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Neighborhoods and health: exploring the effects of physical, social, and cultural stressors in an environmental justice community

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SCHOOL OF PUBLIC HEALTH

Dissertation

NEIGHBORHOODS AND HEALTH:

EXPLORING THE EFFECTS OF PHYSICAL, SOCIAL, AND CULTURAL

STRESSORS IN AN ENVIRONMENTAL JUSTICE COMMUNITY

by

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DEDICATION

I would like to dedicate this work to my family, especially to my grandfather who

encouraged me to pursue my dreams. Grandfather, you are deeply missed and I know you

would have been so proud to see this work completed.

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NEIGHBORHOODS AND HEALTH:

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STRESSORS IN AN ENVIRONMENTAL JUSTICE COMMUNITY

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ABSTRACT

Neighborhoods are composed of physical, social, and cultural environmental factors that influence health and health behaviors. These factors include chronic stressors that are associated with premature mortality. Determining the role of neighborhoods on health is challenging due to individual exposure to multiple types of stressors, and discerning effects of individual stressors from co-occurring neighborhood stressors. This dissertation investigates the role of neighborhood and individual stressors on physical activity, self-rated health, and depressive symptoms in the environmental justice community of Chelsea, Massachusetts.

We interview 354 Chelsea residents aged 18 years and older using open- and closed-ended questions that address health-related topics and perceptions of the environment. We use GIS-based methods to map resident-defined neighborhoods and their relation to attributes of the physical environment, and regression models to quantify relationships between neighborhood factors and individual stressors with health outcomes. We also incorporate responses to open-ended interview questions to develop physical activity outcomes.

We report positive associations between exposure to neighborhood factors and adverse outcomes. Noise, feeling unsafe, and low social cohesion display positive correlations with poor self-rated health and depressive symptoms. Proximity to resident-preferred parks is positively correlated with physical activity, while knowledge of rape or sexual assault is inversely associated with physical activity. Individual stressors, such as health conditions and disability, are positively associated with all adverse outcomes. Including neighborhood factors and individual stressors in the same model does not change any associations. We conclude that neighborhood factors are independent sources of chronic stress that influence health and health behaviors.

In the literature, the outcomes we study are associated with premature mortality. This fact, coupled with the associations we see between our outcomes and neighborhood factors, suggest that aspects of neighborhoods can increase risk for premature mortality. Health could also be improved on an individual level by providing resources to buffer against the negative effects of disability and reported financial problems, such as a sudden loss of income or food insecurity. Environmental policies related to neighborhood conditions should consider the effects of neighborhoods factors on health as a systematic method of improving health.

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INTRODUCTION

A growing body of literature supports the idea that health and place of residence are intertwined. Residential neighborhood characteristics are associated with overall mortality, general health status measures, birth outcomes, chronic conditions, injuries and disability.[1–5] Neighborhoods also associated with behavioral risk factors for chronic disease, such as smoking, poor diet, and a lack of physical activity.[2, 4–9] A literature review of multilevel studies examining the impact of neighborhoods on health finds that twenty-three of twenty-five reviewed articles report significant associations between neighborhood socioeconomic status and a variety of health outcomes.[10] A longitudinal study of Alameda County, California residents reports a causal association between poor perceived neighborhood conditions and decreases in physical function.[1] Studies of residents of New York and North Carolina report significant, positive associations between residential neighborhoods and obesity.[11] The effects of neighborhoods on health persist after controlling for age, income, and race, suggesting that neighborhood effects are distinct from the effects of key individual characteristics. Literature reporting significant spatial variation in heart disease, diabetes, and all-cause mortality rates by neighborhood further supports the role of place on health.[12–15]

Previous studies suggest that neighborhood-based environmental factors capable of causing emotional and/or physiologic stress (stressors), including pollution, pests, and poorly maintained neighborhoods, can influence health-related behaviors and health.[1, 16–18] Physical environmental stressors also include lack of green spaces, noise, transportation resources, city structure, and other characteristics of the built

environment.[2, 19, 20] Social environmental stressors associated with health include crime, racial discrimination, community violence, and low social cohesion.[21–25] Economic stressors in the form of job security, work-place discrimination, and food insecurity also play a significant role in health outcomes.[6, 26] It is likely that residents are exposed to multiple types of stressors, which may further increase their health risk.[27–29] Low-income and minority communities appear to be at highest risk for exposure to combined environmental, social, and economic stressors associated with disease.[17, 30, 31]

Several questions remain about the pathways by which neighborhoods influence health, methods of measuring neighborhood stressors, and definitions of the neighborhoods themselves.[32] Despite evidence supporting associations between neighborhoods and health outcomes, these questions may explain why several studies show no relationship between neighborhoods and health outcomes.[20, 32, 33]

Behavioral Ecological Model and Neighborhood Stressors

In addition to containing sources of pollution that influence health outcomes, current theories hypothesize that neighborhoods impact health by providing social and physical cues that influence health-related behaviors, including chronic stress.

The behavioral ecological model (BEM) links environmental cues to human behavior. The BEM is based on the idea that an individual's genetic, biologic, and learned behaviors (e.g. habitual eating of junk food) interact with the external social and physical environment to produce a specific behavior.[34] This interaction results in decisions and behaviors that can influence health for the better or for the worse.[35] For example, a study of San Diego residents shows that residents living near no-cost exercise

facilities are more likely to participate in physical activity than those living further from the facility.[36] The location of this no-fee facility reduces the physical (e.g. distance to the facility) and economic barriers (e.g. cost of use) that could discourage residents from using it regularly. More social cohesion and living in areas with less crime create social environments that are conducive to physical activity.[37, 38] In contrast, high crime rates and less social cohesion are social barriers associated with less physical activity.[7, 27, 39]

Behavioral changes resulting from physical and social cues may also influence health outcomes. For example, obesity researchers hypothesize neighborhoods lacking the correct physical and social cues can create obesogenic environments that facilitate the overconsumption of food and less physical activity.[40] Such neighborhoods would contain a high density of fast-food outlets and convenience stores, few grocery stores, and a lack of adequate locations for physical activity.

Neighborhoods can also expose residents to sources of chronic stress, which plays a role in the development in chronic health conditions such as cardiovascular disease and diabetes.[41–44] When exposed to stressful conditions, the body releases stress hormones that prompt a "fight or flight" response that usually ends with a period of recovery. Constant exposure to stressors can induce a permanent state of stress resulting in permanent, multisystem damage.[43] The effects of chronic stress accumulates as populations age, eventually increasing the risk of chronic disease and mortality.[24, 31, 42]

Neighborhood stressors can originate from physical, social, or cultural sources. Physical stressors, like noise, are associated with depression and poor self-rated health.[38, 45] Social factors, such as less social cohesion, can result in stress due to social isolation

and is correlated with increased mortality from stroke and heart attack.[46, 47] Cultural

stressors such as perceived discrimination and a lack of language proficiency are also

associated with poorer health.[48, 49] Findings from these studies show that effect of the

neighborhood stressors is separate and distinct from stressors that residents experience

individually, such as financial or housing problems.[14, 42]

Measuring Neighborhood Environments

Studies use a variety of methods to measure neighborhood stressors, and their

results vary similarly.[2, 26, 50, 51] Objective methods of measurement do not rely on

participant perceptions and may incorporate external data sources that record the

presence of environmental stressors. Examples of objective measures are the distance

between resident homes and the nearest park, or the crime rate within a census tract.[21, 33, 52] Subjective methods measure residents' perceptions or feelings about the environment,[1, 53, 54] and vary according to the respondent's age, income, and length of residence.[55]

Although perception shows some correlation with objectively-derived measures,[56, 57] each

method measures a different aspect of the environment.[1, 21, 22, 58] Including both objective

and subjective methods in studies could help clarify associations between neighborhoods

and health.[19]

A major issue when measuring neighborhood exposures is the definition of

neighborhoods. Most studies define neighborhoods using census tracts, which are pre-

defined geographic areas used for generating population statistics.[59] Although they are

relatively stable units of analysis, they do not necessarily reflect residents' definitions of

their neighborhoods.[60] Resident-defined neighborhoods often differ in size, geographic

boundaries, and demographic compositions from census tracts.[61, 62] After examining neighborhoods defined by residents, Coulton et al. reports that neighborhood boundaries and geographic scale are not similar to census tracts.[61, 63] As a result, environmental exposures calculated on a census tract-basis may differ from exposures calculated according to resident self-defined neighborhoods. Despite the acknowledgment of the differences, census tracts are widely used to define neighborhoods in health studies that also ask residents questions about their perceptions of their neighborhood.[64–65]

Chelsea, Massachusetts

This dissertation relies primarily on data from the Chelsea STAR (Science To Achieve Results) project to investigate the influence of multiple neighborhood stressors on health and health-related behavior.[66] The City of Chelsea, an urban suburb of Boston, is home to a diverse population and a variety of environmental pollutants. As a designated port city, Chelsea residents are exposed to air pollution from ships, trains and high traffic roadways, emissions from a variety of local industries, and airborne residues from the road salt piles aligning the city shore. Chelsea's low-income resident population, which compose 24 percent of the total population,[67] express concerns with food insecurity, limited transportation, high crime rates, and a lack of health care services.[68] Chelsea's large Latino population, comprising 62 percent of the total population,[67] may face linguistic and cultural barriers associated with poor health.[69]

According to Massachusetts Environmental Justice Policy, every census tract in Chelsea meets one or more Massachusetts's criteria for an environmental justice community.[70] These criteria define environmental justice communities as census block

groups with a median annual household income at or below 65 percent of the statewide median, a minority population of 25 percent or more, a foreign-born population of 25 percent or more, or a residential population of 25 percent lacking English language proficiency.[70] Populations with these demographic characteristics may have difficulty in voicing concerns with problems in their neighborhoods, participating in decision-making processes affecting the environmental quality of their neighborhoods, and may be exposed to more pollutants than communities with different demographic compositions.

The Chelsea STAR project is a collaboration of the Chelsea Collaborative and faculty at Boston University School of Public Health (BUSPH), Department of Environmental Health. The project includes BUSPH faculty and students, along with Chelsea Collaborative staff and volunteers conducting interviews with 354 English and/or Spanish speaking adult residents of Chelsea, MA between December 2011 and June 2013. The interview guide contains 180 open- and close-ended questions addressing a wide variety of environmental stressors, health-related behaviors, and health outcomes. The interview includes questions from pre-validated instruments and original questions that were developed through focus groups with the community. Responses from the Chelsea population provide information about how residents perceive and engage with their physical environment, how the social environment affects their lives, and how they define their neighborhood.

In addition to the STAR data, for some variables, we are able to pair data measuring perceptions of the physical environment with objective data derived from external sources. We use police reports to measure crime rates, and residential

information for proximity analyses that map and measure distance between participant's homes and several types of parks in Chelsea. Pairing perceptions of the environment with data obtained from these objective sources can verify residents' impressions of their environment, and also be used as predictors in regression models.

Summary of Dissertation Papers

This dissertation is a cross-sectional study that builds on previous literature in several ways. First, the study examines the association between stressors originating from multiple sources and health outcomes. Previous studies examining the independent and combined associations between physical, social and economic stressors with health outcomes show mixed results.[71] Second, the study focuses on a predominantly low-income, minority population whose risk profile may differ from the general population in numerous ways. Effects of the neighborhood environment vary by social and economic status, so studies focusing on a high-risk population could provide more sensitive information to design effective interventions.

Third, the study incorporates qualitative data into the construction of exposure measures. Qualitative methods differ from quantitative methods because they invite the participants to express their views and opinions about their environment, rather than forcing them to choose responses from pre-established options. This includes the incorporation of self-defined neighborhoods, which are not widely used in epidemiologic literature and have been previously identified as source of measurement error.[60, 61, 72]

This dissertation is comprised of three manuscripts or papers. The first paper examines the independent associations of park access and community violence with

physical activity. Physical activity is associated with lower risk for heart disease and obesity.[73] In accordance with the ecologic models of health behavior, poor access to resources for physical activity and community violence limits residents' exposure to environmental resources that encourage and aid resident participation in physical activity. In urban environments, parks are one public resource for physical activity. Community violence may prevent residents from using local parks. The competing effect of community violence on physical activity may explain why previous studies on park access, measured by residential proximity to the nearest park, show mixed results. Without studying community violence alongside park access, the association between parks and physical activity remains unclear.[33, 40, 74]

In this paper we measure proximity to parks in several different ways: The distance between residents' homes and the nearest park of any type, distance between homes and the nearest parks with facilities that adults want to use, and distance between homes and parks that residents identify and recommend for public use. We also identify specific types of community violence that residents report rather than relying on a single measure of feeling safe or an aggregate number of reported violent events.

The second paper investigates the association between physical, social, and cultural stressors, and self-rated health. Self-rated health is used widely to measure population health status and predicts premature mortality, even after accounting for individual-risk factors and health conditions.[75, 76] Low-income populations are identified as a high risk group for poor self-rated health.[65, 77–79]

Chronic stress increases risk for poor self-rated health and premature mortality, and could be a product of consistent exposure to physical, social, or cultural stressors. We examine the independent relationships between fair/poor self-rated health and physical, social, and cultural factors, and the association between self-rated health and cumulative exposure to physical, social, and cultural stressors.

The third paper examines associations between neighborhood and individual stressors, and depressive symptoms. Depression is a debilitating condition that impedes normal daily functioning. Crime, low social cohesion, and noise are neighborhood stressors that show associations with depressive symptoms.[45, 53, 80]

Despite evidence for the role of neighborhoods in the etiology of depressive disorders, the presence of co-occurring individual stressors obscures the influence of the environment. Several studies state that neighborhoods could be surrogate measures for individual events that occur more frequently in specific residential populations.[32] Few epidemiologic studies have data on stressful life events, such as financial trouble or housing issues, which are individual stressors that show associations with depressive disorders. We investigate the independent and combined associations of neighborhood- and individual stressors on depressive symptoms. We measure neighborhoods using objective and subjective methods of measurement, and incorporate the use of resident self-defined neighborhoods into our analysis.

CHAPTER ONE: Park Access, Community Violence, and Physical Activity in an

Urban Community

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Introduction

Physical activity is protective against many health conditions, yet less than half of

US adults meet the Centers for Disease Control and Prevention's recommendations for

leisure physical activity.[73, 81] Safe neighborhoods with parks encourage physical activity

among residents.[82] Consequently, public health professionals promote the installation or

renovation of city parks. However, studies examining residential proximity to parks and

physical activity show mixed findings.[83–88] This may be due to reliance on geographic

methods for measuring park access, and the lack of specificity regarding different types

of parks included in prior studies.

