disorder and mental health, and introducing the previously mentioned additional variables to the model, while controlling for a variety of individual- and census tract-level confounding factors (e.g., age, race, and neighborhood SES). In the first version of the adapted model, I hypothesize that proximity to park space (using objective and subjective measures) will buffer the influence of neighborhood disorder on mental health. This hypothesis is rooted in Stress Recovery Theory and Attention Restoration Theory, which both articulate how contact with nature reduces stress and ultimately improves mental health (Gatersleben & Andrew, 2013; Kaplan 1995; Ulrich et. al., 1991). In the second adapted model, I hypothesize that social cohesion and informal social control will mediate the relationship between neighborhood disorder on mental health. This is based on theoretical and

empirical work demonstrating the protective effect of social ties and sense of belonging on mental health, particularly when individuals are exposed to stressors (Kawachi & Berkman, 2001; Sampson, Raudenbush and Earls, 1997).

I selected and adapted this model for the current study for a number of reasons. First, the model is relevant for urban neighborhoods specifically, which makes it a good match for the HANDLS sample of Baltimore City residents. Second, the signs of “neighborhood decline” noted as the independent variables in the original NDMH model clearly align with the Perceived Neighborhood Disorder Scale, the key predictor in this study. Third, the mental health outcomes in the original model – depression and anxiety – match the outcomes of interest in this study based on theory, prior research, and the measures available in the HANDLS dataset.

Figure 1. Conceptual Diagram of Adapted NDMH Model



## **CHAPTER 3: METHOD**

### **Data Source and Sample**

The proposed study is a secondary analysis of quantitative data from two data sources: (1) Wave 1 of the National Institute on Aging's (NIA) Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study, and (2) neighborhood-level indicators from the Baltimore Neighborhood Indicators Alliance (BNIA).

### **HANDLS**

The primary data source for the proposed study is Wave 1 of NIA's HANDLS research project. HANDLS is a 20-year prospective longitudinal study examining the biological, psychosocial, environmental, and demographic factors that contribute to health disparities among a sample of socioeconomically diverse African American and White adults in Baltimore City. A stratified sampling design based on age, sex, race, and socioeconomic status was used to recruit a representative sample of Baltimore City residents from 12 pre-determined census tract clusters. Data for Wave 1 were collected between August 2004 and February 2009, in two phases: (1) Household interviews using questionnaires pertaining to health status, psychosocial factors, neighborhood conditions, and demographics; and (2) Mobile medical research vehicles to conduct physical and cognitive evaluations, and gather laboratory measurements and medical history.

HANDLS excluded anyone who was pregnant, within six months of undergoing cancer treatment, or individuals who were multi-ethnic and did not primarily identify as either African American or White. Inclusion criteria included individuals between 30 to 64-years-old, ability to provide informed consent, ability to perform at least five

measures (e.g., dietary recall, medical history, physical exam), and possession of a valid picture ID.

### **BNIA-JFI**

I am using a previously linked dataset that combined HANDLS data with household- and neighborhood-level data maintained and stored by the Baltimore Neighborhood Indicators Alliance at University of Baltimore's Jacob France Institute (BNIA-JFI). BNIA-JFI obtains secondary data from various federal, state and local agencies such as the U.S. Census Bureau, Baltimore City Department of Housing, and the Enoch Pratt Free Library. Various neighborhood indicators of interest including park space coverage, crime rates, and percentage of vacant and abandoned housing units have already been merged with Wave 1 of the HANDLS dataset using geocoding to link HANDLS respondents' addresses to BNIA-JFI data.

### **Procedures**

The census tract-level data from BNIA has already been linked to the HANDLS data using census tract identifiers and addresses of HANDLS respondents. This process was conducted in multiple steps by a GIS analyst with BNIA-JFI: (1) HANDLS data were entered into a Geographic Information System (GIS), and plotted on a map using geocoding, which creates unique latitude and longitude coordinates for each HANDLS respondents' home address, (2) Euclidean distances were calculated from each household to neighborhood indicators (e.g., parks) within a given radius, and (3) Census tracts were identified for each HANDLS respondent's household.

### **Measures**

Table 1 provides a list of all variables and measures to be included in the proposed study, along with their corresponding data sources.

## **Mental Health Outcomes**

I assessed two mental health outcomes for this study – depression and anxiety. The HANDLS study measured depression and anxiety with two widely used and validated scales: (1) The Center for Epidemiologic Studies Depression scale (CES-D), and (2) The Psychiatric Diagnostic Screening Questionnaire subscale for Generalized Anxiety Disorder (PDSQ-GAD). Mental health data were collected with the mobile medical research vehicles. Both constructs were selected for inclusion in this analysis because the neighborhood environment and mental health literature commonly cites depression and anxiety as indicators of mental health (Echeverria et. al. 2008; Kawachi & Berkman, 2001; Mair, Roux & Morenoff, 2010). Additionally, these measures have demonstrated validity and reliability across samples.

**Depression.** Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D). This is a 20-item self-report scale designed to measure depression symptoms experienced within the past week. The measure was developed to assess depression symptomology for the general population, and includes six subscales of symptoms – depressed mood, guilt and worthlessness, helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance. Questions ask respondents how often within the past week they have experienced a variety of depressive symptoms. Response options range from 0 to 3 (0 = Rarely or none of the time, 1 = Some or little of the time, 2 = Occasionally or a moderate amount of time, 3 = Most or all of the time), and total scores range from 0 to 60, with higher scores indicating increased depressive symptoms.

The CES-D has been widely used and validated across a variety of samples. A systematic review of 28 studies testing the validity of the CES-D for screening depression

in the general population concluded that the measure has good sensitivity (83%, 95% CI .75-.89) and specificity (78%, 95% CI .71-.83) when using a cut-off score of > 20 as identifying clinically depressed individuals (Vilagut, Forero, Barbaglia, & Alonso, 2016). However, other studies have applied a cut-off score of >16 to distinguish individuals as depressed versus not depressed (Radloff & Teri, 1986). The scale displays high internal consistency across studies, with Cronbach's alpha ranging from .85 to .90 (Radloff, 1977), and high concurrent validity when comparing with other measures of depression (Gorkiewicz & Chmiel, 2015). Internal consistency is very high with this study sample (Cronbach's  $\alpha = .91$ ).

**Anxiety.** Anxiety was measured using the Psychiatric Diagnostic Screening Questionnaire subscale for Generalized Anxiety Disorder (PDSQ-GAD). The full PDSQ is a 90-item self-report screening instrument for the 13 most common DSM-V Axis 1 disorders. It was designed as a diagnostic tool for use in outpatient and mental health settings. The PDSQ subscale for Generalized Anxiety Disorder is a ten-item measure asking respondents if they have experienced a variety of anxiety symptoms within the past six months. Response options include "no" (coded 0) and "yes" (coded 1), with total possible scores ranging from 0 to 10; higher scores indicate greater anxiety symptomology (Zimmerman & Mattia, 2001).

The complete PDSQ and all of its subscales have been widely tested and validated with a variety of samples. The Generalized Anxiety Disorder subscale has optimal sensitivity (90%) and specificity (50%) when using a cut-off score of > 7 for a GAD diagnosis (Zimmerman & Mattia, 2001). The subscale has moderate to high internal consistency (mean Cronbach's  $\alpha = .82$ ) with a sample of psychiatric outpatients

(Zimmerman & Mattia, 1999). Internal consistency is high with this study sample (Cronbach's  $\alpha = .89$ ).

### **Neighborhood Disorder**

Neighborhood disorder is the key predictor for all analyses in this study. Neighborhood disorder has been defined as a set of neighborhood characteristics that indicate physical and social neighborhood decline (Wandersman & Nation, 1998). According to Wandersman and Nation's (1998) Neighborhood Disorder and Mental Health Model, these characteristics include dilapidated and abandoned buildings, vandalism, litter, drug trade, gang activity, loitering, and crime. In this study, neighborhood disorder will be measured using a combination of subjective and objective indicators. Studies have shown that resident perceptions of neighborhood disorder and objective indicators (e.g., crime rates) are predictive of one another (Elo et al., 2010; Quillen & Pager, 2001; Sampson & Raudenbush, 2004), supporting the utility of perceived measures as a supplement to or replacement for objective measures.

**Perceived neighborhood disorder.** Resident perceptions of neighborhood disorder were measured using the Perceived Neighborhood Disorder scale, from HANDLS. These data were collected during the household interview phase of the HANDLS study. This is a 12-item scale that asks respondents how often they observe various signs of physical and social disorder in their neighborhood, including: graffiti, litter, abandoned cars, drug dealers, unemployed adults loitering, gang activity, misbehaving children, prostitution, abandoned buildings, broken windows, serious crime, and houses "not kept up". Response options range from never (coded "0") to very often (coded "4"). Scale scores are summed, with total possible scores ranging from 0,

indicating no signs of neighborhood disorder, to 48, indicating high frequency and prevalence of neighborhood disorder.

This scale was developed for the HANDLS study; therefore it has not been previously tested and validated. However, reliability with this sample is very high ( $\alpha = .92$ ).

**Objective indicators.** Objective indicators of neighborhood disorder from BNIA-JFI have been merged with Wave 1 of HANDLS using census tract identifiers. These indicators include property crime rates and percent vacant and abandoned properties, both measured at the census tract-level. Property crime rate was measured per 1,000 residents, and data were derived from the Baltimore Police Department. Percent vacant and abandoned properties is based on the percentage of residential properties, out of all properties, that meet the following criteria: uninhabitable and boarded up or open to the elements, designated as vacant in prior years, and if a multi-structure home, all units are vacant. These data were collected by the Baltimore City Department of Housing. In order to align census tract-level data as closely as possible with the timeframes for HANDLS data collection, HANDLS respondents who completed the study before 2007 have values for these census tract-level variables based on 2004 data; respondents who completed the study between 2007 and 2009 have census tract data from 2007.

### **Proximity to Park Space**

Proximity to park space is the first hypothesized moderator in this study, and will be measured using two different variables, one of which is a subjective assessment of park proximity, and one of which is an objective indicator. As with neighborhood

disorder, there is value in using both objective and subjective indicators of green space access/exposure, to corroborate findings across measures.

**Perceived proximity to park space.** A single item from the HANDLS study will be used to assess perceived proximity to park space. The question asked respondents whether there was a park or playground close to their home. Response options included yes (coded “1”) or no (coded “0”).

**Objective proximity to park space.** The percentage of park area within a quarter mile buffer of each HANDLS respondents’ household was calculated with a series of steps conducted by a GIS analyst at BNIA-JFI. First, a quarter mile buffer for each HANDLS household was determined. Then, Baltimore’s parks shapefile was merged with the HANDLS Wave 1 dataset. Next, the land area within a quarter mile buffer covered by park space was calculated by dividing total land area by area covered by park space. Values within this sample ranged from 0 to 57%.

### **Collective Efficacy**

The two mediators being tested – perceived social cohesion and informal social control – are components of collective efficacy. These scales were measured in the HANDLS study, during the household interview phase. The original Collective Efficacy scale was developed to measure a neighborhood’s ability to realize their common values and maintain effective social control over their environment (Sampson, Raudenbush, & Earls, 1997). For the purposes of this study, I examined each subscale as a separate construct.

**Perceived Social Cohesion.** Social cohesion was measured using the Perceived Social Cohesion scale. The subscale is a five-item measure of the respondent’s

perceptions of mutual trust with neighbors. Questions ask respondents how strongly they agree with the following statements: “people around here are willing to help their neighbors”, “this is a close-knit neighborhood”, “people in this neighborhood can be trusted”, “people in this neighborhood generally don’t get along with one another”, and “people in this neighborhood do not share the same values” (Sampson, Raudenbush, & Earls, 1997, p.920). Responses were on a five-point Likert-type scale ranging from 0 (strongly disagree) to 4 (strongly agree), and the last two items are reverse-coded. Scale scores are summative, with possible scores ranging from 0 to 20; higher scores indicate stronger social cohesion. This scale demonstrates good reliability with this sample (Cronbach’s  $\alpha = .83$ ).

**Informal Social Control.** Informal social control was measured using the Informal Social Control scale. The subscale is a five-item measure of the respondent’s belief in their neighbors’ willingness to intervene for the common good. Questions asked respondents how likely they thought their neighbors could be counted on to intervene in the following circumstances: if children skipped school, spray-painted graffiti, or disrespected adults, if a fight broke out in front of their house, and if their local fire station was facing budget cuts. Responses were on a five-point Likert-type scale ranging from 0 (very unlikely) to 4 (very likely). Scores were summed, ranging from 0 to 20, and higher scores indicate greater social control. Scale reliability was very good with this sample (Cronbach’s  $\alpha = .87$ ).

### **Covariates**

A number of individual- and census tract-level covariates were included in the analysis, to adjust for their potential influence on the key variables in the models.

**Individual-level.** First, I controlled for individual-level demographic variables that have been demonstrated to influence mental health outcomes, including age, race, sex, poverty status, and education (Alcock et. al., 2013; Gascon et. al., 2015; Elo et. al., 2009; Sugiyama et. al., 2016; White et. al., 2013). I also controlled for self-reported health status, which is linked to mental health (Benson, 2018; Golini & Edigi, 2016), and could potentially influence the relationship between green space and mental health (Tzoulas et al., 2007). Lastly, I included homeownership status, which has a known influence on perceptions of neighborhood conditions (Sampson & Raudenbush, 2004).