Studies relying on geographic methods of measuring park access (e.g. distance to

the nearest park) may misclassify access by considering proximity as a proxy for actual

park use, and not assessing residents' perceptions of the safety and utility of parks for

physical activity. The types of parks available to residents also differ, with some parks

containing green spaces and trails for walking or running,[86, 89] others consisting of

sporting facilities such as basketball courts, and still other parks that are meant for toddlers which provide no opportunity for an adult to be physically active.[90, 91] In standard databases of parks, these types of park would be considered equal while their value for providing adults the opportunity to be physically active is not.

Exposure to community violence and feeling unsafe may also pose barriers to physical activity, but the findings of studies of these associations are unclear.[58] Rather than identifying specific types of community violence present in neighborhoods, studies typically use global measures of the social environment to assess overall feelings of safety and the total number of violent events to which residents are exposed.[58] These measures do not identify specific events that would cause participants to feel unsafe, potentially diluting effects of the different violent events on physical activity.[92, 93]

Challenges studying park access, exposure to community violence, and physical activity are especially present in the urban, majority Latino community of Chelsea, Massachusetts. The 1.8 square-mile city contains over 20 parks,[94, 95] but age-adjusted mortality rate for coronary heart disease, related to physical inactivity, is 70 percent higher than the state rate.[95] Chelsea's reported violent crime rate is almost five times Massachusetts' 2012 rate.[96] Identifying how residents use parks for physical activity, and whether community violence impedes outdoor physical activity could inform public health planning for this population and other low-income urban populations.

This paper explores the independent associations of multiple measures of park access to physical activity, as well as the association of total and specific exposures to

community violence, feeling unsafe, and physical activity. Included in our measures of park access are resident perceptions of park usability along with proximity measures.

Methods

The Chelsea STAR (Science To Achieve Results) project, a community-university collaboration, investigated residents' health and environmental concerns.[97] Researchers and community members developed an interview guide containing over 180 questions that provided qualitative and quantitative data, including pre-validated and original questions that addressed local concerns.

Recruitment for the cross-sectional study occurred between December 2011 and June 2013 via door knocking in the recruitment area between 9 am and 8 pm on weekdays and weekends. The study was publicized on the cable television channel and with flyers posted in community centers and clinics, in neighborhoods, and at local events. Residents could call the project coordinator to schedule an interview. Eligibility criteria included being 18 years of age or older, living in Chelsea for 6 months or more, speaking English or Spanish, and current residence in the recruitment area. Interviews were conducted at participants' homes, or the downtown Chelsea office of the community partner. Either way, geographic coordinates of participants' homes were recorded. Informed consent was obtained prior to each interview with approval from the Boston University Medical Campus Institutional Review Board.

We included a complete list of all questions and responses in Appendix A.

Physical Activity

All-physical activity (all-PA) was measured by asking if participants engaged in any physical activity or exercise during the past month, providing a dichotomous response (Yes or No). If yes, participants were asked open-ended questions about what they do, and where they go for exercise. These qualitative responses were analyzed to identify types of, and exact locations of physical activity. Responses were then assigned the outcomes of indoor physical activity (indoor-PA), outdoor physical activity (outdoor-PA), and park-based physical activity (park-based PA). Indoor-PA identified participants that used indoor facilities such as gyms or community centers. Outdoor-PA indicated participants who reported outdoor activities, including walking or running in a park. Park-based physical activity (a sub group of Outdoor-PA) identified participants who specifically stated they used parks for physical activity. No physical activity (No-PA) was the reference group for all analyses.

Park Access

We defined parks using the City of Chelsea's designations (Figure 1.1), with the exclusion of one cemetery. The City also classified each park by dominant attribute including Playground/Tot Lot, Sports/Walking, Sitting, or All-use park, the last indicating a park containing all of the previously listed attributes.

We defined park access using geographic proximity, but developed three proximity measures incorporating additional park attributes and interview data. The first measured the distance between participants' homes and the nearest park of any type (All parks).
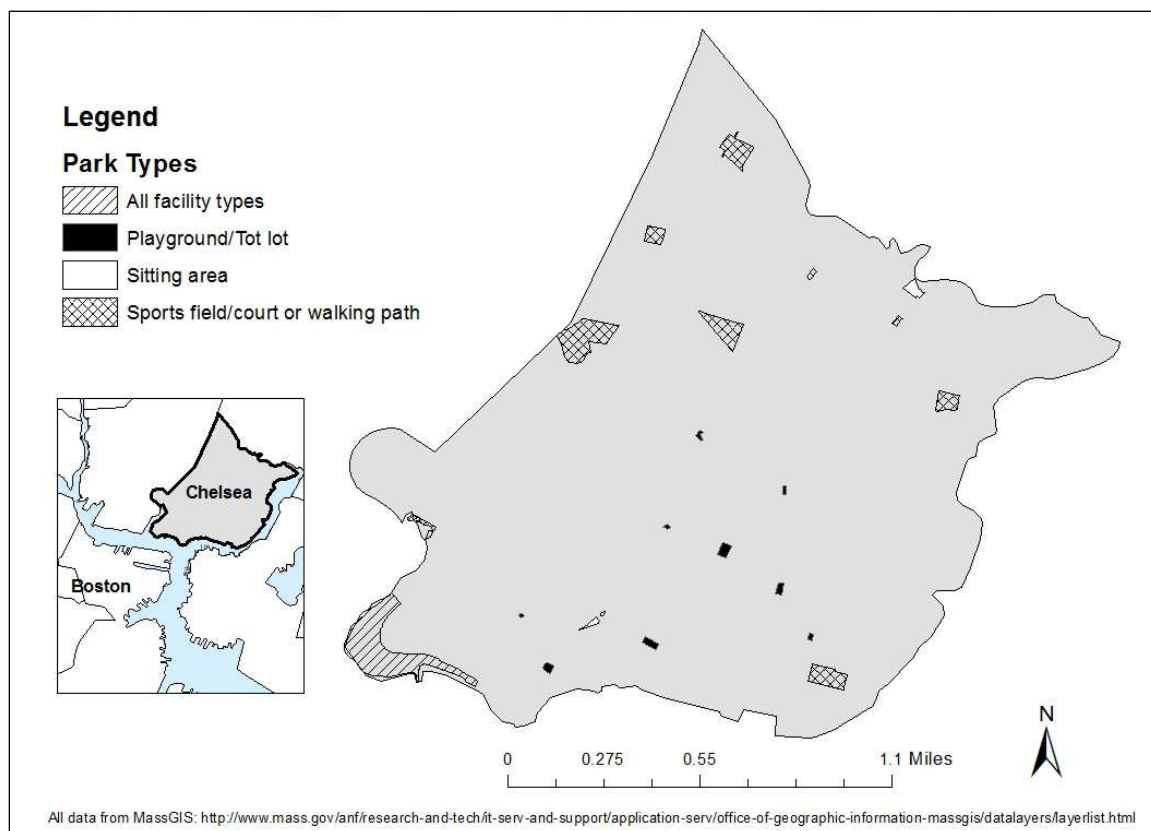
Figure 1.1. Park Types and Locations in Chelsea, Massachusetts

The second measure was the distance to the nearest park with resources that adults would use for physical activity (Parks with sports/walking facilities), excluding parks classified only as playgrounds or sitting areas. The third measure included the distance to parks that participants perceived as usable for physical activity (Resident-preferred park). To identify any parks participants perceived as usable, we asked participants multiple questions including: the name of the park nearest their home, reasons why they use or do not use parks near their home, knowledge of other parks in the city, reasons why they use or do not use other parks, places they would recommend as good for taking a walk, and finally, based on the previously mentioned question regarding physical activity, we

determined the park(s) used by each participant for physical activity. Analyses indicated that 84 percent of participants who used parks for physical activity go to one resident-preferred park. The third proximity measure is the distance between a participant's home and the specific park identified in the qualitative data as the park most used for adult physical activity (Resident-preferred park).

We divided distances from each of these parks categories into quartiles, with the highest quartile (furthest distance) as the reference group.

Community Violence and Feeling Unsafe

We asked participants about community violence using a modified version of the Exposure to Community Violence scale.[98–100] Participants reported whether they knew about one or more occurrences of a fight with a weapon, violent argument between neighbors, gang fight, sexual assault or rape, or robbery or mugging in their neighborhood in the last six months, and if they ever experienced violence against themselves or a member of their household while living in their neighborhood. We analyzed the previously listed events individually and with a total score, with one point per positive response and a maximum of six events.[99, 100] The total score represented a cumulative burden of neighborhood violent events. Since a high prevalence of participants reported no events, we could not evaluate this variable continuously, so scores were divided into groups: no events (reference), 1 event, 2 events, or 3 or more events.

We also asked participants if they felt unsafe while walking alone during the day or at night. To both questions, participants responded using the options No problem/no

opinion, Minor problem, or Serious problem.[101] We used No problem/no opinion as the reference group, with separate groups for the responses of Minor problem and Serious problem.

Demographic Characteristics

Participants reported their age, sex, educational attainment, having children less than 18 years of age at home, and ethnic identity.

Statistical Analyses

Our objective was to determine which of the many measures of park access and community violence were associated with physical activity, while controlling for key demographic variables. Due to the high prevalence of our outcomes, we used robust log-linear regression models with a Poisson distribution to avoid biased effect estimates and confidence levels, a method validated in previous cross-sectional analyses.[102–105]

We identified age, education, sex, ethnicity (Latino, not Latino), reported injury or impairment, having children younger than 18 years of age, work status (working, not working), and season of interview as variables that were likely to affect our outcome.

We used three different methods of variable selection to construct the most parsimonious final model possible. We first examined associations between individual variables and outcomes for significance. We then ran stepwise selection (entry criteria = 0.10, stay criteria = 0.08) on a model that included only significant variables. We then ran stepwise selection on a separate model that included all of the variables. We compared results from these two models to determine if variables recommended by the stepwise

selection process were different from those that showed significant individual

associations with the outcome. Since automated selection methods including stepwise

regression have weaknesses related to low p-values and biased parameter estimates,[106, 107]

we verified our model using the LASSO (Least Absolute Shrinkage and Selection

Operator) method, modified for use with dichotomous outcomes using a method

described by Hastie et al.[108] Our final model controlled for education, ethnicity, and

injuries or impairments. Due to our small sample size, we report results that are

significant (p <0.05), and borderline significant (p <0.1).

Results

Our study includes 354 residents of Chelsea. Seventy-one percent report physical

activity within the past month (Table 1.1), a similar finding to results of the

Massachusetts Behavioral Risk Factor Surveillance System.[109] Thirty-nine percent of all

participants report outdoor-physical activity, with 17 percent of all participants reporting

park-based physical activity (Table 1.1). Participants live an average of 181 meters from

the nearest park of any type to their home, showing that parks are generally

geographically accessible (Table 1.1). Seventy-three percent of participants live closest to

a playground/tot lot.

The majority of our participants are middle-aged, female, Latino, and high school

graduates (Table 1.1). Sixty-one percent identify as Latino, which reflects Chelsea's 2010

Census statistics.[68] Sixty-four percent of our participants are not working, with 33 percent

of the total participants reporting a permanent or temporary physical injury or

impairment. Violent arguments are the most commonly reported violent event (Table

1.1), followed by participant-reported experience with violence while living in their neighborhoods. Rape or sexual assault is the least common reported violent event (Table 1.1). Women report sixteen of the twenty reported instances of rape or sexual assault. Sixty-one percent of participants know about one or more violent events occurring in their neighborhood in the previous six months (Table 1.1). There is no association between interview season and any physical activity measure.

Population characteristics	n (% total)
Physical activity (PA) outcomes	
All-PA	249 (71)
Indoor PA	98 (28)
Outdoor-PA	139 (39)
Park-based PA	61 (17)
	Mean
Distance to nearest park (m)	181
All-PA	180
No PA	185
Facilities available in park nearest home	**n (% total)**
Playground/Tot lot	256 (73)
Sitting area	49 (14)
Sports field/court or walking path	3 (1)
All facility types	44 (13)
Age (years)	
18–44	152 (43)
45–59	108 (31)
60+	92 (26)
Sex: Female	239 (68)
Ethnicity: Latino	215 (61)
Education: ≥ High school	231 (66)
Work status: Not working	224 (64)
Reported injury or impairment	116 (33)
No children < 18 years	220 (63)
Participant-reported violent events	
Gang fight	41(12)
Fight with weapon	88 (25)
Robbery or mugging	93 (26)
Rape or sexual assault	20 (6)
Violent argument	116 (33)
Personal experience with violence	94 (27)
≥1 participant-reported violent events	215 (61)
Total	**352**

Table 1.1. Study population characteristics

	All-PA N = 352		Indoor-PA n = 201		Outdoor-PA n = 242		Park-based PA n = 164	
	POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI
Age								
> 60 years	1.20	0.89, 1.63	1.43*	1.05, 1.95	1.18	0.89, 1.56	1.14	0.70, 1.87
45 – 59 years	1.11	0.82, 1.49	1.02	0.70, 1.48	1.19	0.93, 1.52	1.00	0.62, 1.61
18 – 44 years	Ref		Ref		Ref		Ref	
Sex: Female	0.79	0.61, 1.03	0.68*	0.52, 0.89	0.71*	0.58, 0.87	0.49*	0.34, 0.71
Education: < High School	0.76	0.58, 1.00	0.46*	0.31, 0.69	0.75*	0.59, 0.96	0.37*	0.21, 0.66
Ethnicity: Latino	0.75*	0.59, 0.97	0.60*	0.46, 0.79	0.65*	0.53, 0.80	0.55*	0.38, 0.81
Has a child < 18 years	0.83	0.64, 1.08	0.76	0.56, 1.03	0.79	0.62, 1.00	0.71	0.46, 1.08
Injury or impairment	0.76	0.57, 1.01	0.43*	0.27, 0.69	0.76*	0.59, 0.98	0.47*	0.27, 0.81

* Significant (p≤ 0.05)

Shaded boxes indicate borderline significance (p < 0.1)

Table 1.2. Crude prevalence odds ratios (POR) and 95% CI for the independent associations between demographic variables and physical activity (PA) outcomes

Latino ethnicity, female sex, less than a high school education, having children younger than 18 years, and reported injury/impairment each show reduced odds with physical activity (Table 1.2). Associations for Latino ethnicity are statistically significant for all physical activity measures. Being 60 years or older is significantly associated with indoor-physical activity (Table 1.2). Older age groups are significantly more likely to report indoor-physical activity than younger age groups (Table 1.2).

Proximity to the resident-preferred park is positively associated with physical activity outcomes (Table 1.3). Residence in the quartile closest to the resident-preferred park is positively associated with all-physical activity; this relationship is significant for indoor-physical activity and park-based physical activity (Table 1.3). Effect estimates for all quartiles of proximity to the resident-preferred park are similar in magnitude. The measures proximity to all parks and proximity to parks with facilities for adults show no association with any measure of physical activity, with no apparent trends for distances less than 1606 meters, which is the quartile located furthest from the resident-preferred park.