**Age.** Respondents' age is a continuous variable, ranging from 30 to 65 (mean = 48.6, SD = 9.2).

**Race.** Race is a dichotomous variable, with "White" coded as 0 and "African American" coded as 1.

**Sex.** Respondents identifying as male were coded 0, and individuals identifying as female were coded 1.

**Poverty status.** Poverty status was defined using the 2004 Federal Poverty Guidelines. Any individual living below 125% of the poverty line was considered poverty status (1) and all others were considered above poverty (0).

**Education.** Respondents' education is dichotomized to having a high school diploma or GED (coded as 1) or not (coded as 0).

**Homeownerships status.** This is a dichotomous variable in which respondents who own their homes were coded 1, and those who rent, stay with friends or family, and "other" were coded 0.

***Self-reported health status.*** Self-reported health status is a dichotomous variable; respondents who reported good, very good, or excellent health were categorized as 1, and those who reported poor or fair health were categorized as 0,

**Census tract-level.** Based on theory and previous literature, I will also include census tract-level covariates to adjust for their influence on my models. First, I will control for neighborhood socioeconomic status, which has a well-established association with neighborhood disorder, collective efficacy, and access to urban green spaces (Cagney, Browning, & Wen, 2005; Nutsford, Pearson & Kingham, 2013; Sampson, Raudenbush & Earls, 1997). Some studies have included variables reflecting racial composition, as it is related to perceptions of neighborhood disorder (Henderson et. al., 2005). I will include one census tract-level measure of racial composition – percent of the population that is African American within a census tract.

***Neighborhood SES.*** Neighborhood socioeconomic status is measured by the percentage of residents living below 125% of the Federal Poverty Level for each census tract in the sample.

***Racial Composition.*** This variable is measured as the percentage of residents who are African American within a census tract.

*Table 1. Measures and Data Sources*

<b>Category</b>	<b>Examples of Measures</b>	<b>Data Source</b>
Mental Health (Outcome Variables)	Depression: Center for Epidemiologic Studies Depression (CES-D) scale Anxiety: Psychiatric Diagnostic Screening Questionnaire – generalized anxiety (PDSQ-GAD)	HANDLS
Neighborhood Disorder (Independent Variable)	Perceived Neighborhood Disorder scale Objective indicators: Property crime rate; percent vacant and abandoned housing units	HANDLS BNIA-JFI
Green Space (Moderators)	Perceived proximity to neighborhood parks Percent of park space in quarter mile of household	HANDLS BNIA-JFI
Social Cohesion Informal Social Control (Mediators)	Perceived Social Cohesion subscale Informal Social Control subscale	HANDLS
Covariates	Individual-level characteristics: Age, race, sex, poverty status, education, homeownership status, self-rated health Census tract-level: Neighborhood SES; racial composition	HANDLS BNIA-JFI

### **Data Analysis**

All statistical analysis were conducted with Stata SE version 14.2. Analyses were conducted in multiple steps (explained in more detail in the next section): (1) Preliminary data analysis included assessing missing data patterns, assumption checking, and univariate and bivariate analyses for all variables of interest. (2) All latent constructs were tested for reliability (e.g., Cronbach’s alpha). (3) I tested hypothesis 1 by conducting multilevel random intercept models, to adjust for clustering of cases, taking into account individuals nested within census tracts and sampling stratification; I also included individual and census tract-level covariates to adjust for their influence on the

other variables in the model. (4) To test hypothesis 2, I created a series of interaction terms to examine the moderating influence of perceived and objective proximity to park space on the relationship between neighborhood disorder and mental health, adjusting for all covariates. I again used multilevel random intercept models. (5) In order to test hypothesis 3, I conducted multilevel mediation analyses using fixed effects, to examine whether social cohesion and informal social control mediate the relationships between neighborhood disorder and both mental health outcomes, adjusting for covariates.

### **Preliminary Analysis**

All data were examined for missing data patterns, and to determine the amount of cases with missing data on variables of interest. An examination of missing data for all variables of interest in the full sample (N = 2,707) indicated significant presence of missing data; only 58% of cases had complete data for all variables of interest. Further exploration revealed that 20% of the sample (n = 564) was missing on all PDSQ-GAD items (anxiety scale), and 76 cases were missing all CES-D items (depression scale). Little's MCAR test indicates that these data are not missing completely at random ( $\chi^2_{(6275)} = 7055, p < .001$ ). Communication with an NIA researcher involved with the HANDLS study revealed that some respondents were only surveyed on certain questions and scales depending on when they were interviewed; this was in part due to the long duration (5 years) of the data collection process for wave 1, and indicates that these data are in fact missing at random (N. Mode, personal communication, March 25, 2019).

In light of these findings, I determined which cases were missing on greater than 20% of items on any scale of interest (i.e., depression, anxiety, neighborhood disorder, social cohesion, and social control) and excluded them from the analysis (n = 686) (Schlomer, Bauman, & Card, 2010). Additionally, I used listwise deletion to exclude any

respondents missing on other variables of interest ( $n = 15$ ). This yielded a final analytic sample of  $N = 2,006$ . After removing these cases, total missing data was significantly reduced such that 96% of cases had complete data for all variables of interest. Bivariate analyses were conducted to compare excluded respondents to those retained in the final analytic sample on a number of key variables (see Table 2 for results). Respondents differed on a number of key variables. Most importantly, those who were excluded from the analytic sample experienced significantly more depressive symptoms ( $t = -3.3$   $p < .001$ ). Additionally, individuals living above the poverty line ( $\chi^2 = 7.2$   $p < .01$ ), respondents interviewed during the second interview period ( $\chi^2 = 37.7$ ,  $p < .001$ ), those reporting poor or fair health ( $\chi^2 = 16$ ,  $p < .001$ ), and those with less education ( $\chi^2 = 9.1$ ,  $p < .01$ ) were more likely to be excluded from the sample.

Table 2. Comparison of excluded cases from analytic sample on key variables

	Chi-square/ t	M(SD)/ N(%)	
		Included	Excluded
<b>Outcome variables</b>			
Depression	-3.3***	14.7 (11.3)	16.5 (11.7)
Anxiety	-1.2	3 (3.2)	3.3 (3.5)
<b>Independent variables</b>			
Perceived Neighborhood Disorder	-.05	21.3 (13.2)	21.3 (13.6)
Percent Park Space	.93	6.7 (8.9)	6.4 (8.3)
<i>Self-report of Park Nearby</i>	1.8		
No		227 (11.3)	57 (9.4)
Yes		1,779 (88.7)	552 (90.6)
Social Cohesion	2.5*	10.9 (4)	10.5 (3.9)
Informal Social Control	2.8	12.7 (5.2)	12.7 (5.2)
<b>Demographic Characteristics</b>			
Age	-2.0*	48.4 (9.2)	49.3 (9.2)
<i>Sex</i>	.00		
Male		875 (43.6)	305 (43.5)
Female		1,131 (56.4)	396 (56.5)
<i>Race</i>	1.5		
White		831 (41.4)	309 (44.1)
Black		1,175 (58.6)	392 (55.9)
<i>Poverty Status</i>	7.2**		
Above poverty		1,146 (57.1)	441 (62.9)
Below poverty		860 (42.9)	260 (37.1)
<i>Education</i>	9.1**		
No HS Diploma/GED		494 (24.6)	194 (30.7)
HS Diploma/GED or more		1,512 (75.4)	439 (69.3)
<i>Self-rated Health</i>	16***		
Poor/fair		502 (25)	230 (32.8)
Good/very good/excellent		1,504 (75)	471 (67.2)
<b>Interview Period</b>			
2004 - 2006	37.7***	1,114 (55.5)	295 (42.1)
2007 - 2009		892 (44.5)	406 (57.9)

**Univariate analysis.** Distributions for all continuous variables were examined to check for central tendency, variance, skewness, and kurtosis. All variables were generally normally distributed with skewness between 1 and -1 and kurtosis below 3. The only variable that was significantly skewed was objective proximity to parks (percent of park space within a quarter mile buffer); the distribution was positively skewed

(skewness = 2.03, kurtosis = 7.31), which is partially due to the high frequency of cases with values of 0 ( $n = 404$ ). I conducted various transformations, including log (+1), cube, and square root transformations, as well as dichotomizing the variable into “any park space” (1) versus “no park space” (0) in a quarter mile buffer. However, model results did not change as a result of these transformations, thus I used the original variable for ease of interpretation. Frequency distributions were calculated for all categorical variables. Most categorical variables had relatively equal distributions, with the exception of subjective park proximity: 88.7% of the sample reporting that they live close to a park or playground. See Tables 3 and 4 (in Chapter 4) for distributions of all key variables.

**Bivariate Analysis.** In order to examine relationships between all variables of interest, bivariate analyses were conducted. Analyses include chi-square tests, independent samples t-tests, and Analysis of Variance (ANOVA). Results of bivariate analyses between all key variables with depression and anxiety can be found in Table 5.

**Assumption testing.** The data were examined to determine whether all assumptions of multilevel linear regression are met. These assumptions include: non-problematic multicollinearity between variables, homoscedasticity, linearity between all continuous variables, and residuals are normally distributed (Tabachnik & Fidell, 2007). The assumption of independence of residuals does not need to be met when using multilevel modeling, as multilevel modeling techniques are designed to address this violation (Robson & Pevalin, 2016). I examined Tolerance and Variance Inflation Factors (VIF) to assess any problematic multicollinearity between variables. Using a conservative  $VIF > 2.5$  to indicate problematic collinearity (Allison, 2012), I found that

race (VIF = 2.76), racial composition (VIF = 3.4) percent of vacant and abandoned units (VIF = 5.04), and percent of owner-occupied units (VIF = 6.01) all appear to be highly collinear. Given that percent of vacant and abandoned units was an important predictor for my analyses, I excluded percent of owner-occupied units. However, I retained both race variables, as Allison (2012) suggests that high collinearity between covariates should not affect other variables of interest.

**Measurement Diagnostics.** Measurement diagnostics were conducted for all scales, to determine internal consistency with this sample. Internal consistency ranged from good to excellent, with the Perceived Social Cohesion Scale having the lowest reliability (Cronbach's  $\alpha = .83$ ) and the Perceived Neighborhood Disorder Scale demonstrating the highest reliability (Cronbach's  $\alpha = .92$ ).

### **Multivariate Analyses/Hypothesis Testing**

This study has three primary research aims and corresponding hypotheses, which were tested by conducting multivariate linear regression models, using multilevel modeling to adjust for individuals nested within census tracts. Additionally, all regression models were adjusted for the following individual and census tract-level covariates: age, sex, race, poverty status, education, self-rated health, homeownership status, racial composition, and neighborhood SES.

Aim 1: Examine the association between (subjective and objective indicators of) neighborhood disorder and two mental health outcomes (i.e., depression and anxiety) with a racially and socioeconomically diverse sample of urban residents.

Hypothesis 1: There is a negative association between neighborhood disorder and mental health, such that lower levels of neighborhood disorder are associated with better mental health outcomes, controlling for covariates.

This hypothesis was tested with two sets of multilevel random intercept models, one for each mental health outcome variable. I tested hypothesis 1 in two steps: (1) I tested the null model with no predictors and each outcome, to examine the unconditional Intraclass Correlation Coefficient (ICC). (2) I added all predictors, including the Perceived Neighborhood Disorder Scale and the two objective indicators of neighborhood disorder (e.g., census tract-level variables: property crime rate and percent of vacant housing), controlling for all individual and census tract-level covariates.

Aim 2: Explore the moderating role of two different measures of proximity to urban parks on the relationship between neighborhood disorder and two mental health outcomes (i.e., depression and anxiety).

Hypothesis 2a: Objective proximity to park space will moderate the relationship between neighborhood disorder and mental health, such that an increase in (objective) percent of park space within a quarter mile of respondents' homes will buffer neighborhood disorder's influence on mental health.

Hypothesis 2b: Subjective proximity to park space will moderate the relationship between neighborhood disorder and mental health, such that an increase in (subjective) park accessibility will buffer neighborhood disorder's influence on mental health.

The second set of analyses examined the moderating role of two different measures of proximity to urban parks on the relationship between neighborhood disorder

and two mental health outcomes. I built on the previous models from Research Aim 1. I tested hypothesis 2a and 2b by first creating two interactions terms (i.e., objective proximity to parks X neighborhood disorder, and subjective proximity to parks X neighborhood disorder). Then I ran four regression models, with each of these interactions terms treated as the predictor variable in separate models, for each outcome, controlling for covariates. I then compared results across all models, using the likelihood ratio test, to determine if the interaction terms significantly improved the model fit.

Aim 3: Examine whether social cohesion and social control mediate the relationship between neighborhood disorder and mental health outcomes.

Hypothesis 3a: Social cohesion will mediate the relationship between neighborhood disorder and mental health, such that neighborhood disorder influences mental health through levels of social cohesion.

Hypothesis 3b: Informal social control will mediate the relationship between neighborhood disorder and mental health, such that neighborhood disorder influences mental health through levels of informal social control.

The third set of analyses examined whether social cohesion and social control mediate the relationship between neighborhood disorder and two mental health outcomes. I used fixed effects multilevel mediation analyses to test hypotheses 3a and 3b in the following steps: (1) Establish the relationship between the predictor and the outcome, (2) test the relationship between the predictor and the mediator, (3) test the relationship between the mediator and the outcome, and (4) establish that the mediator mediates the relationship between the predictor and the outcome. In order to determine whether the

mediating variable significantly adds to the model, I bootstrapped the standard errors for all indirect, direct, and total effects and examined the confidence intervals of each (Preacher & Hayes, 2008).

## **CHAPTER 4: RESULTS**

This chapter presents results from all statistical analyses conducted with the final analytic sample (N=2,006). First, I present descriptive characteristics for key individual and census tract-level variables. Next, I provide the results of bivariate analyses examining the relationships between all key variables with my outcomes, depression and anxiety. Finally, findings from multivariate analyses are presented in order of my research aims, addressing each study hypothesis by outcome.

### **Descriptive Statistics**

#### **Individual characteristics**

Descriptive statistics for individual-level characteristics can be found in Table 3. Sample respondents ranged in age from 30 – 66, with an average age of 48 years old (SD = 9.2). As intended by the HANDLS sampling design, just over half of the sample was female (56%), black (59%), and living above 125% of the federal poverty line (57%). Respondents were nearly split along marital status as well, with 46% of the sample identifying as married or partnered, and the remainder either single, divorced or widowed. The majority of respondents (75%) obtained at least a high school diploma or GED, and 59.5% were either renters or staying with family or friends, with the remainder (40.5%) owning their home. Due to the long duration of the data collection period, I also examined when each respondent was interviewed; 55.5% of the sample was interviewed between 2004 and 2006, and the remainder of the sample was interviewed between 2007 to 2009.

Additionally, I examined descriptive statistics for other independent variables of interest, such as perceptions of the physical and social environment, and health indicators including my key outcomes, depression and anxiety. The primary independent variable

of interest, self-reported neighborhood disorder, ranged from 0 to 48, with average scores of 21.3 (SD = 13.2). For the social environment, on a 0 to 20 scale average scores were 10.9 (SD = 4) for social cohesion, and 12.7 (SD = 5.2) for informal social control. For the physical environment, the majority of respondents (89%) reported that they lived close to a park or playground. GIS mapping techniques were used to draw a quarter mile buffer around each respondents' household to determine the amount of park space within walking distance; values ranged from 0 to 56.8%, with a mean of 6.7% park space within a quarter mile of a respondent's home. When reporting on their physical health, 75% of respondents felt they were in good, very good, or excellent health. Regarding mental health, on a 0 to 60 scale, average depression scores were 14.7 (SD = 11.3). Using the standard cutoff of >16 to distinguish depression 39.5% of the sample (n = 792) would be considered depressed (Radloff & Teri, 1986). Using a >20 cut-off point as a clinical diagnosis for Major Depressive Disorder, 28.7% of the sample (n=575) would be considered to have MDD (Vilagut et. al., 2016). Anxiety scores ranged from 0 to 10, with an average of 3 (SD = 3.2). Based on a >7 cut-off score for a GAD diagnosis (Zimmerman & Mattia, 2001), 18.2% of the sample (n=364) would receive a GAD diagnosis.

Table 3. Descriptive Statistics for Individual-level Characteristics (N=2,006)

Variables	N(%) / M(SD)	Category/Range
<b>Outcomes</b>		
Depression (CES-D)	14.7 (11.3)	0 - 60
Clinical cut-off > 16	792 (39.5)	Depressed
Anxiety (PDSQ-GAD)	3 (3.2)	0 - 10
Clinical cut-off > 7	384 (18.2)	GAD Diagnosis
<b>Independent Variables</b>		
Perceived Neighborhood Disorder	21.3 (13.2)	0 - 48
Social Cohesion	10.9 (4)	0 - 20
Informal Social Control	12.7 (5.2)	0 - 20
Self-report of park nearby	1,779 (88.7)	Yes
Percent Park Space in ¼ mile buffer	6.7 (8.9)	0 – 56.8
Self-report Neighborhood Disorder	21.3 (13.2)	0 - 48
<b>Demographics/Covariates</b>		
Age	48.4 (9.2)	30 – 65.9
Sex	1,131 (56.4)	Female
Race	1,175 (58.6)	Black
Poverty Status	860 (42.9)	Below Poverty
Marital Status	920 (45.9)	Married/Partnered
Education	1,512 (75.4)	HS Dip/GED
Homeownership Status	813 (40.5)	Homeowner
Self-rated Health	1,504 (75)	Good/excellent
<b>Interview Period</b>	1,114 (55.5)	2004-2006

### Neighborhood characteristics

Neighborhood characteristics were obtained from the Baltimore Neighborhood Indicators Alliance for the 38 census tracts included in this sample (see Table 4). In order to gain an understanding of neighborhood conditions at the census tract-level, I examined descriptive statistics for objective neighborhood disorder indicators. Average property crime rates for each of the 38 census tracts ranged from 19 to 108 property crimes per 1,000 residents (M = 43.1, SD = 20.7). The percent of units considered vacant or abandoned within a census tract ranged from 0 to 35.5% (M = 7.2, SD = 7.9).

I also examined demographics characteristics and other census tract-level variables of interest. On average, 26% (SD = 11.1) of residents within a census tract were living below 125% of the federal poverty line. Additionally, the percentage of African Americans residing within a census tract ranged very widely, from .6% to 98.2%, with an average of 63% (SD = 36.9) across all census tracts. In 2010, the average median household income was \$36,938 (SD = 14,828), with median household income ranging widely from \$12,384 to \$87,619 across the 38 census tracts. The mean percentage of residents with a college degree within a census tract was 15% (SD = 14.3), with a range from 2.6% to 58.6%. Violent crime rates ranged from 5.3 to 42.6 with an average of 20 violent crimes per 1,000 residents (SD = 8.7).

*Table 4. Descriptive Statistics for Census Tract-level Characteristics (N=38)*

Variables	N(%) / M(SD)	Category/Range
<b>Independent Variables</b>		
% Vacant and Abandoned Units	7.2 (7.9)	0 – 35.5
Property Crime Rate (per 1,000)	43.1 (20.7)	18.7 – 107.7
<b>Demographics/Covariates</b>		
% Poverty	26.1 (11.1)	9 – 57.1
% African American	62.6 (36.9)	.6 – 98.2
Median Household Income (\$)	36,938 (14,828)	12,384 – 87,619
% College Degree	15.2 (14.3)	2.6 – 58.6
Violent Crime Rate	20.1 (8.7)	5.3 – 42.6
% Owner-Occupied Properties	59.7 (16)	21.9 – 84.2

### **Bivariate Analysis**

Results of bivariate analyses examining the associations between depression scores and all variables of interest can be found in Table 5. All individual-level variables except race and percent of park space were significantly associated with depression scores. Using a Pearson’s correlation, I found that an increase in age is associated with lower depression scores ( $r = -.07$ ,  $p < .001$ ), although the effect size was very small

indicating a weak relationship. An independent samples t-test was used to examine the relationships between all categorical variables and depression scores. Respondents' sex was associated with depression such that women had significantly higher depression scores than men ( $t = -3.7, p < .001$ ). Additionally, living below the poverty line ( $t = -8.2, p < .001$ ), being single or divorced versus married or partnered ( $t = 5.1, p < .001$ ), not having a high school diploma or GED ( $t = 7.8, p < .001$ ), renting or staying with family/friends versus owning a home ( $t = 9.6, p < .001$ ), and self-reporting poor or fair (versus good to excellent) health ( $t = 13.2, p < .001$ ) were associated with having higher depression scores. Percent of park space within a quarter mile buffer was not significantly associated with depression scores.

*Table 5. Bivariate Analysis between Key Variables and Depression Anxiety Scores*

Variables	Depression		Anxiety	
	Pearson r/ t	M(SD)	Pearson r/ t	M(SD)
<b>Individual-level</b>				
Perceived Neighborhood Disorder	.18***		.16***	
Social Cohesion	-.22***		-.17***	
Informal Social Control	-.15***		-.10***	
<i>Self-report of Park Nearby</i>	2.3*		2.1*	
No		16.3 (12.5)		3.4 (3.3)
Yes		14.5 (11.1)		2.9 (3.2)
% Park Space in ¼ Mile Buffer	.02		.04	
Age	-.07***		-.12***	
<i>Sex</i>	-3.7***		-5.2***	
Male		13.7 (10.2)		2.5 (3)
Female		15.6 (12)		3.3 (3.3)
<i>Race</i>	.23		3.2**	
White		14.8 (11.5)		3.2 (3.3)
Black		14.7 (11.1)		2.8 (3.1)
<i>Poverty Status</i>	-8.2***		-5.3***	

Table 5 Continued

Above poverty line		13 (10.6)	2.6 (3)
Below poverty line		17.1 (11.7)	3.4 (3.4)
<i>Marital Status</i>	5.1****		2.5**
Single/divorced		15.9 (11.6)	3.1 (3.3)
Married/partnered		13.4 (10.7)	2.8 (3.1)
<i>Education</i>	7.8****		6.3****
No HS Diploma/GED		18.1 (11.3)	3.7 (3.4)
HS Diploma/GED or above		13.6 (11)	2.7 (3.1)
<i>Homeownership Status</i>	9.6****		6.9****
Renter/other		16.7 (.34)	3.4 (.1)
Owner		11.9 (.35)	2.4 (.1)
<i>Self-rated Health</i>	13.2****		9.4****
Poor/fair		20.2 (12.6)	4.1 (3.5)
Good/very good/excellent		12.9 (10.2)	2.6 (3)
<b>Census Tract-level</b>	<b>Depression</b>		<b>Anxiety</b>
% Poverty	.24		.20
% African American	.07		.13
% Vacant and Abandoned Units	.15		.04
Property Crime Rate	.08		-.13

I used Pearson correlations and independent samples t-tests to examine the relationships between depression scores and perceptions of the neighborhood environment; all relationships were significant and weak to moderate. Self-report of living close to a park or playground was associated with lower depression scores ( $t = 2.3$ ,  $p < .05$ ). Perceived neighborhood disorder was positively associated with depression scores ( $r = .18$ ,  $p < .001$ ), indicating that greater incidences of perceived disorder within the neighborhood environment are associated with greater levels of depressive symptoms. Social cohesion and informal social control were both negatively associated with depression scores, indicating that increased perceptions of social cohesion ( $t = -.22$ ,  $p <$

.001) and social control ( $t = -.15, p < .001$ ) within the neighborhood are associated with fewer depressive symptoms. Analyses for all census tract-level variables, including objective neighborhood disorder indicators, yielded non-significant results.

Findings from bivariate analyses of key variables with anxiety scores can also be found in Table 5. The results of all bivariate tests were similar to those found for depression, although one notable difference was a significant association between race and anxiety. White respondents reported significantly higher anxiety compared to Black respondents ( $t = 3.2, p < .001$ ); White respondents had a mean anxiety score of .32 ( $SD = .33$ ) whereas Black respondents' mean anxiety score was .28 ( $SD = .31$ ). Age was negatively associated with anxiety, although this relationship was stronger than with depression ( $r = -.12, p < .001$ ). Among other demographic characteristics, findings were comparable to depression; living below the poverty line ( $t = -5.3, p < .001$ ), being single or divorced ( $t = 2.5, p < .001$ ), lower education ( $t = 6.3, p < .001$ ), renting or staying with family/friends ( $t = 6.9, p < .001$ ), and self-reporting poor or fair health ( $t = 9.4, p < .001$ ) were all associated with greater anxiety. As found with depression, percent of park space was not significantly associated with anxiety.

Relationships between perceptions of the neighborhood environment and anxiety were similar to those found with depression. As expected, subjective proximity to park space was associated with lower anxiety ( $t = 2.1, p < .05$ ). Self-reported neighborhood disorder was significantly and positively associated with anxiety ( $r = .16, p < .001$ ), which is consistent with bivariate findings for depression. Social cohesion ( $r = .17, p < .001$ ) and informal social control ( $r = -.10, p < .001$ ) were inversely associated with anxiety, indicating that as perceptions of social cohesion and informal social control

increase, experiences of anxiety symptoms decrease. Lastly, examinations of all census tract-level variables with anxiety resulted in non-significant associations.

### **Multivariate Analysis**

In this section, I present findings for my three research aims, organized first by aim and then by focal outcome.

#### **Research Aim 1: Examine the relationship between neighborhood disorder and two mental health outcomes – depression and anxiety.**

**Depression.** Table 6 presents the results of multilevel linear regression analyses which tested the relationship between perceived and objective neighborhood disorder measures and depression, adjusting for individual and census tract-level characteristics. First, I tested a null model (Model 1) to determine the amount of variance in depression scores accounted for at both the individual and census tract-level. The Intraclass Correlation Coefficient (ICC) was .023, indicating that 2.3% of the variation in depression can be explained by the differences between census tracts. Despite the small ICC, I proceeded with multilevel modeling to generate an accurate estimation of standard errors (Bickel, 2007). Results of the likelihood ratio test were significant ( $\chi^2 = 16.45$ ,  $p < .001$ ), suggesting that using a random intercept model can explain some of the variance in depression scores (Robson & Pevalin, 2016). According to the null model, the mean weighted depression score for the total sample is 14.7, on a 0 to 60 scale.