Proximity to parks	All-PA N = 352		Indoor-PA N = 201		Outdoor-PA N = 242		Park-based PA N = 164	
	POR	95% CI	POR	95% CI	POR	95% CI	POR	95% CI
All parks								
Quartile 1: 23 – 85 m	0.92	0.77, 1.11	0.94	0.66, 1.33	0.84	0.62, 1.15	0.88	0.47, 1.62
Quartile 2: 86 – 153 m	1.05	0.89, 1.24	1.19	0.85, 1.68	1.06	0.81, 1.38	1.58	0.99, 2.53
Quartile 3: 154 – 236 m	0.92	0.76, 1.12	0.93	0.63, 1.36	0.87	0.65, 1.18	0.87	0.47, 1.61
Quartile 4: > 236 m	Ref		Ref		Ref		Ref	
Parks with sports/walking facilities								
Quartile 1: 75 – 461 m	0.99	0.82, 1.21	1.07	0.70, 1.65	0.96	0.71, 1.31	0.82	0.50, 1.34
Quartile 2: 463 – 638 m	1.03	0.84, 1.25	1.03	0.65, 1.63	1.06	0.80, 1.41	0.67	0.38, 1.19
Quartile 3: 640 – 835 m	0.95	0.77, 1.18	0.99	0.63, 1.57	0.97	0.70, 1.33	0.85	0.52, 1.38
Quartile 4: > 835 m	Ref		Ref		Ref		Ref	
Resident-preferred park								
Quartile 1: 75 – 866 m	1.11	0.94, 1.32	1.45*	1.02, 2.05	1.07	0.79, 1.44	2.42*	1.12, 5.24
Quartile 2: 899 – 1269 m	1.00	0.80, 1.24	1.03	0.65, 1.63	1.00	0.72, 1.39	2.27*	1.06, 4.87
Quartile 3: 1270 – 1606 m	1.10	0.90, 1.35	1.01	0.63, 1.61	1.24	0.93, 1.65	2.15	0.96, 4.81
Quartile 4: > 1606 m	Ref		Ref		Ref		Ref	

a Adjusted for education, ethnicity, injury or impairment, No PA = reference group

* Significant (p≤ 0.05)

Table 1.3. Adjusted prevalence odds ratios (POR) and 95% CI for the independent associations between proximity to parks and physical activity (PA) outcomes

Reported knowledge of any type of violent event shows significant associations with feeling unsafe during the day and at night (Table 1.4). Of the individual events, reported knowledge of gang fights, robberies/muggings, and arguments between neighbors show the highest effect estimates for feeling unsafe during the day as a serious problem (Table 1.4). There also appears to be a positive correlation between knowledge of a greater number of violent events and the severity of problems feeling unsafe during the day and at night (Table 1.4).

Most reported violent events show null associations with physical activity measures (Table 1.5). Knowing about sexual assault or rape is the only type of community violence inversely associated with physical activity outcomes (Table 1.5). The score representing an increase in the number of reported violent events displays null associations with all physical activity measures (Table 1.5). Reporting minor and serious problems with feeling unsafe during the day and during the night also show null associations with physical activity measures (Table 1.5).

	Feeling unsafe during the day				Feeling unsafe at night			
Community Violence	**Minor problem**		**Serious problem**		**Minor problem**		**Serious problem**	
Individual Events	**POR**	**95% CI**	**POR**	**95% CI**	**POR**	**95% CI**	**POR**	**95% CI**
Gang fight	1.91*	1.12, 3.24	2.39*	1.41, 4.05	1.07	0.48, 2.41	1.69*	1.4, 2.04
Fight using weapon	1.71*	1.1, 2.65	2.02*	1.20, 3.40	2.06*	1.50, 2.83	1.72*	1.42, 2.09
Violent argument between neighbors	1.89*	1.26, 2.84	2.03*	1.20, 3.43	1.87*	1.35, 2.58	1.51*	1.23, 1.86
Sexual assault or rape	1.40	0.62, 3.16	1.16	0.45, 2.99	1.79*	1.11, 2.89	1.63*	1.23, 2.15
Robbery or mugging	1.28	0.81, 2.04	2.28*	1.38, 3.77	1.29	0.90, 1.85	1.68*	1.38, 2.03
Personal experience	1.86*	1.23, 2.82	1.91*	1.20, 3.05	1.38	0.97, 1.96	1.55*	1.26, 1.9
Number of reported violent events[b]								
1 event	1.29	0.67, 2.48	1.26	0.44, 3.65	2.19*	1.26, 3.78	1.61	0.97, 2.67
2 events	2.05*	1.06, 3.97	3.35*	1.39, 8.09	2.37*	1.24, 4.56	2.39*	1.49, 3.83
≥ 3 events	2.83*	1.46, 5.47	4.22*	1.76, 10.13	2.87*	1.43, 5.75	2.77*	1.73, 4.43

a Adjusted for education, ethnicity, injury or impairment

b No reported events is the reference group

* Significant (p≤ 0.05)

Table 1.4. Adjusted prevalence odds ratios (POR) and 95% CI for the independent associations between knowledge of community violence and feeling unsafe

	All-PA N = 352		Indoor-PA N = 201		Outdoor-PA N = 242		Park-based PA N = 164	
Violent events[b]	**POR**	**95% CI**	**POR**	**95% CI**	**POR**	**95% CI**	**POR**	**95% CI**
Gang fight	0.98	0.77, 1.24	0.95	0.61, 1.47	1.06	0.74, 1.52	1.34	0.84, 2.15
Fight using weapon	0.98	0.84, 1.16	0.92	0.67, 1.27	0.99	0.76, 1.29	0.89	0.57, 1.4
Violent argument between neighbors	1.02	0.89, 1.17	0.99	0.75, 1.31	1.07	0.86, 1.34	1.33	0.92, 1.93
Sexual assault or rape	0.64	0.39, 1.04	0.52	0.23, 1.20	0.46	0.20, 1.05	0.35	0.10, 1.18
Robbery or mugging	0.99	0.86, 1.15	1.03	0.79, 1.35	0.99	0.76, 1.29	1.10	0.73, 1.64
Personal experience	0.96	0.83, 1.13	0.96	0.69, 1.34	0.95	0.74, 1.21	1.17	0.80, 1.72
Number of reported violent events[b]								
1 event	1.04	0.9, 1.21	1.13	0.68, 1.86	1.11	0.87, 1.42	1.04	0.62, 1.76
2 events	0.96	0.79, 1.16	1.04	0.60, 1.82	0.9	0.66, 1.23	1.20	0.74, 1.93
≥ 3 events	0.99	0.80, 1.21	0.91	0.50, 1.67	1.04	0.74, 1.46	1.22	0.73, 2.06
General feelings of safety[c]								
Feels unsafe during the day								
Minor problem	0.97	0.82, 1.15	0.94	0.54, 1.63	0.97	0.74, 1.26	1.02	0.67, 1.53
Serious problem	1.10	0.88, 1.37	1.13	0.61, 2.08	1.14	0.79, 1.66	1.41	0.79, 2.53
Feels unsafe at night								
Minor problem	0.99	0.84, 1.16	0.99	0.59, 1.65	0.99	0.77, 1.29	0.82	0.51, 1.31
Serious problem	0.98	0.83, 1.16	0.96	0.58, 1.59	0.98	0.76, 1.28	0.93	0.57, 1.5

a Adjusted for education, ethnicity, injury or impairment, No PA = reference group

b No reported events is the reference group

c No problem/ no opinion is the reference group

* Significant (p≤ 0.05), shaded boxes indicate borderline significance (p < 0.01)

Table 1.5. Adjusted prevalence odds ratios (POR) and 95% CI for independent associations between knowledge of community violence, feeling safe, and physical activity (PA) outcomes

Discussion

Our results support the claim that both park access and community violence may influence physical activity in a low-income urban community, but with some subtleties that may not be captured with standard measures. First, proximity to the nearest park of any type is not associated with physical activity, which is similar to previous studies.[31, 39] Rather, proximity to the resident-preferred park is positively associated with park-based physical activity. Analysis of qualitative data indicates that the vast majority of participants perceive one particular park as good for walking and physical activity, and most active participants use the resident-preferred park. In the City of Chelsea, this is the only park that contains large green spaces and walking/running paths, in addition to a soccer field and playgrounds for children. It also located in a neighborhood largely considered safe by our participants. This finding supports literature that reports associations between parks with green spaces and physical activity,[85, 86] and also support the notion that public awareness of available parks is associated with increased physical activity.[110]

Although effect estimates for the association between park-based physical activity and participants that live further than 1606 meters from resident-preferred park are smaller than the estimates for those living closer to the park, the consistent positive association shows that park-based physical activity is not necessarily dependent on residential location within 1606 meters. The widespread preference and awareness of the resident-preferred park suggests that participant perceptions of park accessibility are not solely based on geographic proximity. This also agrees with previous literature showing

that use of neighborhood resources is more closely linked to resident perceptions than the geographic proximity of those resources.[60, 72] Our findings and the studies focusing on resident perceptions show that perception of utility, awareness of parks, and proximity to residences are all important facets of defining park access. Our findings also agree with previous studies that emphasize the importance of measuring both the objective and perceived environments in studies of physical activity.[91, 93, 111]

We report no relationship between physical activity measures and feeling unsafe or the total number of reported violent events, which are null findings noted in previous studies.[111, 113, 114] However, by analyzing violent events individually, we identify an inverse association between knowing about sexual assault/rape and all physical activity. The null associations we see between feeling unsafe and the total number of reported violent events strengthens Foster et al.'s assertion that aggregate measures of safety and violence mask true associations between specific violent events and physical activity.[115] Further, the inverse association between knowing about sexual assault/rape and physical activity agrees with previous studies showing correlations between less physical activity and fear of, or experience with sexual assault.[116–118] This finding supports literature identifying safety as a barrier to physical activity among women, but not men.[74, 119] Sixteen of the twenty participants who reported knowledge of sexual assaults or rapes are women, suggesting that women may be more aware of, or sensitive to, issues regarding gender-based community violence compared with men.

Beyond these pathways, our study also identifies subpopulations at greatest risk for not engaging in physical activity.[92, 120] Specifically, women, participants with less

than high school education, Latino ethnicity, having an injury or impairment, and having a child aged less than 18 years show consistent inverse associations with all measures of physical activity.

Strengths and Limitations

Our study's strengths lie mainly in the use of qualitative data to inform creation of the park access and physical activity measures, along with detailed information regarding community violence. If we rely on conventional definitions of park access and physical activity measures, our results would show null results instead of the subtle relationship we identify regarding the influence of resident perceptions of local parks on their use for physical activity.[74, 121]

We are limited by the lack of information about the duration, frequency, and intensity of physical activity, which limits our ability to draw conclusions about the health implications of parks on changes in physical activity patterns. Our physical activity measures are also subject to potential recall bias.

We should note that null findings with outdoor-physical activity could be due to the fact that the measure outdoor-physical activity includes walking as a form of transportation. Walking as transportation is associated with street connectivity, traffic and pedestrian safety, and mixed land use,[112] which our study does not measure.

Since this is a cross-sectional study, we are limited in our ability to examine causation. Specifically, we cannot determine whether the associations seen in our study are due to social causation (people exercise because they live closer parks) or social selection (people who exercise chose to live closer to parks). Economic status is a source

of confounding because of its relation to residential neighborhood and physical activity.

In our study and others, larger parks and green spaces are located in higher economic

status neighborhoods,[122] whose residents may have options for gym membership. In our

study, the highest percent of gym-users and those of higher economic status live near the

green park. This may explain the association between indoor-physical activity and

proximity to the resident-preferred park. We lack information on household income, and

use education as a proxy measure, but including education in the models may not

completely control for confounding.

Our study is also limited by a small sample size and geographic scope of the

study. Small numbers of participants who know about sexual assault or rape limit our

ability to show statistically significant associations. Since our study population lives in

one city, their park-use habits and preferences could differ from other populations. The

small geographic scale of our study, and the limited number of parks we were able to

include the study limits the generalizability of our findings to other populations. Chelsea

is less than two square miles in area,[68] which limits our ability to investigate associations

between longer distances between residents' homes and parks with physical activity

outcomes.

Conclusion

We report that physical activity is associated with proximity to the resident-

preferred park. Participants consistently report one type of park as usable, characterized

by a wide variety of available facilities and large green spaces. Knowing about sexual

assault or rape is inversely associated with every physical activity measure. Our study

reinforces the importance of using qualitative data to look for patterns in the types of

parks that community residents prefer, and how those preferences are associated with

physical activity. Our findings also support the use of specific measures of community

violence rather than overall feelings of safety or a total violence score.

CHAPTER TWO: THE RELATIONSHIP OF PHYSICAL, SOCIAL, AND CULTURAL FACTORS WITH SELF-RATED HEALTH IN AN ENVIRONMENTAL JUSTICE POPULATION

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Introduction

Self-rated health (SRH) predicts premature mortality, even after controlling for health conditions and socioeconomic status, and is widely used as a measure of population health.[75, 76, 124–126] Physical and social environmental factors show longitudinal associations with poor SRH.[1, 127–129] Previous studies identify traffic, noise, and poor perceived neighborhood conditions as physical factors that increase risk for poor SRH. [38, 125, 128, 130] The social factor, social cohesion, is correlated with excellent, very good, and good SRH.[131]

In Massachusetts, environmental justice communities are defined by their demographic composition of low-income or minority residents, who may have fewer resources and opportunities to voice concerns and participate in decisions regarding the environmental quality of their neighborhoods.[70] These same communities are often exposed to multiple negative physical and social factors that are associated with poor

SRH, and report higher mortality rates than non-environmental justice communities.[132–134]

In addition to physical and social factors, environmental justice communities composed of large minority populations may also experience cultural factors associated with poor SRH.[135] Acculturation and acculturative stress, such as low language proficiency, are cultural factors that show mixed associations with SRH.[48, 49, 136–143] Language itself also influences the reporting of SRH,[141] as respondents who rate their health in non-English languages differentially report poorer health than English-language respondents.[144]

Residents of Chelsea, Massachusetts, are potentially exposed to physical, social, and cultural factors associated with poor SRH. Chelsea is an urban suburb of Boston with a Latino population that comprises 62 percent of the city's total population.[67] The city contains a variety of environmental hazards due to its proximity to a designated port area and multilevel highway.[145] We examine independent and combined associations of social, cultural, and physical factors on SRH while accounting for the effect of interview language and preexisting health conditions. We also investigate the cumulative association of social, physical and cultural factors on SRH.

Methods

The Chelsea STAR (Science To Achieve Results) project was a community-university collaboration investigating health and environmental concerns of Chelsea residents.[146] This cross-sectional study used data gathered from one-on-one interviews with Chelsea residents. The interview guide contained 180 open- and closed-ended

questions, including validated instruments and original questions that address local concerns as identified through focus groups with community leaders and activists.