Table 6. Multilevel Random Intercept Models for Depression

Parameter	Model 1 Null Model			Model 2 Research Aim 1		
	B	SE	CI	B	SE	CI
Intercept	14.7***	.02	13.9, 15.4	24.2***	1.8	20.6, 27.8
<b>Predictors</b>						
Perceived Neighborhood Disorder				.11***	.02	.07 .15
% Vacant Units				-.00	.05	-.10, .09
Property Crime Rate				-.01	.02	-.04, .02
<b>Covariates</b>						
Age				-.08**	.03	-.13, -.03
Female				1.5***	.47	.58, 2.4
Black				.34	.78	-1.2, 1.9
Below Poverty				1.9***	.54	.85, 3.0
HS Diploma/GED				-2.5***	.56	-3.6, -1.4
Homeowner				-2.2***	.56	-3.3, -1.1
Good/Excellent Health				-6.0***	.56	-7.41 -4.9
% Poverty				-.04	.03	-.10, .01
% African American				-.02	.01	-.04, .01
<b>ICC</b>		.023		< .00		
Random Intercepts	B	SE	CI	B	SE	CI
Level 1 variance	124.1	4	116 - 132	108.2	3.4	102, 115
Level 2 variance	2.9	1.3	1.2 – 6.9	< .00	.00	.00, .00
AIC (df)	15399.3 (3)			15130.9 (13)		
BIC (df)	15416.1 (3)			15203.8 (13)		
<b>Likelihood Ratio Test</b>						
Reference Model	--			Model 1		
X <sub>x</sub> (df)	16.45***			304.4 (12)***		

Next, I added the main predictors, perceived neighborhood disorder, and two objective indicators of neighborhood disorder – percent of vacant and abandoned units, and property crime rates per census tract - as well as all individual- and census tract-level covariates to the model (Model 2). Improvements in Model 2’s AIC (10146.2) and BIC (10230.3) compared to Model 1, and a significant likelihood ratio test ( $\chi^2 = 232.5$ ,  $p < .001$ ), both indicated improved fit from Model 1 to Model 2. However, the ICC dropped to approximately 0, which suggests that adding the predictors and covariates to the model

largely eliminated the amount of explained variance due to the difference between census tracts. An examination of the random intercepts demonstrates that, while there is essentially no between-census tract variance, the variance between individuals within census tracts is estimated as 108.2, indicating that variance in the relationship between neighborhood disorder and depression is largely explained by individual-level differences.

As hypothesized, perceived neighborhood disorder was significantly and positively associated with depression ( $B = .11, p < .001$ ), even after controlling for a number of individual and census tract-level covariates. This finding indicates that a one-point increase in neighborhood disorder is associated with a .11 increase in depression scores. Both objective indicators of neighborhood disorder were not significant, suggesting that percent of vacant and abandoned units and property crime rates at the census tract-level are not associated with depression symptomology. Additionally, all individual-level covariates except race were significant predictors of depression. Age was negatively associated with depression ( $B = -.11, p < .001$ ) although this relationship was weak. Consistent with previously reported findings from bivariate analyses, identifying as female ( $B = .1.5, p < .01$ ) and living below the poverty line ( $B = 2.4, p < .001$ ) were associated with higher levels of depression. Also consistent with bivariate results, having a high school diploma or GED ( $B = -2.8, p < .001$ ), being a homeowner ( $B = -2.2, p < .001$ ), and self-reported good, very good, or excellent health ( $B = -6.3, p < .001$ ) were associated with lower levels of depression; these relationships were all relatively strong. All census tract-level covariates were not significantly associated with depression.

**Anxiety.** Findings from multilevel random intercept models for anxiety were similar to those found for depression (see Table 7). In the null model (Model 1), the ICC was .02, indicating that 2% of the variation in anxiety can be attributed to the differences between census tracts. Again, results of the likelihood ratio test were significant ( $\chi^2 = 12.1, p < .01$ ) supporting the continued use of a random intercept model. The constant for the null model was 2.9, which is the weighted mean anxiety score for the total sample, on a 0 to 10 scale.

In Model 2, I added the predictor, perceived neighborhood disorder, and two objective indicators of neighborhood disorder – percent of vacant and abandoned units, and property crime rates per census tract - as well as all individual and census tract-level covariates. The reduced AIC (10146.2) and BIC (10230.3) for Model 2 and a significant likelihood ratio test ( $\chi^2 = 232.5$ ) indicate improved model fit from Model 1 to Model 2. Consistent with Model 2 for depression, the ICC dropped to approximately 0, thus the majority of the variance explained by this model is between individuals within census tracts ( $SD_2 = 9.1$ ).

Table 7. Multilevel Random Intercept Models for Anxiety

Parameters	Model 1 Null Model			Model 2 Research Aim 1		
	B	SE	CI	B	SE	CI
Intercept	2.9***	.01	2.7, 3.1	6.3***	.54	5.2, 7.3
<b>Predictors</b>						
Perceived Neighborhood Disorder				.03***	.01	.02, .04
% Vacant Units				.01	.01	-.02, .03
Property Crime Rate				-.00	.00	-.01, .01
<b>Covariates</b>						
Age				-.04***	.01	-.05, -.02
Female				.65***	.14	.39, .92
Black				-.07	.22	-.51, .37
Below Poverty				.34*	.16	.03, .65
HS Diploma/GED				-.64***	.16	-.96 -.32
Homeowner				.48**	.16	-.79, -.16
Good/Excellent Health				-1.2***	.16	-1.5, -.91
% Poverty				-.01	.01	-.03, .00
% African American				-.01**	.00	-.02, -.00
<b>ICC</b>						
Random Intercepts		.02			< .00	
Level 1 variance	B	SE	CI	B	SE	CI
Level 2 variance	10.1	3.2	9.4, 10.7	9.1	.29	8.5, 9.7
AIC (df)	20.1	.10	.08, .52	< .00	.00	.00, .00
BIC (df)		10354.7 (3)			10146.2 (15)	
Likelihood Ratio Test		10371.5 (3)			10230.3 (15)	
Reference Model		--			Model 1	
X <sub>x</sub> (df)		12.1***			232.5 (12)***	

As hypothesized, perceived neighborhood disorder was significantly and positively associated with anxiety ( $B = .03, p < .001$ ). A one-point increase in neighborhood disorder is associated with .03-point increase in anxiety scores. Similar to depression, the two objective neighborhood disorder indicators were not significantly associated with anxiety scores. All individual-level covariates were significantly associated with anxiety, except race. Specifically, age had a negative association with anxiety ( $B = -.04, p < .001$ ) and this relationship was weak. Identifying as female ( $B =$

.65,  $p < .001$ ) and living below the poverty line ( $B = .34$ ,  $p < .05$ ) were associated with higher anxiety scores. Having a high school diploma or GED ( $B = -.64$ ,  $p < .001$ ), being a homeowner ( $B = .48$ ,  $p < .01$ ), and self-reported good, very good, or excellent health ( $B = -1.2$ ,  $p < .001$ ) were associated with lower levels of anxiety. Interestingly, one census tract-level covariate was significantly associated with anxiety – percent of African Americans residing in a census tract ( $B = -.01$ ,  $p < .01$ ). The effect size was very small, but this finding does suggest that racial composition within census tracts is associated with anxiety symptoms.

**Research Aim 2: Explore the moderating role of proximity to park space on the relationship between neighborhood disorder and mental health outcomes.**

**Depression.** Table 8 presents results of Models 3 and 4, both of which build upon the previous models by including moderators. Given the non-significant main effects of the two objective neighborhood disorder indicators – percent of vacant and abandoned units and property crime rates - I instead treated them as covariates rather than independent variables of interest. In Model 3, I created an interaction term between perceived neighborhood disorder and percent of park space within a quarter mile buffer of each respondent's household. By doing this, I tested whether objective proximity to park space moderated the established relationship between perceived neighborhood disorder and depression. The interaction term was not significant ( $B = .002$ ,  $p > .05$ ), indicating that objective proximity to park space does not moderate this relationship. Additionally, the results of the likelihood ratio  $\chi^2$  test were not significant ( $\chi^2 = 2.1$ ,  $p > .05$ ), which demonstrates that adding objective proximity to park space and the interaction term to the model does not significantly improve model fit compared to Model 2.

In Model 4, I created another interaction term between neighborhood disorder and self-report of living close to a park or playground, to examine whether subjective proximity to park space moderated the relationship between perceived neighborhood disorder and depression. Similar to Model 3, this interaction term was not significant ( $B = -.04, p < .05$ ), so I can conclude that subjective proximity to park space does not moderate this relationship. Consistent with Model 3, the non-significant results of the likelihood ratio chi-square test ( $\chi^2 = 1.8, p > .05$ ) demonstrate that adding this interaction term and perceived proximity to park space to the model did not improve model fit compared to Model 2.

Table 8. Random Intercept Models Testing Moderators for Depression

Parameters	Model 3 Research Aim 2			Model 4 Research Aim 2		
	B	SE	CI	B	SE	CI
Intercept	23.7***	1.6	20.5, 26.9	24.1***	.11	19.6, 28.5
<b>Predictors</b>						
Perceived Neighborhood Disorder	.11***	.03	.06, .16	.15**	.06	.04, .26
% Park Space	.03	.05	-.07, .12			
Interaction Term #1	.00	.00	-.00, .00			
Self-report of Park Nearby				.19	1.5	-2.8, 3.2
Interaction Term #2				-.04	.06	-.15, .07
<b>Covariates</b>						
Age	-.08**	.03	-.13, -.03	-.08**	.03	-.13, -.03
Female	1.5***	.47	.61, 2.5	1.5**	.47	.55, 2.4
Black	.32	.78	-1.2, 1.8	.34	.78	-1.2, 1.9
Below Poverty	1.9***	.54	.80, 2.9	1.9***	.54	.82, 3.0
HS Diploma/GED	-2.5***	.56	-3.6, -1.4	-2.5***	.56	-3.6, -1.4
Homeowner	-2.2***	.56	-3.3, -1.1	-2.3***	.56	-3.3, -1.2
Good/Excellent Health	-5.9***	.56	-7.0, -4.8	-5.9***	.56	-7.0, -4.9
% Poverty	-.04	.03	-.09, .01	-.04	.03	-.10, .01
% African American	-.02	.01	-.04, .00	-.02	.01	-.04, .00
% Vacant Units	-.00	.05	-.1, .1	-.00	.05	-.10, .09
Property Crime Rate	-.00	.02	-.03, .03	-.01	.02	-.04, .02
ICC		< .00			< .00	
Random Intercepts	Est.	SE	CI	Est.	SE	CI
Level 1 variance	108.1	3.4	101.6, 115	108.1	3.4	101.6, 115
Level 2 variance	< .00	.00	.00, .00	< .00	.00	.00, .00
AIC (df)		15120.9 (17)			15121.2 (17)	
BIC (df)		15216.1 (17)			15216.4 (17)	
<b>Likelihood Ratio Test</b>						
Reference Model		Model 2			Model 2	
X <sub>x</sub> (df)		2.1 (2)			1.8 (2)	

**Anxiety.** I tested the same moderators – objective and perceived proximity to park space

– by building on the existing random intercept models from Research Aim 1. Complete results are located in Table 9. In Model 3, I included the interaction term for perceived neighborhood disorder and percent of park space. As with my depression models, the interaction term was not significant ( $B = .001$ ,  $p > .05$ ), therefore I can conclude that objective proximity to park space does not moderate the relationship between

neighborhood disorder and anxiety. The likelihood ratio  $\chi^2$  test results ( $\chi^2 = 5.0, p > .05$ ) suggest that model fit did not significantly improve from Model 2 to Model 3 with the addition of the interaction term and objective proximity to park space variables.

*Table 9. Random Intercept Models Testing Moderators for Anxiety*

Parameters	Model 3			Model 4		
	Research Aim 2			Research Aim 2		
	B	SE	CI	B	SE	CI
Intercept	6.2***	.54	5.1, 7.2	6.5***	.66	5.3, 7.8
<b>Predictors</b>						
Perceived Neighborhood Disorder	.03***	.01	.02, .04	.03	.02	-.00, .06
% Park Space	.01	.01	-.02, .04			
Interaction Term #1	.00	.00	-.00, .00			
Self-report of Park Nearby				-.32	.45	-1.2, .55
Interaction Term #2				.00	.02	-.03, .03
<b>Covariates</b>						
Age	-.04***	.01	-.05, -.02	-.04***	.01	-.051, -.02
Female	.67***	.14	.40, .93	.65***	.14	.38, .91
Black	-.07	.22	-.51, .37	-.07	.22	-.51, .37
Below Poverty	.32*	.16	.01, .63	.33*	.16	.02, .64
HS Diploma/GED	-.63***	.16	-.95, -.32	-.63***	.16	-.94, -.31
Homeowner	-.46**	.16	-.77, -.14	-.48**	.16	-.80, -.16
Good/Excellent Health	-1.2***	.16	-1.5, -.89	-1.2***	.16	-1.6, -.91
% Poverty	-.01	.01	-.03, .00	-.02	.01	-.03, .00
% African American	-.01**	.00	-.02, .00	-.01**	.00	-.02, -.00
% Vacant Units	.01	.00	-.02, .03	.01	.01	-.02, .03
Property Crime Rate	-.00	.00	-.01, .01	-.00	.00	-.01, .01
ICC		< .00			< .00	
Random Intercepts	Est.	SE	CI	Est.	SE	CI
Level 1 variance	9.0	.29	8.5, 9.6	9.1	.29	8.5, 9.6
Level 2 variance	< .00	.00	.00, .00	< .00	.00	.00, .00
AIC (df)		10145.2 (17)			10148.7 (17)	
BIC (df)		10240.5 (17)			10243.9 (17)	
Likelihood Ratio Test						
Reference Model		Model 2			Model 2	
$\chi^2$ (df)		5.0 (2)			1.5 (2)	

In Model 4, I included the interaction term between neighborhood disorder and subjective proximity to park space. Once again, the interaction term was not significant ( $B = .004, p > .05$ ), demonstrating that perceived proximity to park space does not moderate the relationship between neighborhood disorder and anxiety. The non-significant likelihood ratio test ( $\chi^2 = 1.5, p > .05$ ) further supports that there is no improvement in model fit by including this interaction term or the perceived park proximity variable.

**Research Aim 3: Examine whether social cohesion and social control mediate the relationship between neighborhood disorder and mental health outcomes.**

**Depression.** The results of multilevel mediation analyses for depression are located in Table 10 and Figure 2. According to Barron and Kenny (1986), in order to test for mediation, one must take the following steps: (1) Establish the relationship between the predictor and the outcome, (2) test the relationship between the predictor and the mediator, (3) test the relationship between the mediator and the outcome, and (4) establish that the mediator mediates the relationship between the predictor and the outcome. Based on more recent research, Preacher and Hayes (2008) encourage testing multiple mediators in the same model rather than in separate simple mediation models as this allows for detection of any indirect effects in the presence of other key variables. The two mediators in this study, social cohesion and informal social control, are closely related to one another conceptually, therefore testing both mediators simultaneously provides a more accurate picture of direct and indirect effects of my outcomes. Here I will discuss my findings first for social cohesion as a mediator (Mediator 1), and then informal social control as a mediator (Mediator 2) of the relationship between neighborhood disorder and depression, controlling for individual-level characteristics.

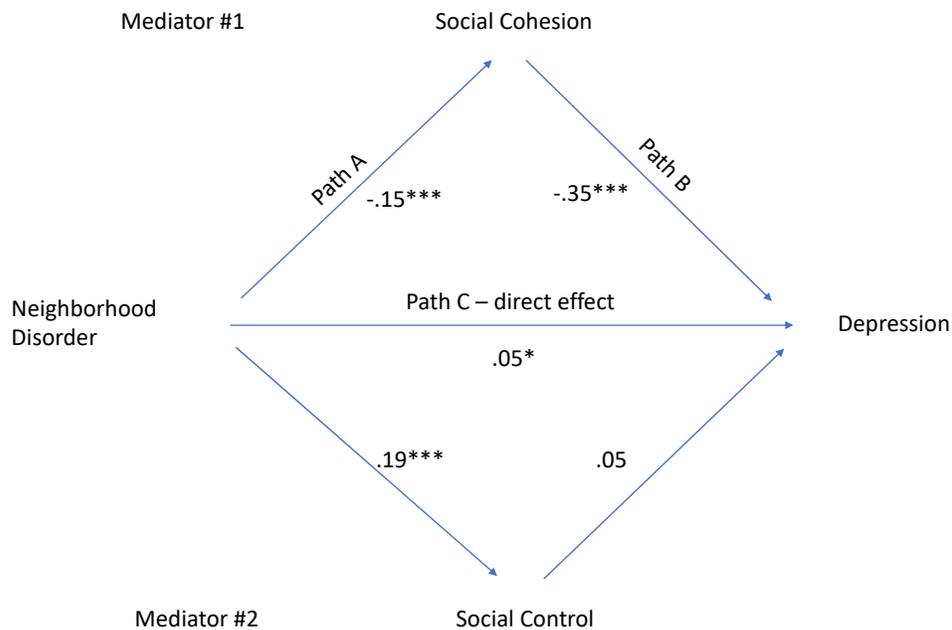
Table 10. Multilevel Mediation Analyses for Depression

	Direct Effects		Indirect Effects		Total Effects	
	B	CI	B	CI	B	CI
<b>Mediator 1 (Social Cohesion)</b>						
ND → Depression	.05*	.01, .00	.05***	.03 .08	.10***	.06, .14
ND → SCoh	-.15***	-16, -.13				
SCoh → Depression	-.35***	-.51, -.19				
<b>Bootstrapped SEs</b>	.05*	.00, .10	.05***	.03, .07	.10***	.05, .16
<b>Mediator 2 (Social Control)</b>						
ND → Depression	.05*	.01, .00	-.01	-.03, .01	.04	-.00, .08
ND → SCont	-.19***	-.21, -.18				
SCont → Depression	.05	-.07, .17				
<b>Bootstrapped SEs</b>	.05*	.00, .10	-.01	-.04, .02	.04	-.01, .09
<b>Variance Components</b>						
	Variance	CI				
Social Cohesion	10.3	9.7, 10.9				
Social Control	19.0	17.9, 20.3				
Depression	107.4	101, 114				
Census Tract	.57	.30, 1.1				

The direct effect of perceived neighborhood disorder (Path C) on depression was significant and positive ( $B = .05$ ,  $p < .001$ ), which is consistent with previous models presented in this paper and other studies. Next, I examined the indirect effects of paths A (IV → mediator) and B (mediator → DV). The relationship between perceived neighborhood disorder and social cohesion was significant and negative ( $B = -.15$ ,  $p < .001$ ), indicating that greater perceptions of neighborhood disorder are associated with lower levels of self-reported social cohesion. Then I examined the relationship between social cohesion and depression, and again found a significant negative relationship ( $B = -.35$ ,  $p < .001$ ) such that lower social cohesion was associated with greater depression. In

the final step, I tested the full mediation model by calculating the indirect and total effects for all variables in the model. The indirect effect or the product of Paths A and B was significant ( $B = .05, p < .001$ ) indicating the presence of mediation. The total effect ( $B = .10, p < .001$ ) was significant, which represents the product of Paths A and B plus Path C. A calculation of the proportion mediated represents the ratio of the total effect to the indirect effect of the mediator (Avanth, 2019). This ratio ( $.10/.05$ ) indicates that half of the total effect of neighborhood disorder on depression was mediated by social cohesion. In order to determine whether the mediating variable significantly adds to the model, I bootstrapped the standard errors for all indirect, direct, and total effects and examined the confidence intervals of each (Preacher & Hayes, 2008). Consistent with previously stated results, the direct effect of neighborhood disorder ( $B = .05, p < .05$ ), the indirect effect of social cohesion ( $B = .05, p < .001$ ), and the total effect ( $B = .10, p < .001$ ) were all significant.

Figure 2. Multiple Mediation Model for Depression



Following the same steps, I tested the mediating role of informal social control (Mediator 2). Having already established that perceived neighborhood disorder was significantly associated with depression, I examined the relationship between neighborhood disorder and social control and had similar findings as with Mediator 1; greater perceived neighborhood disorder was significantly associated with lower social control ( $B = -.19, p < .001$ ). Next, I examined the relationship between social control and depression and found non-significant results ( $B = .05, p > .05$ ). As one would expect, given the results of the prior step, the full mediation model also yielded non-significant findings ( $B = .04, p > .05$ ) indicating that informal social control does not mediate the relationship between neighborhood disorder and depression. An examination of the bootstrapped standard errors for all effects confirmed these findings.

**Anxiety.** Results for multilevel mediation analyses with anxiety as the outcome can be found in Table 11 and Figure 3. Following the aforementioned steps, I tested both mediators (social cohesion and informal social control) in the same model, to determine whether each mediates the relationship between perceived neighborhood disorder and anxiety, controlling for individual-level characteristics. I will first discuss the results of social cohesion, followed by the results for informal social control.

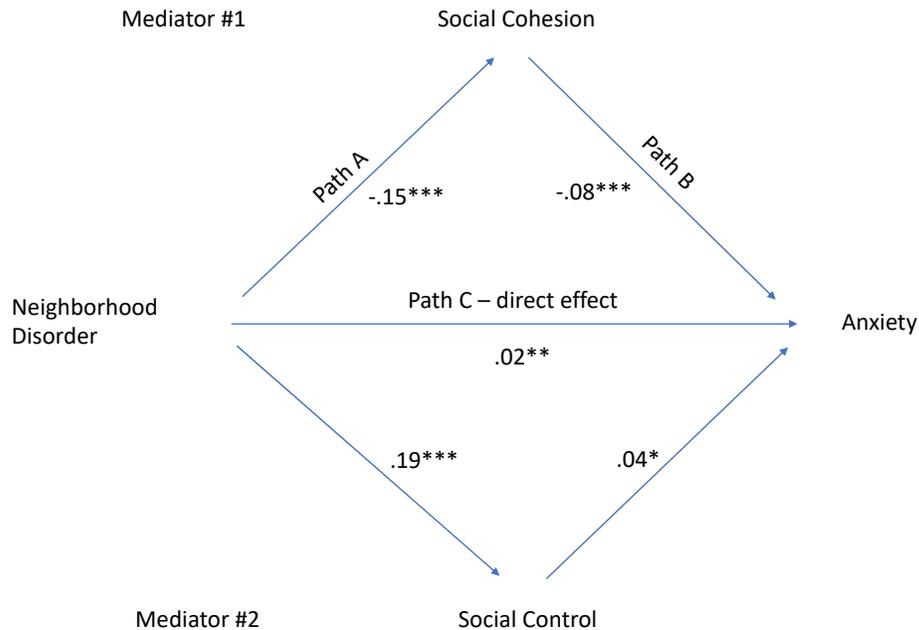
Table 11. Multilevel Mediation Analyses for Anxiety

	Direct Effects		Indirect Effects		Total Effects	
	B	CI	B	CI	B	CI
<b>Mediator 1 (Social Cohesion)</b>						
ND → Anxiety	.02**	.01, .03	.01***	.00, .02	.03***	.02, .04
ND → SCoh	-.15***	-.16, -.13				
SCoh → Anxiety	-.08***	-.12, -.03				
<b>Bootstrapped SEs</b>	.02**	.01, .03	.01**	.00, .02	.03***	.02, .05
<b>Mediator 2 (Social Control)</b>						
ND → Anxiety	.02**	.01, .03	-.01*	-.01, -.01	.01*	.00, .03
ND → SCont	-.19***	-.21, -.18				
SCont → Anxiety	.04*	.00, .07				
<b>Bootstrapped SEs</b>	.02**	.01, .03	-.01*	-.01, .00	.01	-.00, .03
<b>Variance Components</b>						
	Variance	CI				
Social Cohesion	10.3	9.7, 10.9				
Social Control	19.0	17.9, 20.3				
Anxiety	9.1	8.5, 9.7				
Census Tract	.57	.30, 1.1				

The direct effect of perceived neighborhood disorder on anxiety (Path C) was significant and positive ( $B = .02, p < .01$ ). The indirect effect for Path A (IV → mediator) was identical to the prior set of models ( $B = -.15, p < .001$ ) as this represents the relationship between perceived neighborhood disorder and social cohesion. The indirect effect of Path B (mediator → DV) indicates that social cohesion is significantly associated with anxiety ( $B = -.08, p < .01$ ), such that lower levels of social cohesion are associated with greater anxiety symptomology. Examining the full mediation model, the significant indirect effect ( $B = .01, p < .001$ ) indicates mediation. Additionally, the total effect was significant ( $B = .03, p < .001$ ). By calculating the proportion mediated ( $.03/.01$ ), I found that one third of the total effect of perceived neighborhood disorder on

anxiety was mediated by social cohesion. After examining the bootstrapped errors, all of these findings remain significant.

Figure 3. Multiple Mediation Model for Anxiety



Following the same steps as above, I tested the mediating role of informal social control. Having already established the direct effect of neighborhood disorder on anxiety, I examined the indirect and total effects in the model. The indirect effect of Path A (IV -> mediator) was significant ( $B = -.19, p < .001$ ), indicating that lower levels of perceived neighborhood disorder predict greater perceived informal social control. The indirect effect of Path B (mediator -> DV) was also significant ( $B = .04, p < .05$ ), but not in the expected direction, suggesting that greater perceived informal social control predicts greater anxiety symptomology. Lastly, the significant indirect effect ( $B = -.01, p < .05$ ) indicates the presence of mediation, which differs from my findings with depression as the outcome. The total effect was no longer significant after bootstrapping the standard errors for all effects ( $B = .01, p > .05$ ), although the other effects remained

significant. The proportion mediated (ratio of total effect to indirect effect) was 0, which would typically indicate non-significant mediation. However, in this case the proportion mediated represents the opposing directions of the indirect ( $B = -.01$ ) and total effects ( $B = .01$ ). Kenny (2018) refers to this as inconsistent mediation, and notes that in such cases, the mediator often acts as a suppressor variable by reducing the size of the total effect. Given that the indirect effect was significant after bootstrapping ( $B = -.01$ ,  $p < .05$ ), I can conclude that informal social control mediates the relationship between neighborhood disorder and anxiety, but not in the hypothesized direction.