Recruitment for the study took place between December 2011 and June 2013. Participants were deemed eligible if they were 18 years of age or older, spoke either English or Spanish, lived in Chelsea for at least 6 months, and lived in one of five census tracts that were selected for their proximity to a designated port area.

Interviewers recruited participants by traveling door-to-door between 9 am and 8 pm, on weekdays and weekends. Flyers placed in community centers, at local events, and clinics also invited residents to participate. Interviews took place in participants' homes or our community partner's office in Chelsea, as indicated by participant preference. Either way, interviewers recorded the geographic coordinates of participants' homes. Informed consent, as approved by the Boston University Medical Campus Institutional Review Board, was obtained from each participant prior to the interview.

All of the questions used in this study are located in Appendix B.

Self-Rated Health (SRH)

We measured SRH by asking participants to rate their own health, with the response options of excellent, very good, good, fair, or poor. We dichotomized responses into two categories, one consisting of the responses excellent, very good, or good health (reference), and the other with responses fair or poor health. Dichotomization was previously validated as practice that showed similar results with the original scale.[147] We refer to the outcome as fair/poor SRH.

Physical Factors

We asked about resident perceptions of air quality, pest problems in the home, noise and odor disturbances, and perceived neighborhood conditions. Perceived air quality was measured with the categories very good/good (reference), very bad/bad, and uncertain/never thought about it. Participants indicated if rats, mice or insects bothered them in their homes within the past year with a yes or no response.[148]

We used three noise-related variables to measure noise disturbances: 1) the number of noises that regularly bothered participants; 2) losing sleep because of noise disturbance; and 3) the feelings elicited by the noise.

Odor disturbances were measured with three similar variables: 1) the number of smells or odors that regularly bothered participants; 2) odors from outdoor sources that prevented participants from opening their windows or going outside (no odor, odors that did not affect behavior, odors that affect behavior); and 3) odors that produced a negative response (e.g. nausea).

Neighborhood conditions were measured using questions from a modified version of the Neighborhood/Block Conditions Assessment used by Perkins et al. and published by the US Centers for Disease Control and Prevention. [101, 149] We added seven questions to the original 13-question instrument; five were based on input from residents, and two from a Chicago-based community survey.[150] We used seven items from the resulting 20-item instrument to measure the severity of perceived problems with neighborhood conditions. Neighborhoods with more reported problems were labeled as having poorer conditions.

Social Factors

Social cohesion was measured using the social cohesion section of Sampson's collective efficacy scale.[23] Responses were recorded on a Likert scale.

Ethnic identity described how individuals identify with a particular ethnic group.[153] Ethnic group orientation described a sense of belonging within an ethnic group, usually identified through heritage, and the perceptions and behaviors associated with membership in that ethnic group.[153] Conversely, other ethnic group orientation represented a sense of belonging to groups outside one's own ethnicity. We measured ethnic identity and ethnic group orientation using a shortened version of Phinney's Multi-group Ethnic Identity Measure.[153]

Feeling unsafe, crime, drug use and loitering were measured using items from the modified version of the Neighborhood/Block Conditions Assessment tool.[154] Feeling unsafe and crime were each measured using four questions. Drug use and loitering were measured using five items from the modified instrument.

Cultural Factors

We assessed acculturation with a score comprised of language spoken in the home, country of birth and age at immigration.[151, 152] We assigned points within each category ranging between 1 and 3, with higher points awarded to more acculturated participants (e.g. Latinos or Non-Latinos born in US, speak primarily English at home, or immigration to the US at 18 years or younger).

We also asked participants where they were born, if they are US citizens, if they consider themselves an immigrant and if they feel secure with their immigration status.

Using this information, we created one group containing US-born citizens and immigrants that feel secure with their immigration status (reference), and another group containing non-US-born immigrants who feel insecure with their immigration status.

We measured stress from language by asking participants if language was ever a source of stress for them, with a yes/no response option. We also accounted for the interview language chosen by the participants. Using those variables, we categorized responses into two categories. One consisted of participants interviewed in English and participants that interviewed in Spanish, but reported no language stress (reference). The second category included participants who interviewed in Spanish and reported language stress.

Physical and Mental Health Conditions

We assessed current physical and mental health conditions using questions from the Behavioral Risk Factor Surveillance System.[154] Participants reported physician diagnoses of chronic physical and mental health conditions. We developed two variables, one with a count of physical health conditions, and a dichotomous variable indicating the presence of mental health condition(s).

We measured disability through participant report of temporary or permanent disabilities that prevented employment.

Statistical Methods

We examined the individual and combined associations of the physical, social, and cultural factors on fair/poor SRH. Because of the high prevalence of the outcome

fair/poor perceived health, we used robust log-linear regression models with a Poisson distribution to avoid biased effect estimates and confidence levels. This method has been validated in previous cross-sectional analyses investigating the relationship between neighborhoods and self-rated heath.[102, 104] To develop the combined models, we compared results from adjusted individual models with output from stepwise regression and LASSO selection models. We evaluated the potential for over-fitting the model by entering the control variables individually to assess their impact on the effect estimates and confidence intervals.

We evaluated the following variables for inclusion in our models: education, interview language, age, sex, disability, current smoking status, alcohol consumption within the past month, physical health conditions, and mental health conditions. Current smoking and alcohol consumption were not included in the final models due to null associations with the outcome. Since cultural factors indirectly measured or included language in their construction, we did not control for language in analyses of cultural factors. We also tested for effect modification using multiplicative terms, none of which were significant.

To assess the cumulative burden of all factors on fair/poor SRH, we used a previously established method of summing a number of factors to which participants are exposed, and grouping participants based on their exposures.[155] Using results from the combined model, we created dichotomous groups for factors that maintained positive, significant associations with the outcome in that combined model. If the factor was a categorical variable, the dichotomous groups indicated the presence or absence of that

factor. If the factor was a continuous variable, the dichotomous grouping indicated a factor score that represented the presence of a neighborhood problem. We summed the dichotomous groups to represent concurrent exposure to up to three factors. We used that sum to create one variable with three categories indicating exposure to no factors (reference), one factor, two factors, or three factors.

The modified Neighborhood/Block Assessment instrument contained twenty questions that covered several topics.[101, 149] We used principal component analysis (PCA) with an orthogonal varimatrix rotation and a loading factor of 0.3 to examine logical groupings among the questions, and to verify that questions we expected would measure crime, poor neighborhood conditions, drugs and loitering, and feeling unsafe fell into those pre-identified groupings. PCA confirmed that items in the instrument measured the larger concepts of crime, poor neighborhood conditions, drugs and loitering, and feeling unsafe when placed in thematic groups.

Results from PCA also produced a latent factor score, which measured the contribution of each individual question to the larger group. We calculated weights for each group based on the individual contributions, and then created a score with a mean of zero with scores in the negative to positive range. This range indicated the difference between participants' weighted scores and the mean of zero, with positive scores indicating more severe problems. We analyzed these factors continuously in the regression models.

The instruments for ethnic identity, other ethnic group orientation, acculturation, and social cohesion were already grouped by theme, so we did not look for further

groupings among these instruments. To standardize our analytical methods, these instruments were separately weighted using PCA to create scores with a mean of zero, with scores in the negative to positive range indicating differences between the mean and an individual's score. Positive scores indicated more social cohesion, acculturation, stronger ethnic identity, or stronger other ethnic group orientation. These scores were run as continuous variables in the regression models.

Analyses were performed using SAS version 9.3. Estimates with p-values of 0.05 or less or confidence intervals excluding the null were significant.

Results

The analyses include 354 Chelsea residents, the majority of whom are female, Hispanic or Latino, unemployed, and high school graduates (Table 2.1). Approximately 27 percent of the study population reports a disability that prevents employment, 70 percent of the population reports at least one chronic physical health condition, and 37 percent report at least one mental health condition (Table 2.1). Forty-one percent of participants report fair/poor SRH (Table 2.1).

Approximately 50 percent of participants report regular noise disturbances, and 33 percent report sleep disruption or negative responses to noise (Table 2.2). Noise from trucks and planes are the most commonly reported sources. Approximately half of the participants report problems with pests (52%).

Population characteristics	Median (Range)
Age	49 (18–93)
	N (% total)
Sex: Female	239 (68)
Education: ≥ High school	231 (66)
Ethnicity: Hispanic or Latino	215 (61)
Interview language: English	184 (52)
Feels insecure with immigration status	
Feels secure	298 (84)
Feels insecure	56 (16)
Not working	224 (64)
Permanent or temporary disability	96 (27)
Self-rated health	
Excellent/Very good/Good	207 (58)
Fair/Poor	144 (41)
Physical health conditions[a]	
No conditions	110 (29)
1 condition	101 (29)
2 conditions	78 (22)
≥ 3 conditions	65 (18)
Mental health conditions[b]	
No conditions	222 (63)
≥ 1 condition	130 (37)
Non-smokers	289 (82)
No alcohol use in past month	194 (56)

[a]Heart disease, current asthma, diabetes, hypertension, cancer, psoriasis, vitiligo, emphysema or other respiratory disease, arthritis, other self-reported physical conditions

[b] Depression, anxiety, insomnia, other self-reported mental conditions

Table 2.1. Study population characteristics

Physical factors	N (%)
Noise disturbance	
No noise	184 (52)
1 noise	79 (22)
$\geq$ 2 noises	89 (25)
Sleep disruption from noise	
No noise	184 (52)
No sleep disruption	50 (14)
Sleep disruption	118 (33)
Negative response to noise	
No noise	184 (52)
No negative response	38 (11)
Negative response	110 (31)
Odor disturbance	
No odor	228 (64)
Reported odor	123 (35)
Odors affecting behavior	
No odor	228 (64)
Can open window/go outside	15 (4)
Can not open window/go outside	59 (17)
Missing	52 (15)
Odors with negative response	
No odor	228 (64)
No negative response	36 (10)
Negative response	74 (21)
Missing	16 (5)
Pest problems	
No pests	165(47)
Pests	184 (52)
Perceived air quality	
Very good/Good	98 (28)
Uncertain/Never thought about it	133 (38)
Very bad/ Bad	118 (33)
Total	354

Table 2.2. Frequency of reported physical factors

The different types of factors show varied associations with fair/poor SRH. Participants categorized as more acculturated show reduced odds of fair/poor SRH (Table 2.3). In contrast, feeling insecure with immigration status was positively associated with fair/poor SRH (Table 2.3).

Stress from language proficiency shows no association with fair/poor SRH. To verify these results, we regroup language proficiency by language of interview. This categorization results in three groups: English interviews (reference), Spanish interviews indicating no language-proficiency stress, and Spanish interviews indicating stress. The associations for the two Spanish interview groups showed positive effect estimates, but did not differ in magnitude (results not shown).

Social factors show inverse associations with fair/poor SRH. Specifically, social cohesion and stronger other ethnic group orientation each display a lower odds of reporting fair/poor SRH (Table 2.3).

The only physical factors that positively associated with fair/poor SRH are noise disturbances, sleep disturbance from noise, and poor conditions (Table 2.3). Poor neighborhood conditions show a borderline significant association with fair/poor SRH.

The combined model shows positive associations between noise disturbances and feeling insecure with immigration status on fair/poor SRH (Table 2.4). Two or more noises display a significant positive correlation with fair/poor SRH. The association between social cohesion maintains reduced effect estimate (Table 2.4). Physical health conditions are positively correlated with fair/poor SRH.

		POR	95% CI
Cultural factors[a]			
More acculturation[b]		0.84*	0.77, 0.92
Immigration status	Feels secure	Ref	
	Feels insecure	1.53*	1.12, 2.10
Language proficiency stress		0.94	0.72, 1.22
Social factors[a]			
Stronger ethnic identity		0.92	0.82, 1.03
Stronger other ethnic group orientation		0.88	0.76, 1.01
More social cohesion		0.88	0.78, 1.01
Feeling unsafe		1.08	0.96, 1.21
Crime		1.03	0.92, 1.16
Drug use and loitering		1.05	0.93, 1.19
Physical factors[a]			
Noise disturbance	No noise	Ref	
	1 noise	0.85	0.60, 1.21
	$\geq$ 2 noises	1.54*	1.22, 1.94
Negative response to noise	No noise	Ref	
	No negative response	1.27	0.92, 1.74
	Negative response	1.26	0.97, 1.63
Sleep disturbance from noise	No noise	Ref	
	No sleep disturbance	0.91	0.56, 1.47
	Sleep disturbance	1.29*	1.02, 1.63
Odor	No odor	Ref	
	$\geq$ 1 odor	1.01	0.79, 1.29
Odor with negative response	No odor	Ref	
	Odor, no negative response	1.08	0.76, 1.54
	Odor with negative response	0.89	0.65, 1.23
Odors affecting behavior	No odor	Ref	
	Affected behavior	0.96	0.67, 1.39
	Did not affect behavior	0.89	0.34, 2.35
Perceived air quality	Very good, good	Ref	
	Bad, Very bad	1.21	0.90, 1.64
	Uncertain/Haven't thought about it	1.26	0.94, 1.68
Pests	No pests	Ref	
	Pests reported	1.16	0.91, 1.48
Poor neighborhood conditions		1.11	0.99, 1.23

* Significant (p<0.05), shaded boxes indicate p-values < 0.1

a Adjusted for age, sex, education, all health conditions, language, disability

b Adjusted for age, sex, education, all health conditions, disability

Table 2.3. Adjusted prevalence odds ratios (POR) and 95% CI for the independent associations between physical, social, and cultural factors on fair/poor SRH

		POR	95% CI
More social cohesion		0.87*	0.77, 0.98
Immigration status	Feels secure	Ref	1.08, 5.67
	Feels insecure	1.64*	1.20, 2.24
Noise disturbance	No noise	Ref	
	1 noise	0.79	0.55, 1.12
	≥ 2 noises	1.53*	1.21, 1.92
Interview language	English	Ref	
	Spanish	1.51*	1.16, 1.96
Age	18–44 years	Ref	
	45–59 years	1.11	0.85, 1.46
	> 60 years	0.91	0.64, 1.29
Education	≥ High school	Ref	
	< High school	1.48*	1.16, 1.89
Sex	Male	Ref	
	Female	1.12	0.84, 1.50
Physical health conditions	No conditions	Ref	
	1 condition	1.96*	1.28, 3.01
	2 conditions	2.88*	1.86, 4.47
	3+ conditions	2.99*	1.90, 4.71
Mental health conditions	No conditions	Ref	
	1+ condition	1.11	0.84, 1.46
Disability	No disability	Ref	
	Reported disability	1.39*	1.08, 1.80

* Significant

a Adjusted for age, sex, education, physical and mental health conditions, language, disability

Table 2.4. Adjusted prevalence odds ratios (POR) and 95% CI for the combined associations of physical, social, and cultural factors on fair/poor self-rated health

Concurrent exposure to less social cohesion, two or more noise disturbances, and feeling

insecure with immigration status is positively correlated with fair/poor SRH (Figure 1).