## **CHAPTER 5: DISCUSSION**

In this final chapter, I discuss my study findings for my research aims, addressing each study hypothesis sequentially. I present these findings within the context of the broader empirical and theoretical literature. Next I describe the study's strengths and limitations, as well as how these limitations influence the implications. Based on these findings, I present implications for theory, future research, and social work policy and practice. I conclude with a discussion of lessons learned and key takeaways.

### **Study Findings**

The stratified sampling design for the HANDLS study yielded nearly equal representation from men and women, black and white individuals, and people living above and below 125% of the Federal Poverty Line. According to 2010 U.S. Census data, 29.6% of Baltimore City residents were white, and 63.7% were black or African American (U.S. Census, 2018). Additionally, 52.9% of the population was female and 28.8% of residents were living below 125% of the poverty level (U.S. Census Bureau, 2012). Comparing these figures indicates that this sample had a significantly higher proportion of black participants, lower proportion of white participants, and a higher proportion of individuals living below the poverty level compared to Baltimore City as a whole. Additionally, this sample was less educated than Baltimore residents, with 75% of study participants having earned a high school diploma or GED, compared to 84.2% of all city residents. In general, vulnerable populations were overrepresented in this sample as intended by the HANDS study.

Focusing on the outcome variables for this study, CES-D scores for this sample were higher when compared to the general population. According to Radloff and Teri (1986), the general population had an average score of 9, and 21% of patients scored

above 16, the standard cut-off point for depression, compared to this sample which reported a mean of 14.7 (SD = 11.3), with 39.5% of respondents above the same cut-off. A comparison with more recent studies has demonstrated this sample to be within a typical range, with mean scores ranging from 8 with an older adult sample (Cole, Kawachi, Maller & Berkman, 2000) to 19 among a sample of Baltimore residents living in high drug use neighborhoods (Latkin & Curry, 2003). However, the prevalence of respondents scoring above the 16-point cut-off appears to be higher when compared to other studies (Elo et. al. 2009; Head et al., 2013). Presence of Generalized Anxiety Disorder was slightly higher in this sample compared to other studies, with 18.2% of this sample meeting the criteria for a GAD diagnosis, compared to 17.5% of psychiatric outpatients in one sample (Zimmerman & Mattia, 2001) and 12.4% in another sample (Zimmerman & Mattia, 2001).

### **Research Aim #1**

Hypothesis 1 – There is a negative relationship between neighborhood disorder and mental health, such that lower levels of neighborhood disorder are associated with better mental health outcomes, adjusting for covariates.

Findings from multilevel random effects models partially confirmed Hypothesis 1. Consistent with prior research and theory, perceived neighborhood disorder was found to have a significant and negative relationship with both mental health outcomes, controlling for a number of individual and census tract-level covariates. More specifically, perceived neighborhood disorder predicted depression such that for every 1-point increase in the Perceived Neighborhood Disorder Scale, there is a .11-point increase in CES-D scores and .03-point increase in the PDSQ-GAD. These findings indicate that

greater perceived frequency of observable signs of neighborhood disorder is associated with increased depressive and anxiety symptoms among this sample. In both cases, the coefficients were rather small, especially that of anxiety ( $B = .03$ ), indicating modest effect sizes. Bivariate analyses indicate that white respondents ( $t = 2.8, p < .01$ ), and those living below the poverty line ( $t = -7.9, p < .001$ ) reported higher levels of neighborhood disorder, suggesting that perceived disorder may be conflated with race and income.

Due to the fact that the Perceived Neighborhood Disorder Scale used in this study has not been previously tested or validated, I am unable to make direct comparisons between this sample and others. However, I was able to locate other studies that used similar measures (Elo et. al., 2009; Mair, Diez Roux, & Morenoff, 2010), and comparison to these studies suggests that perceived disorder was relatively high with this sample. On a 0 to 48 scale, the mean score for this sample was 21.3 ( $SD = 13.2$ ), indicating that the average respondent did observe various signs of neighborhood disorder, although neither rarely nor frequently. In contrast, a study of 3,988 low-income, inner-city women in Philadelphia (Elo et. al., 2009) reported a mean score of 18.2 ( $SD = 12.8$ ) on a 0 to 50 scale, measuring physical disorder with frequency of resident observations of litter, graffiti, abandoned cars, vacant buildings, and houses not kept up. It is worth noting that higher scores on a perceived neighborhood disorder scale could either indicate objectively greater levels of disorder within the neighborhood, or more negative perceptions of disorder based on expectations of how a neighborhood should look.

Other studies exploring the relationship between neighborhood disorder and depression with multivariate models have reported similar results. Using multilevel

regression, Ross (2000) found perceived neighborhood disorder positively predicted depression ( $B = .299, p < .001$ ) among a probability sample of Illinois residents from the 1995 Community, Crime, and Health Survey. Kim (2010) employed SEM with the same sample, and reported that neighborhood disorder positively predicted depression ( $B = .222, p < .001$ ), controlling for similar demographic characteristics. Both of these studies used a shortened version of the CES-D, measured on a slightly different scale, thus unstandardized coefficients are not directly comparable.

While studies examining the association between perceived neighborhood disorder and depression were ubiquitous in the literature (Mair et. al., 2008), there was much less documented evidence of an association between disorder and anxiety. I was able to locate one study that used multilevel modeling techniques to examine the relationship between perceived neighborhood disorder and both depression and anxiety among a sample of youth with perinatal HIV in New York City (Kang et. al., 2011). Results from final models indicated that neighborhood disorder was significantly associated with anxiety and depression, but after controlling for gender and age, depression became non-significant. Their findings suggest that the association between perceived disorder and depression can be partially attributed to gender and age, whereas my study controlled for both of these variables (among many others) and still yielded significant results. The differences between samples may provide an explanation for the divergent findings; the HANDLS study consists of middle to older adults (30 to 64 years old), whereas the other study (Kang et. al., 2011) sampled youth between the ages of 9 to 16 years old. Perhaps the association between perceptions of disorder and depressive symptoms is simply not as strong among youth as with older adults because children and

adolescents do not internalize signs of disorder at the same magnitude or in the same way as adults. Considering that both studies found a significant association between perceived disorder and anxiety, but not depression, seems to indicate that the ways in which perceived disorder relates to different mental health outcomes may differ by population, in this case age group.

The variance components from depression and anxiety models indicated that nearly all of the variance in depression and anxiety scores was between individuals within census tracts, rather than between census tracts. This finding is comparable to one study that used multilevel modeling, and reported an individual-level variance of 1.163 ( $p < .001$ ), and a census tract-level variance of .001 ( $p > .05$ ). A larger within-census tract (or Level 1) variance suggests that the variation in depression and anxiety scores can largely be accounted for by differences between individuals, and not differences between census tracts. This finding suggests that there is very little “neighborhood effect” on depression and anxiety among the census tracts in this sample. One plausible explanation for this finding is the use of census tracts as a proxy for neighborhoods; given that census tracts are not meaningful boundaries for residents, it is likely that any “neighborhood effects” would not be accounted for using census tracts. Additionally, census tracts are rather large geographical units that may intersect multiple neighborhood boundaries. Given that the Perceived Neighborhood Disorder Scale measures respondents’ observations of their neighborhood’s conditions, there is a mismatch between this measure and the grouping variable (i.e., census tract). Lastly, it is possible that variations in depression and anxiety scores are primarily due to differences between individuals in this sample.

This limitation in my ability to accurately capture neighborhood effects may also partially explain why both objective indicators of neighborhood disorder – percent of vacant housing units within a census tract and property crime rates per 1,000 residents within a census tract – were not significant predictors of depression or anxiety. Compared to other studies, census tracts included in this sample had higher levels of objective neighborhood disorder. Based on 2000 Census data, Elo and colleagues (2009) reported an average of 6.9% vacant buildings and an average burglary rate of 19.6 per 1,000 residents for census tracts in their sample. Although percent of vacant units was comparable in this sample at 7.2%, the property crime rate was much greater (43.1 per 1,000 residents) in comparison. The only study that included objective neighborhood disorder measures at the neighborhood-level (Mair, Diez Roux, & Morenoff, 2010) reported significant associations between these measures and depression; however, the associations became non-significant after adjusting for individual-level factors, which is consistent with my findings.

These findings suggest that objective measures of neighborhood disorder do not predict mental health outcomes as well as subjective measures, such as the Perceived Neighborhood Disorder Scale used in this study. This makes sense considering that subjective measures represent resident perceptions of the neighborhood environment; if a resident perceives the neighborhood to be dangerous or disordered, it would stand to reason that self-report of depressive and anxiety symptoms might be higher as well. On the other hand, an objective indicator of disorder, such as percent of vacant and abandoned units within a census tract, might be experienced and perceived differently, depending on expectations, or where one lives in relation to the vacant units in that

census tract, for instance. Similar findings have been reflected in other studies examining the associations between neighborhood disorder and cognition among older adults (Lee & Waite, 2018), perceived versus objective measures of crime and physical activity (van Bakergen et. al., 2017), and neighborhood conditions and self-rated health among older adults (Weden et. al., 2008). Taken together, these findings demonstrate that subjective measures of the environment tend to be more closely linked to various health outcomes than objective measures. However, other studies have shown that subjective reports of the neighborhood environment are strongly associated with objective, area-level indicators (Elo et. al., 2009; Sealy-Jefferson et. al., 2017), which supports the utility in including both, especially when objective measures are thoughtfully constructed.

In the first set of models with depression, all individual-level characteristics were significant predictors of depression except race. This is consistent with some studies (Mair, Diez Roux, & Morenoff, 2010; Ross, 2000), yet contradicts findings from other studies (Beyer et. al., 2014), which demonstrated an association between race or ethnicity and depression. Interestingly, while racial composition at the census tract-level did not significantly predict depression, it was significantly associated with anxiety ( $B = -.01, p < .01$ ). Although the coefficient was very small, it suggests that an increase in the percent of African American residents within a census tract is associated with decreased anxiety symptoms. This finding makes sense, given that bivariate analyses indicated black respondents had lower anxiety scores ( $M = 2.8$ ) compared to white respondents ( $M = 3.2$ ). This finding was consistent with another study which examined racial and ethnic differences in neighborhood disorder and anxiety (Coman & Wu, 2017). Using a sample of black and white women from Texas, the authors reported that black women overall

reported lower levels of anxiety symptoms compared to white women, controlling for a variety of factors.

Other individual-level covariates were in the expected directions and mostly consistent with prior literature. Older age was associated with fewer depressive and anxiety symptoms (30 – 66 years old,  $M = 48$ ,  $SD = 9$ ). These findings are reflected in other studies that show declines in depressive and anxiety symptoms moving from early and middle to later adulthood (Blazer & Hybels, 2005; Wang et. al., 2017). Being female and living below poverty status were associated with increased depressive and anxiety symptoms, consistent with prior research (Latkin & Curry, 2003; Mirowsky, 1996; Ross, 2000). Lower educational attainment, renting versus owning, and reporting poor or fair health predicted greater anxiety and depressive symptoms, as has been documented previously (Mair et. al., 2008).

### **Research Aim #2**

Hypothesis 2a – Objective proximity to park space will moderate the relationship between neighborhood disorder and mental health, such that an increase in percent of park space within a quarter mile of respondents’ homes will buffer neighborhood disorder’s influence on mental health.

Hypothesis 2b - Perceived proximity to park space will moderate the relationship between neighborhood disorder and mental health, such that an increase in subjective proximity to park space will buffer neighborhood disorder’s influence on mental health.

Random intercept models testing the moderation effect of park proximity on the established relationship between neighborhood disorder and mental health outcomes did not confirm Hypothesis 2a or 2b. Percent of park space within a quarter mile of

respondents' homes and self-report of parks nearby were not significant moderators and thus did not significantly influence the relationship between neighborhood disorder and either mental health outcome. Not only was there no significant interaction effect for each of the park space variables, there were also no main effects; in other words, objective and perceived proximity to park space did not predict anxiety and depressive symptoms, controlling for individual and census tract-level covariates. In the bivariate models, I found significant relationships between self-report of nearby parks and both outcomes, however when other variables were included in multivariate models, these relationships became null. Results of independent samples t-tests revealed that perceived neighborhood disorder is associated with perceived park proximity, with those who live near a park or playground reporting significantly fewer signs of disorder ( $M = 20.9$ ) compared to those who do not live near a park or playground ( $M = 24.3$ ). Similarly, objective proximity to parks was also associated with disorder ( $r = -.12, p < .001$ ), further supporting the finding that greater proximity to park space is associated with more positive perceptions of the neighborhood environment. However, when tested in a multivariate model, these park proximity variables do not significantly contribute to our understanding of depression and anxiety outcomes.