Participants exposed to all three factors show a nearly four-fold increase in the odds for

fair/poor SRH compared to participants who are not exposed to any factors.
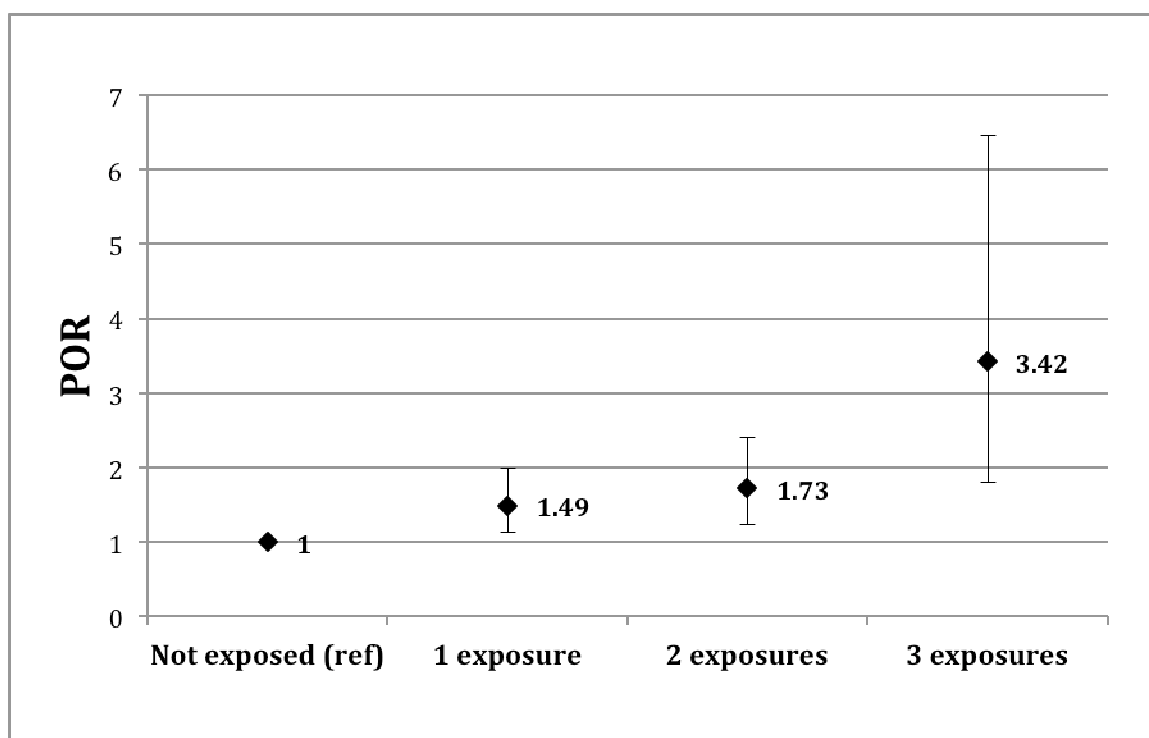
Figure 2.1. Adjusted prevalence odds ratios (POR) and 95% confidence intervals for the association between cumulative exposure to physical, social, and cultural factors on fair/poor SRH

Discussion

Physical, social, and cultural factors show positive, independent associations with fair/poor SRH, even after adjusting for physical and mental health conditions and interview language. The physical stressors of noise, sleep disturbance from noise, and poor conditions show independent positive correlations with fair/poor SRH. Participants reporting more social cohesion display lower odds of reporting fair/poor health. The cultural factor feeling insecure with immigration status is positively correlated with fair/poor SRH, while acculturation is inversely correlated with the outcome. In the combined model, the factors that retain significance are social cohesion, immigration status, and noise disturbances. As participants report more exposure to physical, social, and cultural factors, we also see increased odds of reporting fair/poor self-rated health.

The association between noise and poor SRH is supported by previous findings.[38, 128, 130] Previous work identifies annoyance from road traffic and sleep disruption as mediators on the pathway from physical noise to poor SRH.[38, 130] Our adjusted individual models support the idea that overall noise exposure and sleep disturbance from noise are associated with fair/poor SRH.

Noise may be a proxy measure for other social and physical factors that cause noise. We asked participants to list noises that bother them regularly, and these noises ranged from transportation sources (e.g. boats, buses, trucks, airplanes) to residential sources of noise (e.g. noisy neighbors, shouting). Participants who report two or more noises disturbances cite transportation vehicles, other residents, and local construction or industries as sources of noise. Our finding that two or more reported noises is positively

correlated with fair/poor SRH supports the idea that combinations of environmental disturbances influence fair/poor SRH.

Our finding that social cohesion is associated with reduced odds of fair/poor self-rated health supports previous findings with social cohesion.[24, 156] Social cohesion is also associated with more social support and a reduction in psychosocial distress.[24,156]

The association between social cohesion and fair/poor SRH, even after inclusion of physical and cultural stressors, provides evidence for the protective effect of social cohesion against poor neighborhood conditions noted in previous studies.[24, 156] As indicated in those studies, the moderating effect breaks down in neighborhoods with very poor conditions, which may explain why the association between two or more noises and fair/poor SRH was not influenced or affected by social cohesion.

Similar to our findings, previous literature shows that feeling insecure with immigration status is positively correlated with poorer health.[157] Feeling insecure with immigration status may represent social isolation and perceived discrimination, which are correlated with poor SRH.[142] The inverse association between poor SRH and acculturation further supports the idea that integration into mainstream culture protects against poor SRH.[138] This could be attributed to reduced acculturative stress due to more social support, better language proficiency, and less perceived discrimination.[138, 139]

The association between language and fair/poor SRH in the combined model supports previous studies that show positive associations between language and poor SRH. Language rather than language proficiency may also be a source of stress, evidenced by the fact that stress from language proficiency is not associated with

fair/poor SRH.[141] The strong association between language and fair/poor SRH could also be due to the correlation between Spanish language and socioeconomic status, or cultural differences in rating health irrespective of health status.

The model examining the cumulative exposure to one, two, or three factors supports the idea that SRH represents cumulative burden of stress from all types of sources.[124] Although this method is a crude way to show the cumulative burden of exposure to stress-inducing factors and fair/poor SRH, the positive correlation supports the idea that combined stress from social, cultural and physical factors influences SRH.

Strengths and Limitations

Limitations for this study include the cross sectional study design, which does not allow us to determine causality. We cannot control for social selection (sick people move into one specific neighborhood) or social causation (neighborhoods cause illness), which is a major problem noted in the literature.[32] We also lack objective measures of the environment, such as instrument-measured noise. Because we rely on perceived measures of the environment, our associations may be due to dependent, differential misclassification.[158] This describes a situation in which perceptions of the environment are differentially reported based on the current health of participants, or vice versa. It is possible that people with more illnesses report poorer perceived health and worse environmental conditions. We attempt to control for this by including physical health conditions and mental health in our analysis.

We lack a formal scale measuring acculturation and acculturative stress. To measure acculturation, we use a uni-dimensional measure of acculturation, which

assumes that acculturation occurs at a consistent rate over time, but does not measure personal cultural preferences or cultural affiliation. In contrast, acculturation scales incorporate participant values and preferences.[152] Given the data and the instruments we have, the uni-dimensional method is the only option we have to measure acculturation. We do include language stress and feeling insecure with immigration status as measures of acculturative stress, which have been used in previous literature.

Another possible weakness is our dichotomous outcome variable, which may reduce overall precision. Although dichotomization is a validated method yielding results that are similar to the original scale,[147] using a multinomial regression model with all SRH response levels may produce more specific results. However, we lack the sample size to examine all levels of SRH individually.

One weakness of the model examining the cumulative burden of stressors is that we assume that the cumulative exposures are additive. Because the data are categorical, we are unable to explore non-additive or non-linear effects of the combinations of factors.

Despite these limitations, we still identify strong associations between environmental factors and cultural factors with fair/poor SRH. This is one of the few studies to incorporate cultural factors into a study of the environment while accounting for the effect of interview language. These associations persist after adjustment for physical health and mental health conditions, which suggest that the neighborhood environment itself is a source of chronic stress.

Conclusion

We report significant associations between physical and social environmental stressors and fair/poor SRH. Our results support the protective effect of social cohesion against fair/poor SRH, but the effect does not impact populations that report a poorer physical environment, as measured by noise. We also identify feeling insecure with immigration status as a social stressor associated with fair/poor SRH, even after adjusting for physical and mental health conditions, and language.

CHAPTER THREE: ASSOCIATIONS OF NEIGHBORHOOD AND INDIVIDUAL STRESSORS WITH DEPRESSIVE SYMPTOMS IN A LOW-INCOME URBAN COMMUNITY

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Introduction

Depressive disorders affect daily functioning and increase risk for overall mortality; they are a major public health problem.[159–162] Depressive disorders are attributed to a variety of factors including demographic characteristics, genetic predisposition, and traumatic events.[163] A growing body of literature proposes that neighborhood environments also contribute to the etiology of depressive disorders.[164, 165] Multiple longitudinal studies support a causal relationship between depressive symptoms and stressors found within neighborhoods.[166]

Physical neighborhood stressors that show independent associations with depressive symptoms include poor neighborhood conditions (e.g. litter, poor lighting, and cracked sidewalks), noise, and traffic.[1, 64, 167] Social stressors such as feeling unsafe, low perceived social cohesion, and crime show positive correlations with depressive symptoms,[1, 21, 22] These results are consistent in longitudinal and cross-sectional studies that control for age, sex, and income, suggesting that neighborhood factors exert effects

on depression independent of individual characteristics.[54, 80, 167]

However, it is challenging to discern the effects of neighborhoods from the effects of individual attributes that may be highly correlated.[22, 168] For example, neighborhood poverty is associated with depressive symptoms,[169] but debt-related stress and financial problems at the individual level are also associated with depressive symptoms and may be more prevalent in low-income neighborhoods.[170] Poor neighborhood conditions display persistent associations with depressive symptoms,[1] but individual stressors related to housing quality and arrangements with strong positive correlations with the onset of depressive symptoms also may occur within neighborhoods with poor conditions.[171] [172–174] However, the inclusion of individual stressors is not common in studies of neighborhoods and depressive symptoms.[175–177] Without accounting for these factors, it is possible that neighborhood stressors act as surrogate measures of individual stressors.

One potential reason why studies find mixed results regarding the influence of neighborhoods on depressive symptoms is error in measuring neighborhood stressors based on inaccurate assessments of the neighborhood itself.[60, 178, 179] The use of census tracts or other administrative boundaries to define neighborhoods and measure neighborhood stressors could produce measures of the environment that are not reflective of true exposure. Resident-defined neighborhoods differ in geographic area and demographic composition from census tracts.[72] Inaccurate assessment of neighborhood boundaries could result in an inaccurate measure of actual neighborhood stressors, such as crime rates.

Problems with identifying the association between neighborhood and individual

factors and depressive symptoms intersect in Chelsea, MA, an urban suburb of Boston. Chelsea's large Latino and low-income populations are recognized as at-risk demographic groups for depressive symptoms.[160] The city contains multiple neighborhood factors that show positive relationships with depressive symptoms. Physical stressors could arise from the city's proximity to a designated port area and a multi-level highway. Social stressors may originate from crime and community violence present in the city; Chelsea's 2012 violent crime rate is almost five times Massachusetts' state rate.[96] The city's residents also have the potential for exposure to stressful life events and poor physical health.

We investigate independent and combined associations between depressive symptoms and neighborhood and individual stressors. We include the neighborhood stressors of crime, perceived noise and safety, and less social cohesion in our analysis. To address issues relating to inaccurate measurement of neighborhood boundaries and the exposures contained within, we use a novel approach for measuring crime by calculating crime rates within self-defined neighborhoods, as well as census-tracts.[22, 180] We include stressful life events and physical health conditions, along with basic demographics, as individual factors in our analysis.

Methods

The Chelsea STAR (Science To Achieve Results) project was a community-university collaboration that investigated residents' health and environmental concerns. This cross-sectional study used data gathered from one-on-one interviews with Chelsea residents. The interview guide contained 180 open- and closed-ended questions,

including validated instruments and original questions that address local concerns as identified through focus groups with community leaders and activists.

Recruitment for the study took place between December 2011 and June 2013. Participants were deemed eligible if they were 18 years of age or older, spoke either English or Spanish, lived in Chelsea for at least 6 months, and lived in one of five census tracts that were selected for their proximity to a designated port area.

We recruited door-to-door between 9 am and 8 pm on weekdays and weekends. Flyers and booths in community centers, local events, and clinics publicized the study. We conducted interviews at participants' homes or our community partner's office in Chelsea. We recorded geographic coordinates of participants' homes.

All questions used in this study can be found in Appendix C.

Depressive Symptoms

Depressive symptoms were measured using a modified version of the depressive symptoms section of the Behavioral Risk Factor Surveillance System (BRFSS).[181] We used five questions dealing with negative affect and sleep problems to measure the frequency of depressive symptoms experienced by participants within the past two weeks (Appendix C). We summed the scores to produce a score ranging from 0 to 10, with 10 indicating the most frequency of depressive symptoms.

Neighborhood Stressors

We measured neighborhood specific crime rates objectively using dates and street addresses of all criminal incidents reported in Chelsea between January 2011 and July

2013 as recorded by the Chelsea Police Department. Police records contained 13,165

incidents documented using the National Incident Based Reporting System (NIBRS)

system. We included incidents categorized as assault, arson, robbery/muggings,

burglary/theft/shoplifting, murder, property damage, weapons law violations, drugs, and

prostitution. These events were chosen for analysis because they were related to types of

crime that our survey also address, and were relevant to neighborhood environments. We

excluded incidents with the same address as the police station, hospital, or courthouse

(i.e., places where crimes are reported but the actual address of the incident is unknown).

After applying the exclusionary criteria for addresses and types of incidents, we had

9,877 incidents left in the data.

      We first verified addresses in the police records using census records in ArcGIS.

The first round of verification indicated that 92 percent the police-recorded addresses

matched completely with the addresses that the census recognized. We corrected police-

recorded addresses that did not have a complete match to the closest street address in the

census records (rematch score of 80 percent). One hundred thirty-nine incidents took

place in a city square known for high crime, but did not have a specific address. We

divided these incidents between two census tracts that intersect the square. Although the

incident locations are not exact, these addresses make up fewer than two percent of the

total number of mapped incidents, and did not substantially reduce the accuracy of our

mapping method or alter the crime rate in those census tracts. In total, we mapped 9,674

incidents (94%) that took place from January 2011 to July 2013.

      We calculated the six-month crime rate per 1,000 residents by census tract. We

chose this time frame because one of the interview questions we analyzed asked participants to recall crime-related events that occurred in their neighborhoods in the previous six months. To determine the rate for this time period, we calculated the total number of incidents in each census tract that occurred in the six months prior to each interview, and divided that number by the 2010 census tract population.[67] Each participant was then assigned a six-month crime rate based on their census tract of residence and interview date.

To calculate the crime rate in the participants' self-defined neighborhoods, we first asked participants to show us on a map, or describe the area they consider to be their neighborhood. Participants drew their neighborhoods on a map of Chelsea, or verbally described the streets, parks, or other city landmarks to describe the neighborhood boundaries. We used the map or verbal descriptions to create an ArcGIS layer that shows the size and shape of each neighborhood. We then calculated the total number of incidents that occurred in each self-defined neighborhood within the six-months prior to the participant's interview.

We estimated the population of each participant's neighborhood using 2010 US Census data and ArcGIS's tabulate function using census block groups. This smaller unit of analysis allowed us to capture the variation in population distribution in a geographic region. The function calculated percent of land from each census block group that fell within a self-defined neighborhood, which we used to estimate the population in each of these subdivisions, and summed the estimates to get a total population for each self-defined neighborhood. To ensure accuracy, we compared the populations of self-defined

neighborhoods with the population of census tracts and block groups that covered similar geographic areas. We calculated the total number of crimes that occurred within a participant's self-defined neighborhood, and divided that number by the total number of residents in that self-defined neighborhood to arrive at a neighborhood crime rate for each participant for the six-month period prior to their interview date.

Since crime varied by season, we also noted the season in which their interview was conducted.

We measured knowledge of crime with the Exposure to Community Violence instrument (Appendix C).[98–100] We analyzed events individually and categorically by the number of events grouped as no event, 1 event, or 2 or more events.

Feeling unsafe and poor neighborhood conditions were measured using a modified version of the Neighborhood/Block conditions instrument used by Perkins et al. and published by the US Centers for Disease Control and Prevention.[101, 149] We added seven questions to the original 13-question instrument. Five were based on input from our collaborators, and two from a Chicago-based community survey.[150]

We measured social cohesion using Sampson's collective efficacy scale (Appendix C).[23] Questions were weighted by their latent score coefficients and transformed into a score with a mean of zero; positive and negative scores indicating the difference between the mean of zero and an individual's score. Positive scores indicated less social cohesion.

We used three noise-related variables to measure noise disturbances: 1) the number of noises that regularly bothered participants; 2) losing sleep because of noise disturbance; and 3) the feelings elicited by the noise.

Individual Stressors

We measured health conditions by participants' report of physician diagnoses of chronic health conditions, such as cancer, high blood pressure, diabetes, heart disease (myocardial infarctions, coronary heart disease, or stroke), and respiratory conditions (asthma, emphysema). We used the data to create a count of physical health conditions (no condition, 1 condition, 2 conditions, or ≥ 3 conditions).

We assessed disability by asking unemployed participants reasons for their unemployment. We created a dichotomous variable indicating the presence or absence of a temporary or permanent disability.

We measured stressful life events using the Crisis in Family Systems (CRYSIS) instrument.[182] This instrument listed life events occurring within the past year that could contribute to feeling stress, and participants reported whether each event occurred. This instrument was scored using one point per reported event. We divided each type of problem into categories based on the distribution of the data. Scores for financial and housing events were divided into three categories (no event, 1–2 events, or ≥ 3 events). Legal events were dichotomized into groups indicating no event or one or more events.

We ascertained feeling insecure with immigration status by asking questions about citizenship, country of birth, and feeling secure with their immigration status. Foreign-born participants who were not US citizens and who reported feeling insecure

with their immigration status were categorized as "Feels insecure with immigration status." All other participants were in the reference group "Feels secure."

Participants reported their age, sex, educational attainment, and reported ethnic identity.

Statistical Methods

Depressive symptoms were measured using a Likert scale, so we used the cumulative logit model, a type of ordinal regression, for the responses ranging from 0 to 10. This method is accepted in the medical literature using this scale as a test for depression in patients.[183]

We measured feeling unsafe and poor neighborhood conditions using the modified Neighborhood/Block Assessment instrument, which contained twenty questions that covered several topics.[101, 149] We used principal component analysis (PCA) with an orthogonal varimatrix rotation and a loading factor of 0.3 to examine logical groupings among the questions, and to verify that questions we hypothesized would measure poor neighborhood conditions and feeling unsafe fell into those pre-identified groupings.

Results from PCA showed that four questions in the instrument measured poor neighborhood conditions, and another four questions measured feeling unsafe. This method also produced a latent factor score measuring the contribution of each individual question to the larger group. We calculated weights for each group based on the individual contributions, and then created a score with a mean of zero with scores in the negative to positive range. This range indicated the difference between participants' weighted scores and the mean of zero, with positive scores indicating more severe

problems. We analyzed these factors continuously in the regression models.

Crime rates for census tracts and self-defined neighborhoods showed a right-skewed distribution, so we log-transformed the crime rates. We ran crude and adjusted individual models including the demographic characteristics of age, sex, education, and ethnicity, which are known risk factors for depressive symptoms.[159, 160] Due to the correlation between feeling insecure with immigration status and ethnicity, we adjusted only for age, sex, and education. We followed this same modeling strategy to analyze the association between depressive symptoms and neighborhood factors.

We also included individual and neighborhood stressors in a single model to examine their combined associations with depressive symptoms. Along with these factors we examined interview season as a potential confounder because season of interview could be related to perceptions of the environment, crime rates, and the frequency of depressive symptoms. It was not included in the final models due to its null association with the outcome. We also considered reported neighborhood size as an independent predictor of depressive symptoms, as a potential proxy for size and extent of social networks, but it was also excluded in the final model.

We used multiple variable selection processes to avoid over-fitting the model. We used stepwise selection (stay and entry criteria = 0.1) and Least Absolute Shrinkage and Selection Operator (LASSO) selection to aid in choosing which individual and neighborhood factors to include. Age, chronic physical conditions, disability, and stressful financial events were individual factors that remained in the model in both selection processes. We first tested the individual factors with the variables relating to

noise, neighborhood conditions, social cohesion, and feeling unsafe. The stepwise model included sleep disturbance from noise and feeling unsafe, while LASSO did not. Since feeling unsafe showed borderline significance (p=0.1) and previous literature supported it as a predictor of depressive symptoms, it remained in the final combined model.

Since one question in the depressive symptoms instrument asked about the frequency of trouble sleeping, we ran sensitivity analyses excluding that question from the outcome to make sure the associations were not attributed to similar questions in the response and outcome variables. The effect estimates in the models excluding trouble sleeping from the outcome were similar to the original effect estimates, so we decided to keep the question relating to trouble sleeping in the outcome measurement.

In addition, we wanted to examine how including crime rates would alter the combined model. We looked at crime rates continuously and categorically with the other variables we identified. Using the continuous measure, we used a multiplicative term to evaluate possible significant interactions. For interaction terms that showed p-values less than 0.1, we ran stratified analyses based on the crime rate tertiles. We used this process for both census-tract and self-defined neighborhood crime rates.

Results

We include 354 interviews in the analyses. The majority of our participants are middle aged, female, and Latino. Approximately 34 percent of participants did not complete high school or its equivalent, and 27 percent report a temporary or permanent disability that prevents them from working (Table 3.1). A large percent (69%) of our participants report at least one physical health condition. Most of our participants report

at least one stressful financial (69%) or housing event (70%) within the past year (Table 3.1).

Our participants report several neighborhood stressors. Almost half report at least one regular noise disturbance, with over 30 percent reporting a negative emotional response or sleep disturbance related to noise. Fifty-five percent of participants know about at least one crime occurring in their neighborhood within the past six months (Table 3.1). Crime rates differ between census tracts and self-defined neighborhoods. The geometric means of both rates are similar, but the range in self-defined neighborhoods is much larger (Table 3.1). The neighborhood with the most crime has a small residential population, a small geographic area, and a large number of recorded crimes probably due to its location near a shopping center.

The crude regression models show that women are significantly more likely than men to report depressive symptoms (Table 3.2). Adults aged 38 years or younger are significantly more likely than adults 60 years or older to report more depressive symptoms (Table 3.2). We identify positive correlations between depressive symptoms and the number of chronic physical conditions, and with disability (Table 3.2). Stressful financial and housing events are also positively associated with depressive symptoms. Participants reporting three or more financial events show the highest effect estimates of all the individual stressors (Table 3.2). Participants who feel insecure with their immigration status report significantly less frequent depressive symptoms (Table 3.2). These associations remain after adjustment for demographic variables.

Demographic characteristics	N (% total)
Gender: Female	239 (68)
Education: ≥ High school	231 (66)
Ethnicity: Latino	215 (61)
Feels insecure with Immigration status	56 (16)
Individual stressors	
Chronic physical conditions: 1 or more	245 (69)
Disability (temporary or permanent)	96 (27)
Stressful life events (1 or more)	
Financial events	245 (69)
Legal events	59 (17)
Housing events	148 (70)
Neighborhood stressors	
Perceived physical environment	
Noise disturbances (1 or more)	169 (48)
Negative emotional response to noise	110 (33)
Sleep disturbance from noise	118 (34)
Knowledge of neighborhood crime (1 or more)	197 (55)
Crime rate, per 1000	**Geometric Mean (Range)**
Census tracts	60 (21–193)
Self-defined neighborhoods	62 (0–1790)
Depressive symptoms	3.86 (0 – 10)

Table 3.1. Study population characteristics

		Crude models		Adjusted models[a]	
Demographic characteristics		**OR**	**95% CI**	**OR**	**95% CI**
Age	Q1: ≤ 38 years		Ref		Ref
	Q2: 39 – 46 years	1.51	0.91, 2.53	1.47	0.87, 2.47
	Q3: 47 - 59 years	1.49	0.90, 2.47	1.57	0.93, 2.65
	Q4: ≥ 60 years	0.56*	0.33, 0.93	0.54*	0.32, 0.93
Sex	Male		Ref		Ref
	Female	1.51*	1.02, 2.24	1.47	0.97, 2.21
Education	Finished High School		Ref		Ref
	Didn't finish High School	1.44	0.98, 2.11	1.30	0.86, 1.97
Ethnicity	Not Latino		Ref		Ref
	Latino	1.28	0.88, 1.86	1.03	0.69, 1.56
Individual stressors					
Immigration status[b]	Feels secure		Ref		Ref
	Feels insecure	0.77	0.47, 1.27	0.50*	0.28, 0.86
Physical health problems					
Chronic physical conditions	No conditions		Ref	Ref	
	1 condition	2.25*	1.39, 3.63	2.48*	1.51, 4.07
	2 conditions	2.47*	1.48, 4.13	2.97*	1.72, 5.15
	3+ conditions	3.96*	2.28, 6.86	5.69*	3.13, 10.32
Disability (temporary or permanent)	No disability		Ref		
	Disability	3.33*	2.18, 5.10	2.92*	1.87, 4.54
Stressful life events					
Financial events	No events		Ref		Ref
	1–2 events	2.44*	1.53, 3.90	2.38*	1.48, 3.83
	3+ events	6.24*	3.88, 10.05	5.57*	3.35, 9.23
Legal events	No events		Ref		Ref
	1+ event	2.33*	1.42, 3.81	2.21*	1.34, 3.64
Housing events	No events		Ref		Ref
	1 event	1.44	0.93, 2.23	1.26	0.80, 2.00
	≥ 2 events	3.22*	1.98, 5.24	2.57*	1.52, 4.33

a Adjusted for age, sex, education, ethnicity, b Adjusted for age, sex, education

Table 3.2. Crude and adjusted odd ratios (OR) and 95% CI for independent relationships between demographic characteristics and individual stressors on depressive symptoms

Results for the crime covariates vary depending on the method of measuring crime. The only objective measure of crime that is positively associated with depressive symptoms is the tertile representing the census tract with the highest crime rates (Table 3.3). No self-defined neighborhood crime rates show significant associations with depressive symptoms (Table 3.3), although the effect estimates are positive. In contrast, less social cohesion, feeling unsafe, and noise disturbances are associated with depressive symptoms, even after controlling for demographic variables (Table 3.3).

The model combining neighborhood and individual stressors shows significant positive associations between frequent depressive symptoms and sleep disturbance from noise, physical health conditions, disability, and financial events (Table 3.4).

		Crude		Adjusted[a]	
Crime rate per 1,000		OR	95% CI	OR	95% CI
Census tract	Low (< 40)		Ref		Ref
	Medium (40 – <58)	1.39	0.88, 2.17	1.39	0.89, 2.19
	High (≥ 58)	1.88	1.19, 2.96	1.63*	1.03, 2.58
Self-defined neighborhood	Low (< 40)		Ref		Ref
	Medium (40 – <77)	1.47	0.94, 2.31	1.44	0.92, 2.27
	High (≥ 77)	1.45	0.92, 2.28	1.23	0.78, 1.93
Knowledge of neighborhood crime	No events		Ref		Ref
	1 event	1.51	0.98, 2.35	1.39	0.89, 2.17
	≥ 2 events	1.95*	1.25, 3.04	1.78*	1.11, 2.84
Perceived social stressors					
Less social cohesion		1.35*	1.09, 1.69	1.31*	1.04, 1.65
Feeling unsafe		1.49*	1.25, 1.78	1.45*	1.19, 1.77
Perceived physical factors[b]					
Poor neighborhood conditions		1.43*	1.20, 1.69	1.36*	1.14, 1.63
Number of noise disturbances	No noise		Ref		Ref
	1 noise	1.66*	1.05, 2.64	1.87*	1.16, 3.01
	≥ 2 noises	1.98*	1.27, 3.09	2.33*	1.47, 3.68
Negative response to noise	No noise		Ref		Ref
	Noise, no negative response	2.34*	1.27, 4.32	2.84*	1.52, 5.32
	Noise, with negative response	1.96*	1.29, 2.98	2.21*	1.42, 3.41
Sleep disturbance from noise	No noise		Ref		Ref
	No sleep disturbance	1.05	0.61, 1.81	1.43	0.81, 2.52
	Sleep disturbance	2.36*	1.57, 3.56	2.48*	1.63, 3.78

a Adjusted for age, sex, education, ethnicity

Table 3.3. Crude and adjusted odds ratios (OR) and 95% CI for the independent associations between neighborhood stressors and depressive symptoms.