The objective park space indicator used in this study was the percentage of park space within a quarter mile buffer of each respondent's home, with values ranging from 0 to 56.8% and a mean of 6.7% ( $SD = 8.9$ ). Other empirical studies examining the green space mental health relationship used similar buffers to assess green space proximity, such as density of green space within 300 meters (Nutsford, 2013), percentage of 4 km<sup>2</sup> area covered by green space (White et. al., 2013), and categorical residential distance

from a park, including a quarter mile (Sturm & Cohen, 2014; Sugiyama et. al., 2016). However, none of these studies used an identical continuous measure of park space coverage within that buffer. Comparing this sample to Baltimore City as a whole, it appears that HANDLS respondents live disproportionately closer to parks; 26.2% of all residential properties in Baltimore City are located within a quarter mile of at least one park, and roughly 60% of all census tract centroids are located within a quarter mile of at least one park (Boone et. al., 2009), compared to this sample, with 67.9% of households living within a quarter mile of park space. As noted in a study of environmental justice in Baltimore City, “[t]he Baltimore metropolitan area is well endowed with parks, totaling 56,397 acres or 22.5 acres per thousand population”, which significantly exceeds the national standard of 6.25 to 10 acres of park per 1,000 residents (Boone et. al., 2009, pp.772-73). Using a variety of park access measures to examine environmental justice revealed that Baltimore homes located within a quarter mile of parks tend to be older and have lower market values compared to homes outside of this buffer, suggesting that park proximity may be conflated with SES in Baltimore City, but in the opposite direction of what one might expect (Boone et. al., 2009). Additionally, lower income areas and census block groups with higher proportions of black residents have better access to parks in Baltimore City. These relationships were reflected in this sample, with a significant and negative correlation between percent of park space and median household income ( $r = -.14, p < .001$ ) and a positive correlation between park space and percent of African Americans within a census tract ( $r = .14, p < .001$ ).

Considered in light of my null findings, it seems as though the objective measure I used, total park area within a quarter mile buffer, may be a proxy for lower SES and

racial composition in Baltimore City. However, the environmental justice study (Boone et. al., 2009) examined park congestion and total park acreage as additional measures of park equity, and found that although black residents live within closer proximity to parks, white neighborhoods have access to greater park acreage and parks with lower congestion, both of which enable park usage. Given these nuances, it is clear that total park area within a quarter mile buffer is not capturing important information that would impact park usage and therefore the potential benefits that parks have to offer.

Although the empirical literature has not yet documented any findings pertaining specifically to this conceptual model, various theories and experimental studies provided conceptual and empirical support for a direct association between park proximity and mental health outcomes. The broader green space and mental health literature has demonstrated the association between green space exposure and both anxiety and depression. For instance, a cross-sectional study by Beyer and colleagues (2014) found a positive association between neighborhood green space exposure and depression and anxiety, controlling for a number of individual and neighborhood characteristics. However, a critical difference from my study was the green space measured used; Beyer and colleagues used the Normalized Difference Vegetation Index (NDVI) which is a continuous measure of vegetation density using remote-sensing technology. Their measure captured all potential green features in the neighborhood environment, which is arguably a more sensitive measure of green space than the proximity to parks variables used in this study. The theories which guided this conceptual model, Attention Restoration Theory and Stress Recovery Theory, provided some explanation for a causal relationship between exposure to green space and improved mental health. While my

findings did not support these theories, it is highly likely that the park space variables used in this study were too narrow and excluded many forms of green space in the neighborhood environment (e.g., street trees, gardens, fields, schoolyards) which likely would influence levels of depression and anxiety. Thus I believe a more inclusive measure of green space in the neighborhood environment needs to be explored with this study sample.

The subjective park proximity variable in this study, self-report of living nearby a park or playground, was not a significant predictor of depression and anxiety. Results of an independent samples t-test demonstrate that this measure was significantly associated with objective park proximity ( $t = -6.8, p < .001$ ), such that respondents who reported no park or playground close to their home had a significantly lower percentage of park space within a quarter mile buffer ( $M = 3\%, SD = 5.4$ ) compared to respondents who reported “yes” ( $M = 7.2\%, SD = 9.2$ ). I located one study which used a similar subjective measure of green space; Sugiyama and colleagues (2008) found perceived level of greenness was positively associated with mental health, such that those reporting the highest levels of greenness were almost twice as likely to have better mental health than those who perceived little greenness. It is important to note the absence of neighborhood disorder and crime indicators in their study (Sugiyama et. al., 2008) which could provide one explanation for the difference between our findings. In other words, it is possible that some of the association between green space and mental health is due to the general conditions of the neighborhood environment (including disorder and crime), which are not captured by many of the studies in the current literature.

Although the findings from this study do not support the empirical or theoretical literature, they do corroborate one other study. Examining park space as a moderator, Sugiyama and colleagues (2016) found that the perceived attractiveness of parks within 800 meters and 1200 meters of a respondent's home significantly moderated the relationship between area-level SES and psychological distress, but other moderators including total park area were not significant. These null findings, considered in light of my findings, may be partially attributed to the measurement of park space. Proximity to park space does not likely capture all of the influence that parks have on mental health outcomes; as documented in numerous other studies, safety, congestion, physical and social conditions, and programs offered may all contribute to the ways that parks influence mental health (Sugiyama et. al., 2016; Wolch et. al., 2014). Thus my findings provide support for the need to parse out park quality, congestion, safety, access, and usefulness and examine how each of these factors might differentially influence mental health outcomes, independent of other neighborhood characteristics.

### **Research Aim #3**

Hypothesis 3a – Social cohesion will mediate the relationship between neighborhood disorder and mental health, such that neighborhood disorder influences mental health through levels of social cohesion.

Results of multilevel mediation analyses testing the mediating role of social cohesion on the relationship between neighborhood disorder and mental health confirmed Hypothesis 3a. Social cohesion was found to partially mediate the relationship between neighborhood disorder and depression as well as anxiety. Social cohesion was directly associated with neighborhood disorder ( $B = -.15, p < .001$ ), as well as depression ( $B = -$

.35,  $p < .001$ ) and anxiety ( $B = -.08$ ,  $p < .001$ ), net of the effects of informal social control, and controlling for individual-level covariates. For every 1-point increase in the Perceived Neighborhood Disorder Scale, there is a .15-point reduction in the Perceived Social Cohesion Scale. Also, for every 1-point increase in the Perceived Social Cohesion Scale, there is a .35-point decrease in CES-D scores, and a .08-point decrease in PDSQ-GAD scores. Additionally, the significant indirect effects in both mediation analyses indicate that the relationship between neighborhood disorder and both outcomes is partially explained by the presence of social cohesion. Social cohesion explains 50% of the total effect of neighborhood disorder on depression, and 33% of the total effect of neighborhood disorder on anxiety.

These findings corroborate a similar study which demonstrated that subjective alienation, which includes powerlessness, normlessness, mistrust, and social isolation, almost completely mediated the effect of neighborhood disorder on depression and anxiety (Ross & Mirowsky, 2009). More specifically, both powerlessness and mistrust constituted the majority of these indirect effects. This study by Ross and Mirowsky (2009) provides some nuance to my findings, by explaining how different elements of the perceived social environment may influence the ways in which neighborhood disorder impacts experiences of depression and anxiety symptoms. Ross (2011) describes the process of subjective alienation, which is a feeling of separation from others when neighborhood disorder is prevalent in the local environment. It makes sense that more frequent observable signs of disorder (e.g., vandalism, gang activity, litter, adults loitering) would lead to feelings of vigilance and mistrust, thus reducing social cohesion in the neighborhood, ultimately increasing psychological distress. Findings from my

study provide additional support for this theory, by indicating that presence or absence of social ties and trust is a key mediating pathway through which a disordered environment influences mental health. Overall, these findings highlight the importance of relationships and social connections between neighbors in understanding how the urban environment influences mental health outcomes.

Hypothesis 3b – Informal social control will mediate the relationship between neighborhood disorder and mental health, such that neighborhood disorder influences mental health through levels of informal social control.

Results of multilevel mediation analyses testing the mediating role of informal social control on the relationship between neighborhood disorder and mental health differed by outcome. Informal social control was directly associated with perceived neighborhood disorder ( $B = -.19, p < .001$ ), as well as anxiety ( $B = .04, p < .05$ ), but not depression ( $B = .05, p > .05$ ), net of the effects of social cohesion. For every 1-point increase in the Perceived Neighborhood Disorder Scale, there is a .19-point reduction in the Perceived Informal Social Control Scale, indicating that higher levels of perceived disorder are associated with lower levels of perceived social control, consistent with prior theory and research (Sampson et. al, 1997). On the other hand, for every 1-point increase in the Perceived Informal Social Control Scale, there is a .04-point increase in PDSQ-GAD scores, suggesting that greater perceived social control is associated with greater anxiety symptoms. Ross (2011) found a similar unexpected pattern with a positive association between neighborhood disorder and greater social ties and proposed that perhaps the greater levels of perceived disorder lead to formation of social ties as a way of coping with the danger and threat associated with disorder. Applying this hypothesis

to my findings, it is plausible that efforts to establish and maintain social control within the environment are associated with higher levels of anxiety. Informal social control is measured as the willingness to take action against a number of neighborhood problems or threats (e.g., children spray painting or fights in front of one's house), thus the willingness to take action may be associated with increased vigilance, frustration, or anxiety.

Examining effects from the full model with anxiety, there is a significant indirect effect ( $B = -.01, p < .05$ ), however it is in the opposite direction. This is due to the unexpected positive relationship between social control and anxiety symptoms. When the indirect and total effects are in opposite directions, this indicates that the mediator acts as a suppressor variable, reducing the total effect; this might explain why the total effect for this model was no longer significant after bootstrapping. The indirect effect suggests that greater perceived neighborhood disorder predicts greater anxiety symptoms through higher levels of informal social control.

Although this construct of informal social control is not prevalent in the literature, Ross and Mirowsky (2009) used mediation analyses to test a series of similar constructs – powerlessness, normlessness, mistrust, and social isolation – which together they refer to as subjective alienation, for potential mediating pathways between neighborhood disorder and depression and anxiety. They found that feelings of mistrust and powerlessness, which undermine a sense of control, strongly mediate the relationship between depression and anxiety, with the strongest effect on anxiety. While their measure of mistrust overlaps with both social cohesion and control, powerlessness appears to represent the inverse of social control, but focused at the individual-level; powerlessness reflects an

individual's expectation or belief that they have little control of their life (Ross & Mirowsky, 2009). Interestingly they found powerlessness to have a stronger indirect effect on depression than anxiety, which differs from my findings as social control did not mediate the effect of perceived disorder on depression. Taken together, this provides some evidence that social control is an important link between neighborhood disorder and anxiety. However, the unexpected positive relationship between informal social control and anxiety suggests that although anxiety may be harmful when experienced over prolonged periods of time, it may also indicate necessary vigilance when living among crime and neighborhood disorder. Results from my mediation analyses answer some questions and yet introduce new questions regarding the different ways that social cohesion and informal social control interact with depression and anxiety in the presence of neighborhood disorder.

### **Strengths and Limitations**

There are important limitations to note, which influence the implications that can be drawn from this study. First, there are a number of limitations pertaining to the measures used in this study. In an effort to test the potential moderating effect of green space on the relationship between neighborhood disorder and mental health, I included two measures of park proximity. Although parks are one important element of the urban natural environment, there are many other elements that were not measured (e.g., tree canopy, community gardens, schoolyards, urban farms). Also, I did not include any measures of park quality or conditions, as these data were not publicly available.

Therefore, findings pertaining to park proximity were absent of information regarding the quality of such parks, which will likely influence residents' use of and experiences with local parks. I attempted to partially address this limitation by testing the interaction

effect between neighborhood disorder (which measures neighborhood conditions) and park proximity, however I recognize that is merely a proxy for park quality and conditions.

I recommend that future research include more inclusive measures for green space exposure, as theory suggests that viewing any natural element including trees, flowers, plants, and ponds can promote stress recovery. Authors of one systematic review examining literature on urban green space and its impact on health (Kondo et. al., 2018) recommended that future studies employ emerging technologies such as remote sensing and geocoding to quantify green space exposure with more detail and precision. They also encourage supplementing quantitative data with qualitative descriptions of green spaces to provide more context. To further understand the relationship between urban green spaces and mental health, it is necessary to use comprehensive green space measures, both quantitative and qualitative, which capture the broad array of green elements in the urban environment and the conditions of those spaces.

Additionally, the census tract-level measures of neighborhood disorder used in this study – percent of vacant and abandoned buildings and property crime rates – may not fully capture all aspects of neighborhood disorder, and therefore may have limited the ability of this study to demonstrate an impact of objective neighborhood disorder on mental health outcomes. Using other studies as a guide, future research examining the effects of neighborhood disorder at the aggregate level could develop an index or summary measure combining data from various sources, such as objective indicators from Census or administrative data, systematic social observations, and spatial data using GIS. Neighborhood effects research continues to face the challenge of determining the

appropriate spatial scale relevant for mental health outcomes, as noted in one systematic review (Mair et. al. 2008). The small ICCs found in this study might be indicating that the census tract is not an accurate proxy for neighborhoods. Other studies have used census block groups, neighborhood clusters (Mair et. al., 2010), and census tracts (Ross, 2000) as proxies for neighborhoods, with census tracts yielding the smallest ICCs. It would be useful for future research to examine neighborhood effects on mental health at different spatial scales, to determine the optimal aggregate level (Mair et. al., 2008).

Another limitation is neighborhood selection bias, such that individuals who have the means to choose the neighborhood in which they live might prefer neighborhoods with closer proximity to parks and lower levels of neighborhood disorder. This issue of selection bias is closely related to the issue of reverse causation. As these data are cross-sectional, I am unable to make any causal inferences about the directionality of relationships between these variables. Lastly, the use of census tracts as a proxy for neighborhoods poses a significant limitation, as census tract boundaries are not particularly meaningful to residents and thus do not accurately capture the distinction between neighborhoods.

In spite of these limitations, this study presents a number of strengths and will make significant contributions to the empirical literature. Strengths of this study relate to the variety of measures used to examine these relationships, as well as the use of multilevel data. Most importantly, this is the first study to test the moderating effect of two urban green space measures and collective efficacy on the relationship between neighborhood disorder and mental health. Additionally, very few studies have incorporated both objective and subjective measures of neighborhood disorder and

proximity to parks. A major strength of this study is the use of a unique linked dataset which combines individual respondents' perceptions on key neighborhood and mental health indicators with objective census tract-level data. Further, this study effectively accounts for the nested data structure using multilevel modeling techniques to adjust for clustering of cases within census tracts. The inclusion of two mental health outcome measures (i.e., depression and anxiety) follows the lead of more recent studies (Beyer et al., 2014; Cohen-Cline, Turkheimer & Duncan, 2015) attempting to parse out the differential relationships between neighborhood factors and various mental health outcomes.

## **Implications**

### **Theory Implications**

Findings from this study offer insights into numerous theories. The overall findings from this study continue to support the Social Determinants of Health framework, specifically, that there is a relationship between the neighborhood context and mental health outcomes for individuals. The SDOH framework states that reducing inequities in the social and physical environment can improve well-being for individuals (U.S. Department of Health and Human Services, 2010). Inequities in the social environment pertain to social relationships, exposure to crime and disorder, the level of resources within a community, and the ability to interact with neighbors. Inequities in the physical environment refer to exposure to stress-inducing factors (e.g., noise, overcrowding toxic conditions) as well as elements that promote healthy behaviors such as parks and sidewalks. This study demonstrates that resident perceptions of neighborhood conditions, pertaining to the social and physical environment, have a clear association with depression and anxiety symptoms, even after adjusting for a number of

individual and census tract-level variables. More specifically, exposure to higher levels of perceived physical and social disorder is associated with poorer mental health outcomes. Although this study is cross-sectional, therefore I am unable to infer a casual direction between these variables, this finding adds to a consistent body of empirical evidence which supports the notion that neighborhood physical and social conditions matter for mental health.

These findings also partially support the Neighborhood Disorder and Mental Health Model (Wandersman & Nation, 1998), which outlines the process whereby signs of social and physical disorder (e.g., vandalism, abandoned buildings) signal a lack of social control and social deterioration, which promotes crime as well as a fear of crime, ultimately leading to elevated anxiety and depression over time. Given the cross-sectional nature of these data, I am unable to demonstrate the casual chain of events to fully confirm this hypothesis; however, these findings do indicate a clear association between perceptions of disorder and increased anxiety and depressive symptoms. Interestingly, Ross and Mirowsky (2009) proposed a theory of subjective alienation to further shed light on this relationship, suggesting that feelings of mistrust and powerlessness act as mediators between perceived neighborhood disorder and both anxiety and depression. Results from my analyses provide some support for this subjective alienation hypothesis, as the presence of social cohesion partially mediated the path between disorder and mental health among this sample. This finding suggests that disordered environments trigger feelings of mistrust towards neighbors, which ultimately lead to increased anxiety and depression. Thus the conditions of the neighborhood environment can put the social fabric of a neighborhood at risk, which can have

detrimental consequences for mental health. However, greater social control is associated with greater anxiety but not depression, which indicates that different elements of the social environment associate differentially with depression and anxiety.

Two theories, Attention Restoration Theory and Stress Recovery Theory, both explain how exposure to the natural environment can benefit mental health by reducing stress and fatigue and increasing the ability to focus (citations). Using these theories as a guide, I examined the potential buffering effect of the natural environment on the harmful relationship between perceived neighborhood disorder and mental health. Findings from multivariate models did not support this hypothesis, thus it appears that exposure to parks, one element of the natural environment did not promote mental health in this sample. However, the measures used to approximate exposure to the natural environment were arguably narrow, as they only measured proximity to parks. There are many other elements of the natural environment besides parks, such as trees, gardens, fields, schoolyards, urban farms, and even bodies of water, that if measured could show significant influence on mental health. This study was unable to measure these other green elements found in the urban environment.

I was able to detect a significant and positive bivariate association between subjective park proximity and both outcomes, indicating that this subjective measure of park space was more strongly associated with depression and anxiety than the objective measure. This aligns with my findings from both neighborhood disorder measures, and suggests that an individual's perceptions of access to park space may have a stronger influence on mental health outcomes than their objective reality. Perhaps there are many

factors associated with park access, such as safety, street networks, walkability, and traffic which could influence one's ability to reap the benefits from proximity to parks.

### **Research Implications**

Findings from this study demonstrate that subjective measures of neighborhood disorder may be more meaningful than objective indicators, in understanding the link between exposure to neighborhood disorder and individual mental health. This is reflected in at least one other study that used multilevel modeling, and found stronger associations with subjective measures, controlling for variables at the individual and neighborhood cluster-level (Mair, Diez Roux, & Morenoff, 2010). However, other studies have documented strong associations between subjective and objective indicators of neighborhood disorder (Elo et. al., 2009). Considered in the context of the broader literature, this study demonstrates that estimating neighborhood effects on mental health is challenging and requires thoughtful construction of objective measures.

There is more to learn about the relationship between neighborhood disorder and mental health, particularly what aspects of depression and anxiety are most influenced by exposure to disorder, and which components of disorder are most consequential to depression and anxiety. For instance, the CES-D comprises six scales reflecting various facets of depression (e.g., depressed mood, feelings of helplessness and hopelessness, and psychomotor retardation). It would be worthwhile to investigate the strength of association between disorder and each of these scales separately, to develop a deeper understanding of disorder and depressive symptoms. Additionally, the Perceived Neighborhood Disorder Scale assesses numerous aspects of disorder, including observable signs of physical and social disorder. Future research should examine

whether any differences exist between perceptions of physical versus social disorder and their influence on depression and anxiety.

The relationship between urban green space and mental health requires further investigation. Findings from this study did not support the existing empirical and theoretical literature documenting that exposure to green spaces has a positive influence on mental health outcomes. The literature shows three potential pathways through which green space influences mental health – stress reduction, increased physical activity, and greater opportunities for social contact (Rugel, 2015). Within the context of Baltimore, a city which has abundant park space and the majority of residents live within walking distance of parks (Boone et. al., 2009), more study is needed to understand why parks are not beneficial to mental health with this sample. Parks may be congested, perceived as unsafe, lack organized programs, or difficult to access, all of which could potentially interrupt the pathways through which parks influence mental health. Future research should continue to test these pathways using longitudinal data. Additionally, qualitative data regarding park conditions, access, and usage could shed further light on these findings.

Other steps for moving this field forward include the use of experimental, quasi-experimental, and longitudinal designs to infer casual directions between variables. For example, it is possible that individuals with lower levels of depression or anxiety may select neighborhoods with greater social cohesion, and lower levels of neighborhood disorder, as they prefer to live in more socially connected environments. Testing these same models with longitudinal data would provide more clarity about the directionality of such relationships. This would be particularly useful in testing mediating pathways, as

scholars suggest that causal mediation analysis should be conducted with data from multiple time points (MacKinnon, Fairchild, & Fritz, 2007). The HANDLS study has concluded data collection for waves 2 and 3, making it possible to conduct mediation analyses with this sample using longitudinal data. In doing so, the question of bi-directionality is significantly reduced.

The concept of informal social control has been understudied in the literature, and findings from this study were rather mixed. Ross and Mirowsky's study (2011) suggests that the concept of subjective alienation plays an important role in understanding how neighborhood disorder influences depression and anxiety. The subconstructs of subjective alienation – mistrust, powerlessness, social isolation, and normlessness - appear to reflect social cohesion and informal social control. Future research should continue to investigate this concept of informal social control and the role that it plays in individual mental health, parsing out potential differences between depression and anxiety. Overall, more consistency of measures used across studies could increase comparability of findings. Researchers use many different indicators to measure neighborhood disorder, green spaces, and depression and anxiety, making it challenging to directly compare results and draw broader conclusions in the literature.

### **Practice and Policy Implications**

This study demonstrates that neighborhood conditions and individuals' perceptions of those conditions matter to individual mental health. Living in a neighborhood with high rates of graffiti, vandalism, vacant homes, and gang activity, for example, can reduce social ties and trust among neighbors, leading to elevated levels of anxiety and depressive symptoms. The social environment, specifically social cohesion,

is critical to urban residents, and acts as a pathway through which neighborhood stressors can harm mental health. In light of this information, social workers should view the urban neighborhood environment, and resident perceptions of their environment, as important factors in understanding and treating individual mental health. Clinicians, community practitioners, and other behavioral health professionals serving urban populations should continue to promote programs and opportunities that build trust and mutual support among residents. Strategies for building social cohesion in urban neighborhoods could include identifying anchor points where residents tend to gather or socialize, and expanding opportunities for interaction through organized community events. In order to facilitate interaction across diverse groups, community facilities (e.g., recreation centers, parks, schools, libraries) and local businesses could be used to host programs such as social clubs, sports leagues, and festivals. Community-level efforts to bring residents together across sociodemographic divides could promote social ties which could in turn buffer the negative influence of disordered environments on mental health.

Additionally, my findings indicate that the physical conditions of neighborhoods influence mental health. Observing signs of physical disorder, such as vandalism, broken windows, and abandoned cars and buildings, signals to residents and visitors that there is a lack of social control and social bonds within the community, ultimately resulting in greater experiences of depression and anxiety symptoms. Community organizers and community-based organizations should continue to invest in the physical improvements of urban neighborhoods, to address blight and reduce signs of disorder. Cleaning up neighborhoods may signal to residents that the area is well-maintained and cohesive, thus improving their perceptions of the environment, and ultimately reducing depressive and

anxiety symptoms. In light of the fact that many do not have access to standard mental health treatment, efforts to improve the physical and social environment of disordered urban neighborhoods could be one way to supplement the work of mental health professionals.

While large-scale neighborhood revitalization projects may be expensive and resource-intensive, more localized grassroots efforts could be funded by non-profits and small CBOs and stipulate resident involvement in two-pronged efforts to build cohesion and improve the physical space. One local example is the Healthy Neighborhoods Initiative, which targets “middle neighborhoods”, and funnels small block project grants to residents through a local CBO to engage in a block improvement project. The project must be initiated by the block residents, involve a majority of households on the block, and involve a façade improvement to participating homes. This program is based on the philosophy that the physical improvements to homes, combined with resident-led efforts improve the local physical environment, increase social cohesion, and convey to outsiders that the block is well cared for, ultimately deterring unwanted behaviors and promoting a sense of community (Sissman & Russell, 2016). Programs such as this one should expand to lower income neighborhoods which need these physical improvements the most, as they are often the most plagued with neighborhood disorder.

Examples of other efforts to concurrently improve the physical and social conditions of urban neighborhoods include community gardens, neighborhood clean-ups, tree plantings, or block projects organized around property improvements such as installing front porch lights. It is worth noting that some of these efforts can be entirely resident-driven, while others may require significant cooperation with CBOs and city

agencies such as the local Parks and Recreation department. Thus while residents should play a central role in such activities, local institutions must also invest resources in supporting these efforts.

### **Conclusion**

Overall findings from this study demonstrate that perceived neighborhood conditions are an important factor in understanding the mental health of urban residents. This is consistent with the current theoretical and empirical literature. The frequency with which residents observe signs of physical and social disorder, such as vandalism, drug dealers, prostitution, and abandoned buildings, is associated with increased depressive and anxiety symptoms, controlling for a variety of factors at the individual and census tract-level. Contrary to my study hypotheses, residential proximity to park space did not moderate the relationship between neighborhood disorder and mental health. This finding suggests that living near parks does not seem to buffer the negative influence of a disordered environment on mental health. Taken in the context of Baltimore City, residential proximity to parks is not necessarily a protective factor as parks are ubiquitous, and often closer proximity to parks is associated with greater disadvantage. To add to our understanding of the relationship between urban parks and mental health, more study is needed to parse out the qualitative aspects of parks and other green spaces that influence park usage and access, particularly in communities with higher levels of disorder.

Findings from this study also demonstrate that the social environment acts as an important mediating pathway between observed disorder and increased depressive and anxiety symptoms. The absence of social cohesion between neighbors explains a

significant amount of the association between disorder and depression and anxiety, indicating that the presence of disorder is breaking down trust and social ties, harming mental health. On the other hand, informal social control mediates the relationship between disorder and anxiety such that higher levels of control lead to increased anxiety. The social environment is complex and requires further study in order to understand what conditions are optimal to promote mental health for urban residents. Social workers and community practitioners should consider the neighborhood effects on mental health when working with urban residents, and support programs that simultaneously improve the physical and social conditions of neighborhoods. Elected officials, policy makers, and urban planners should consider investing more resources into strengthening the social fabric of Baltimore City neighborhoods, to improve living conditions, increase trust, and ultimately promote resident well-being. Although Baltimore is unique in many ways, it shares characteristics with many other deindustrialized U.S. cities experiencing segregation, gentrification, population loss, and health disparities. Lessons learned from this study may benefit cities facing similar challenges, as part of an effort to improve health outcomes and close the health disparities gap for urban residents.

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