		Crude		Adjusted[a]	
Neighborhood stressors		OR	95% CI	OR	95% CI
Feeling unsafe		1.24	1.02, 1.50	1.19	0.96, 1.46
Sleep disturbance from noise[b]	No noise		Ref		Ref
	No sleep disturbance	1.37	0.77, 2.42	1.57	0.88, 2.80
	Sleep disturbance	1.98	1.29, 3.04	2.02*	1.30, 3.16
Individual stressors					
Chronic physical conditions	No conditions		Ref		Ref
	1 condition	1.73	1.04, 2.86	1.87	1.12, 3.11
	2 conditions	2.06	1.20, 3.52	2.40*	1.36, 4.24
	3+ conditions	2.48	1.38, 4.46	3.11*	1.65, 5.86
Disability (temporary or permanent)	No disability		Ref		Ref
	Disability	2.18	1.38, 3.44	1.95*	1.22, 3.12
Financial events	No events		Ref		Ref
	1–2 events	1.91	1.17, 3.12	1.95*	1.19, 3.17
	3+ events	3.84	2.30, 6.40	3.74*	2.20, 6.34
a Adjusted for age, sex, education, ethnicity					

Table 3.4. Crude and adjusted odds ratios (OR) and 95% CI for the combined relationship of neighborhood and individual stressors on depressive symptoms

Including crime rates in the combined model does not change the effect estimates for sleep disturbance from noise, feeling unsafe, financial events, or disability. We find no interaction terms with significant p-values or consistent trends in the beta estimates when we examine interactions between tertiles of crime rates and each neighborhood and individual stressors.

We test for a possible mediating effect of crime through feeling unsafe in our data. We find evidence that suggests mediation in our data (results not shown). Another possible explanation for the association between feeling unsafe and depressive symptoms is that feeling unsafe and crime rates are correlated variables, and that correlation drives the null result between crime and depressive symptoms. Upon examining the association between feeling unsafe and crime rates, we found a significant association but low correlation (rho = 0.17, p = 0.002).

Discussion

Our results support the idea that both individual and neighborhood stressors are independently associated with depressive symptoms. We report strong independent associations between depressive symptoms and the individual stressors of financial issues, chronic physical conditions, and disability status. Even after controlling for these factors and basic demographics, depressive symptoms are positively correlated with sleep disturbance from noise and feeling unsafe. Our finding regarding sleep disturbance from noise supports longitudinal studies that report sleep disruption as significant predictor of depression.[184, 185]

We find null associations between objectively measured neighborhood stressors

(e.g. crime rates) and depressive symptoms, which have been reported in other studies.[21, 64] In contrast, as shown elsewhere, perceived measures of the neighborhood (e.g. noise disturbances, feeling unsafe) show are strongly associated with depressive symptoms.[1, 167] This could be due to resident perceptions or stressful life events having a more direct correlation with psychosocial stress and related depressive symptoms.[53 168]

Our findings regarding chronic health conditions and depressive symptoms are interpretable and consistent with the literature. Depression and depressive symptoms are recognized as both a risk factor for chronic health conditions,[173, 186, 187] and a result of health conditions.[174, 188, 189] Although we cannot assess the direction of causality, our findings further support studies that identify strong associations between depressive symptoms and health conditions.

The association between feeling insecure with immigration status and depressive symptoms is contra intuitive; immigration status is not associated with depressive symptoms after adjustment for individual risk factors in some studies,[190, 191] and is not significant in our combined model. However, immigration-related stressors, such as perceived discrimination, social isolation, and immigration status, are associated with depressive symptoms in other studies.[157, 192] The association could be due to the large Latino population within Chelsea, which would provide a buffer against feelings of isolation and possible anxiety. These findings could also be related to Chelsea's designation as a sanctuary city for undocumented immigrants.[193] This designation creates a safe haven for immigrants regardless of immigration status, which could decrease anxiety. The healthy immigrant effect may also explain the association,[194] which

proposes that immigrants' lifestyle and strong social ties reduce the risk for depressive symptoms.

Strengths and Limitations

One major limitation of our cross-sectional study is our inability to control for social selection (populations with poor health moving into similar neighborhoods) and social causation (moving into a neighborhood causes a health condition). The inability to control for these effects is widely known in the literature studying the effect of neighborhoods on health.[22, 32, 195] We are unable to determine if the depressive symptoms occur prior to or after stressful life events or the occurrence of health conditions. Perceived measures of neighborhood stressors are subject to dependent misclassification, as people with frequent depressive symptoms may be more likely to report more stressors. This error would bias the estimates away from the null. Despite the potential for bias, our cross-sectional study supports longitudinal studies that report noise, poverty or low socioeconomic status, health conditions, and poor neighborhood conditions as independent predictors of depressive symptoms.[15, 80, 167]

We also recognize that our study area and population are small, and our study lacks the sample size and geographic scale to draw conclusions that are applicable to a broader population. Although we only have five census tracts in our study area, we are able to introduce temporal variation in our dataset by calculating crime rates during the six months prior to participant interviews within census tract and self-defined neighborhoods. Although this population is small, it provides much-needed information about an environmental justice population. Similarly, while we identify multiple

individual and neighborhood factors associated with depressive symptoms, we lack the geographic scale to conduct formal multi-level analyses to identify the effects of, for example, neighborhood poverty versus individual poverty. Similarly, we cannot conduct formal mediation analyses to determine whether some of the observed effects are mediated through intermediate variables.

Another weakness is lack of specificity regarding participant reported noise disturbances. Noises that our participants report originate from a wide variety of sources. For example, participants report noises that are caused by traffic, acts of violence, noisy neighbors, or pests. This wide range of noise sources and their subsequent consequences on sleep disturbances and negative emotions may be surrogate measures for other underlying issues that are related to neighborhood disorder.

The way we define or calculate self-defined neighborhood crime rates may have been subject to measurement error. We rely on census data to calculate the population of self-defined neighborhoods because true measures of the neighborhood do not exist. To capture the variation in residential density and obtain the most accurate population count possible, we base our population calculation on census block groups instead of census tracts. Although we still assume that the population is distributed evenly within block groups, the amount of error is reduced because census blocks are a smaller unit of analysis than census tracts. Using the NIBRS system could also inflate the number of criminal events recorded, since all incidents are recorded in the dataset rather than just noting the presence of one event.

In addition to the inclusion of individual and neighborhood stressors from

multiple sources into this analysis, we also incorporate a novel approach to calculating neighborhood crime rates. Differences between the shape, size, and demographic composition of census tracts and resident-defined neighborhoods are well-recognized.[60, 72, 178] However, many studies define neighborhoods as census tracts or other administrative units despite the literature showing that self-defined neighborhood differs dramatically.[10–12,14] This study is one of the few that uses self-defined neighborhoods to measure a neighborhood stressor in relation to a health outcome.

Although we do not find consistent associations between crime rates and depressive symptoms using any neighborhood definition, this method reveals that exposures estimated using census tracts do not match with exposures estimated using self-defined neighborhoods, and that the range of crime rates in self-defined neighborhoods is substantially larger than those of census tracts.

A strength of the study is the specificity of neighborhood stressors included in our analysis. In addition to examining the effect of overall neighborhood conditions, we identify specific physical stressors present in the neighborhood environment and their effect on human behavior. This specificity allows us to identify noise as a stressor related to depressive symptoms, and sleep disturbance from noise as a specific noise-related stressor that affects depressive symptoms.

Conclusion

The relative contribution of individual and neighborhood stressors to depressive symptoms is a topic of great debate. We address concerns that neighborhood stressors may be surrogate measures for co-occurring individual stressors by examining the

associations between depressive symptoms and a wide range of neighborhood and individual stressors. Within a low-income urban population, sleep disturbance from noise, financial events, health conditions, and disability all show strong individual and multivariable associations with depressive symptoms. Our study reinforces the influence of the physical and social environments on depressive symptoms.

CONCLUSION

This study incorporates several novel methods to examine associations between neighborhood exposures and health. We incorporate qualitative data, individual stressors, objective and perceived measures of the neighborhood environment, and resident self-defined neighborhoods in our analyses.

Incorporating qualitative data in environmental studies is not a common practice, but our qualitative data reveals a variety of stressors present in the residents' lives that are not usually the focus of environmental epidemiologic studies. For example, residents voiced concerns with stable employment, language, and immigration status that they perceive as pressing concerns. This qualitative data could be a valuable resource when deciding what non-chemical factors to include as risk factors in future epidemiologic studies and cumulative risk assessments.[29]

Our study also includes individual stressors in analysis of the environment. Authors suggest that associations between neighborhoods and health are attributed to stressful life events, or are a result of spurious associations between environmental conditions and health.[32, 168] We find that neighborhood stressors display relationships with the outcome that are independent of individual stressors, supporting previous multi-level studies that show independent effects of neighborhoods on health.[31]

We report a complex relationship between actual neighborhood characteristics and the resident perceptions of those same characteristics. Perceptions of the environment cannot be predicted by only one environmental measure, but appear to be a combination of several neighborhood factors. For example, studies defining park access as geographic

proximity between any park and a resident's home assume that geographic proximity is related to actual use.[33, 74] Qualitative data from this study informs us that adult participants do not use parks based on the proximity of parks to their homes. Instead, the majority of our participants choose to use and recommend the use of one large park. The widespread opinion that this one park is considered usable provides evidence that resident perceptions and use of parks follows a pattern that is not directly related to geographic proximity. Instead, the type of resources contained within a park or its safety may have more influence on resident use of local parks.

We observe a similar pattern with crime rates and feeling unsafe. Although feeling unsafe could be directly attributed to crime or violence within a neighborhood, the variables are only weakly correlated. This suggests that crime rates are not the sole predictor of feeling unsafe. Resident perceptions of safety may include other social stressors, such as perceived discrimination or less social cohesion.

One perceived environmental characteristic that shows no correlation with its corresponding objective measure is resident self-defined neighborhoods. Despite literature showing that resident-defined neighborhoods differ in size and demographic composition from census tracts,[61, 63, 72] using self-defined neighborhoods to measure environmental exposures is not a common method. We mapped the neighborhoods that our participants drew or described and find no similarities between the census tracts and self-defined neighborhoods.

We also calculate crime rates using both neighborhood definitions, and discover that the rates of crime vary based on neighborhood definition. The difference between

census tract and self-defined neighborhood crime rates show that measurement error due to incorrect neighborhood definitions is possible and may provide a source of exposure misclassification, however in our study this does not seem to be the case.

The difference between actual and perceived measures of the environment also creates inconsistent results with health outcomes. For example, geographic proximity to any park shows null associations with physical activity.[33] In contrast, we see positive association between proximity to resident-preferred parks and physical activity. Crime rates in this study show mostly null associations with depressive symptoms, but feeling unsafe is positively correlated with depressive symptoms.[21, 54] Previous authors discuss differences in the associations between neighborhoods and health outcomes based on the method of measurement.[21, 53] Because actual and perceived methods are not directly associated with each other, the two types of measurements may represent different aspects of the neighborhood environment. Our findings and previous studies support the incorporation of resident perceptions along with actual measures of the environment in future studies.

Contribution to Previous Literature

These analyses using data from the Chelsea STAR study provide evidence for the associations between neighborhood stressors and park-based physical activity, poor self-rated health, and depressive symptoms. Our findings are in agreement with previous studies showing adverse effects of neighborhood exposures on health outcomes.[2, 18–20] The results highlight the importance of ecologic models of human behavior when examining the pathways by which neighborhoods influence health behaviors and

outcomes.

The positive correlation between physical activity and proximity to resident-preferred parks supports previous studies reporting positive correlations between physical activity and access to green space.[85, 90] The inverse association between physical activity and knowledge of rape or sexual assault expands on studies reporting a positive correlation between previous experience with sexual assault or rape and less physical activity.[116] Our results also contribute to literature suggesting that the influence of positive physical cues on human activity competes with the negative influence of co-occurring social stressors. This observation is noted in previous studies on physical activity and urban parks.[27, 74] Cutts et al. note that some populations that are vulnerable to obesity live in walkable neighborhoods with many proximate parks, but social stressors in the same locations act as barriers to accessibility, and residents' ability to engage in physical activity. The conclusion is that public health interventions to promote physical activity should have physical as well as social components to mitigate the effects of social stressors while also providing physical resources.[35]

We find independent positive correlations in the relationships of social, cultural, and physical stressors with poor self-rated health, and support the role of neighborhoods as source of chronic stress.[41, 42] We identify noise, less social cohesion, and feeling unsafe with immigration status as stressors that show correlations with fair/poor self-rated health. The joint effects of neighborhood conditions and social cohesion are previously studied,[156] but this is one of the few studies that examine cultural and neighborhood stressors while accounting for language.

We also report a positive association between the cumulative burden of physical, social, and cultural stressors and fair/poor self-rated health, providing more support for the hypothesis that the effects of neighborhood stressors accumulate and result in poor self-rated health.[41–44]

We report positive associations between neighborhood and individual stressors with depressive symptoms, supporting previous studies.[45, 168, 196]

Neighborhoods and individual stressors exert independent effects that increase risk for depressive symptoms. Mechanisms explaining the effects of stress on depressive symptoms remain unclear. Studies suggest that stress damages brain tissue associated with mood disorders including depression.[197, 198].[175, 196, 199] Studies also provide evidence that sleep disturbance impairs the brain's ability to recover from stress,[200] which is supported by our study and other epidemiologic studies identifying sleep disturbance as a predictor of depression.[185] These pathways also support the ideas that sleep disturbances, and chronic stressors from neighborhoods and life events can work in combination to increase risk for depressive symptoms. Reducing exposure to stressors causing sleep disturbance is one possible method to decrease risk for depressive disorders.

Limitations

The possibility of selection bias and dependent misclassification are also limitations in the literature and in this study. Social selection (people with similar characteristics move into the same neighborhood) and social causation (neighborhoods causing illness) are two types of selection bias that explains associations between neighborhoods and health. We are unable to control for self-selection, but our

associations support previous longitudinal and experimental studies showing associations between neighborhoods and health.[37, 46, 201, 202] However, other cohorts examining neighborhood effects on health and health behaviors report no association, and attribute effects of other studies to social selection or individual differences between residents.[32, 203]

An experimental study by Leventhal et al. examining the link between depressive symptoms and neighborhood poverty addresses the issue of social selection. Families from high-poverty neighborhoods are moved to private housing or higher income neighborhoods, while others remain in the same high-poverty neighborhood. After three years, parents and children of families who moved neighborhoods report fewer problems with anxiety and depression than those that remained in the original housing.[204] Although the long-term effects of this trial are unknown, this study provides evidence for social causation.

Dependent, differential misclassification is another explanatory factor for the previous studies.[158] This type of misclassification refers to differential reporting of perceptions based on current health status (e.g. people with more depressive symptoms report poorer neighborhoods). Effects from studies that only use perceived measures of the neighborhood, including longitudinal studies, may be attributed to this type of misclassification rather than showing an actual association. We cannot control for dependent, differential misclassification, but this study affirms previous associations between neighborhood exposures and health outcomes.

Public Health and Policy Implications

The findings from this study have far reaching public health and policy implications. Heart disease, stroke and diabetes are listed as some of the leading causes of death nationwide.[205] Obesity is a common, costly condition related to heart disease and stroke.[206] A lack of physical activity and chronic stress are risk factors for all of these chronic conditions,[207] and show associations with specific aspects of the urban environment. Eighty-one percent of US citizens live in urban areas,[208] including low-income and minority populations that are considered at-risk for mortality from these chronic diseases. Therefore, reducing sources of environmental stress, including social stressors, and providing public resources for physical activity can increase physical activity, reduce stress, and may reduce morbidity.

Improving overall neighborhood conditions and installing physical cues to promote health behaviors can lessen the negative impact of physical environments on health. Health-promoting neighborhoods could include features like public transportation and bicycle lanes, public parks, and walkable streets.[2, 87, 115] Removing sources of noise and air pollution from residential areas would also reduce health-related stressors and improve quality of life.[209]

Political and economic challenges create barriers to forming health-promoting neighborhoods. Responsibility for the maintenance of physical neighborhood characteristics falls to several different governmental agencies. Air and noise pollution standards are under the jurisdiction of the Environmental Protection Agency, but implementation of those standards is the responsibility of individual states.[210] Regulation

of air traffic and federal highways falls under the Department of Transportation, while local roads and public transportation systems fall to the jurisdiction of individual states and cities.[211] Political and economic conflict may occur over the rights to and nature of public spaces such as parks.[212] Standards regarding the mandatory allocation of public open space vary greatly among states. States have historically allocated anywhere between 12 to less than 5 percent of land for public use.[213] Neighborhood conditions and park resources also vary by income level, which creates an economic barrier to accessing health-promoting neighborhoods.[214]

The sheer number of agencies involved in neighborhood maintenance, and the differences among state land use regulations makes the creation of a unifying standard for neighborhood quality very difficult. The Center for Disease Control and Prevention provides guidelines for healthy community design,[215] but these guidelines do not have legislative force. Federal bills like the Urban Revitalization and Livable Communities Act (H.R. 709) and the Community Parks Revitalization Act (S.3583) propose the provision of federal grants that match city investments in the development of urban recreational spaces. However, these bills died in Congress after introduction in 2012.[216, 217] The Environmental Protection Agency provides grants for the development and maintenance of public land,[218] but these grants are limited in number. Even if improvements are made, the introduction of public spaces and improved conditions may increase property value and force current residents out due to higher rent and property taxes.[219] Therefore, a major challenge lies in ensuring that all communities irrespective of income level have access to health-promoting environments.

Social environments also positively influence health. Social cohesion measures feelings of unity and trust within a community, and repeatedly shows positive effects on health outcomes.[46, 47, 131] Social cohesion is linked to social support and social networks that can reduce stress and risk for mortality.[220] Although community trust and social support are vital to ensure good health outcomes, social cohesion and overall community participation within the United States is decreasing over time.[221] Robert D. Putnam's Bowling Alone documents the decline of the American community, and provides examples of waning participation in volunteer organizations, public participation in government elections, and even in-person social interaction.[221] Declining social cohesion is of concern to other European nations as well as the United States.[222, 223] Even global organizations express concern with the effects of less social cohesion and its resulting exclusion of historically marginalized and poverty stricken groups.[224]

The fraying of social cohesion may explain why feeling unsafe appears to be a relevant concern to our participants. The loose correlation between feeling unsafe and crime rates found in our study is also found on a national level and implies that other factors influence overall feelings of safety. The US national rate of violence crime shows declines over the past four years and within the past decade.[225, 226] However, polls of US residents report that the public perceives that crime is increasing over time. Nearly 40 percent of respondents say they are afraid to walk near their homes at night.[227] Public fear and perceptions of worsening crime, despite a significant decrease in actual crime rates, suggest that feeling unsafe may be a product of less social cohesion and an overall lack of community trust.

The cause of eroding social cohesion is unclear. Civic unrest, discrimination and immigration, political polarization and distrust of the government, income inequality, and declines in interpersonal trust are all theorized to contribute to recent declines in social cohesion.[222, 228, 229] These broad and pressing issues require macro-level policies that have the ability influence political structure and increase economic inclusion.[230] However, interventions can increase social cohesion on a smaller scale. Providing educational opportunities and friendly competition can increase social cohesion without resorting to major policy changes.[37, 231] Incorporating more greenery and green public spaces in urban environments may also increase social cohesion.[232]

Despite the challenges, creating health-promoting neighborhood environments is possible and should be a priority to prevent chronic diseases. One success story is Oklahoma City, noted in a recent news article as the "obese city [that] lost one million pounds."[233] In 2009, Oklahoma City was ranked as the second most obese city in the United States, putting the residents at risk for mortality from heart disease, stroke, and diabetes. The mayor issued a friendly challenge to city residents to together lose a total of one million pounds. Oklahoma City invested in the construction of public transportation systems, city parks and trails, improving sidewalk conditions, education, and increasing city greenery to provide an environment that supports an active lifestyle.[234] The City also hosted walking and running races to promote friendly competition, which also increases social cohesion, and to provide residents with a goal to help them meet the weight loss challenge.[233]

Two years later, the city achieved its goal of losing a cumulative one million

pounds. This case study shows that a combination of physical changes and social

influences can promote health behaviors and improve health on a city scale. Cities should

take advantage of existing federal funding and potential partnerships with local

businesses to improve the quality of urban areas. Cities can also promote social activities

like educational opportunities, art festivals, and sporting events to increase social

cohesion. This combination of physical and social environmental changes can change

cities into health-promoting refuges for urban communities.

APPENDIX A: CHAPTER ONE INTERVIEW QUESTIONS

Physical Activity

Leisure Physical Activity[154]

During the past month, other than your regular job, did you participate in any physical

activities or exercises such as running, aerobics, dancing, or walking for exercise?

0□ No   1□ Yes

[If Yes] What do you do for exercise? *[Note to interviewer: Get specifics: If running,*

where? If park, what park?]

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[If Yes] Where do you go for exercise?

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Park Use

Do you know of any good places in Chelsea to take a walk?   0□ No   1□ Yes

[If Yes] Where? _____

Do you go to other parks in the city?   0□ No   1□ Yes

[If Yes] What parks? 1) _____

                                    2) _____

                                    3) _____

Community Violence and Feeling Unsafe

Knowledge of Neighborhood Crime[98, 99]

To your knowledge, did any of the following occurred in your neighborhood during the past six months:

A fight in which a weapon was used?	1□ **Yes**	0□ **No**
A violent argument between neighbors?	1□ Yes	0□ No
A gang fight?	1□ Yes	0□ No
A sexual assault/rape?	1□ Yes	0□ No
A robbery or mugging?	1□ Yes	0□ No

Personal Experience with Violence

While you have lived in this neighborhood, have you experienced violence, such as a mugging, physical fight, or sexual assault, against you or any member of your household anywhere in your neighborhood?   1□ Yes   0□ No

Feeling Unsafe[101]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem:

Feeling unsafe in your home?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe while out alone on the street during the day?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe alone during the night?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Slow police response or police protection?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

APPENDIX B: Chapter Two Interview Questions

Self-Rated Health

Would you say that in general your health is:

1☐ Excellent   2☐ Very good   3☐ Good   4☐ Fair   5☐ Poor   7☐ No response

Physical Factors

Perceived Air Quality

Generally speaking, what do you think about the air quality in Chelsea?

Choose from these responses *[Refer to response options card]:*

1☐ Very bad

2☐ Bad

3☐ Good

4☐ Very good

5☐ I have never thought about it

6☐ I am uncertain

7☐ Refused

Pests[148]

The following questions ask about events in your life that may have contributed to feeling

stress. You may answer Yes or No to each question.

In the last year…

　　　Did rats, mice or insects bother you in your home?

1☐ Yes   0☐ No

Noise Count, Negative Response, and Sleep Disturbance

When at home, are there noises that regularly bother you?   0□ No   1□ Yes

[If yes,] Please, can you tell me what noises bother you?

[For each source of noise checked on list ask the following questions]:

How does *[fill in noise]* make you feel?

Do you ever lose sleep because of *[fill in noise]*?

	Noise	Feeling	Sleep	
1□	Street traffic		0□ No	1□ Yes
1□	Trucks		0□ No	1□ Yes
1□	Noisy neighbors		0□ No	1□ Yes
1□	People talking or shouting in the street		0□ No	1□ Yes
1□	Jets, airplanes, helicopters		0□ No	1□ Yes
1□	Trains		0□ No	1□ Yes
1□	Emergency vehicle sirens		0□ No	1□ Yes
1□	Car alarms		0□ No	1□ Yes
1□	Cars playing loud music		0□ No	1□ Yes
1□	Loud music		0□ No	1□ Yes
1□	Other: _____		0□ No	1□ Yes
1□	Refused		0□ No	1□ Yes

Odor Count, Negative Response, and Behavioral Effect

When at home, are there smells or odors that ever bother you?   0□ No   1□ Yes

 [If yes,] Please, can you tell me what smells or odors bother you?

[For each source of smell checked on list ask the following questions]:

How does *[fill in odor]* affect you or make you feel?

Does the *[fill in smell/odor]* occur at any particular time of day, or in any pattern that you

are aware of?

Does the *[fill in smell/odor]* ever keep you from going outside or opening your windows?

Odor	Feeling	Time	Impact	
1□ Petroleum or oil			0□ No	1□ Yes
1□ Low tide			0□ No	1□ Yes
1□ Vehicle emissions or exhaust			0□ No	1□ Yes
1□ Sewer			0□ No	1□ Yes
1□ Kayem hot dog factory			0□ No	1□ Yes
1□ Boston Hides and Furs / company that works with animal skins			0□ No	1□ Yes
1□ Other: _____			0□ No	1□ Yes
1□ Refused			0□ No	1□ Yes

Poor Neighborhood Conditions[101]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem.

Property damage?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Poor lighting on the streets at night?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Graffiti on buildings and walls?	0□ No problem/No opinion	1□ Minor problem	2□ Serious problem
Irregular trash pickup?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Poor city services?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Litter, trash or broken glass on sidewalks?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Vacant or abandoned houses, storefronts and lots?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

Social Factors

Social Cohesion[23]

Now I will read four statements and you choose the response that best represents your agreement about what I said. The options are: (1) Strongly agree, (2) Agree, (3) Neither agree nor disagree, (4) Disagree, (5) Strongly disagree. These statements are about your neighborhood and the people who live here.

People are willing to help their neighbors.

1□ Strongly agree 2□ Agree 3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

This is a close-knit neighborhood

1□ Strongly agree 2□ Agree 3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

People in this neighborhood can be trusted.

1□ Strongly agree 2□ Agree 3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

People in this neighborhood don't get along with each other.

1□ Strongly agree 2□ Agree 3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

Responses for the last question were reverse coded.

Ethnic Identity[153]

For the following questions I will make a statement and ask you to say how well the statement represents your own thoughts. You may say you: Strongly agree, Agree, No opinion, Disagree, or Strongly disagree.

I am active in organizations or social groups that include mostly members of my own ethnic group

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                    nor disagree   disagree

I participate in cultural practices of my own group, such as special food, music, or customs.

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                    nor disagree   disagree

I have a clear sense of my ethnic background and what it means to me.

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                    nor disagree   disagree

Ethnic Group Orientation[153]

For the following questions I will make a statement and ask you to say how well the

statement represents your own thoughts. You may say you: Strongly agree, Agree, No

opinion, Disagree, or Strongly disagree.

I like meeting and getting to know people from ethnic groups other than my own.

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                  nor disagree   disagree

I sometimes feel it would be better if different ethnic groups did not try to mix together.

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                  nor disagree   disagree

I often spend time with people from ethnic groups other than my own.

1□ Strongly agree   2□ Agree   3□ Neither agree   4□ Disagree   5□ Strongly
                                  nor disagree   disagree

I am involved in activities with people from other
ethnic groups.

1□ Strongly agree   2□ Agree   3□ Neither agree nor   4□ Disagree   5□ Strongly
                                  disagree   disagree

Feeling Unsafe[101]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem.

Feeling unsafe in your home?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe while out alone on the street during the day?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe alone during the night?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Slow police response or police protection?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

Crime[101]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem.

Gangs?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Gunshots?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Physical fighting?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Physical assaults of people on the street?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

***Drug Use and Loitering*[101]**

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem.

Drug dealing and/or use?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Group of people hanging around with nothing to do?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Prostitution?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
No or few supervised activities for youth?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Too few recreational facilities available for young people?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

Cultural Factors

Acculturation

The following questions were asked to measure acculturation. Points were assigned so that a larger point total indicated more acculturation or US native status.

Preferred Language: What language(s) do you usually speak at home?

Only Spanish	□ 1
More Spanish than English	□ 2
Both Equally	□ 3
More English than Spanish, OR	□ 4
Only English	□ 5
Refused	□ 7
Don't Know	□ 9

Nativity: In what country were you born? _____

Citizenship: Are you a citizen of the US citizen?   0□ No   1□ Yes   7□ No response

 Age at Immigration: Do you consider yourself an immigrant?

0□ No   1□ Yes   7□ No response

[If yes, and not born in the US] How long have you lived in the US?

☐☐ Months   ☐☐ Years

Age: What year were you born?   ☐☐☐☐

Feeling Insecure with Immigration Status

Do you feel secure about your immigration status?   0□ No   1□ Yes   7□ No response

Are you a citizen of the United States?   0□ No   1□ Yes   7□ No response

Do you consider yourself an immigrant?   0□ No   1□ Yes   7□ No response

Language Stress

Is language ever a source of stress for you?   0□ No   1□ Yes   7□ No response

Health Conditions

Physical Health Conditions

Diabetes[154]

Have you ever been told by a doctor that you have diabetes?

[If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"]

1□ Yes

2□ Yes, but female told only during pregnancy

3□ No

4□ Pre-diabetes or borderline diabetes

7□ No response/Don't know/Not sure

Cardiovascular Disease[154]

Has a doctor, nurse, or other health professional EVER told you that you

had any of the following?

(Ever told) a heart attack, also called a myocardial infarction?

0□ No   1□ Yes   7□ No response

(Ever told) angina or coronary heart disease?   0□ No   1□ Yes   7□ No response

(Ever told) a stroke? 0□ No   1□ Yes   7□ No response

Asthma or Respiratory Disease[154]

Have you EVER been told by a doctor, nurse, or other health professional that you had

asthma? 0□ No   1□ Yes   7□ No response

[If yes] Do you still have asthma? 0□ No   1□ Yes

Has a doctor or other health professional EVER told you that you had emphysema or

some other respiratory disease? 0□ No   1□ Yes   2□ Emphysema   3□ Other _____

7□ No response

Arthritis[154]

Have you EVER been told by a doctor or other health professional that you have some

form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia? 0□ No   1□ Yes

7□ No response

Hypertension[154]

Have you EVER been told that you had hypertension (hy-per-ten-shun), also called high

blood pressure?

[Interviewer instruction: If person says "high normal blood pressure", "borderline

hypertension" or "prehypertension" code "No" below].

[If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"]

1□ Yes

2□ Yes, but female told only during pregnancy

0□ No [Go to next section]

7□ Don't know/Not sure

9□ No response

Skin Conditions[154]

Psoriasis (sore-eye-asis)? *[if asked, a chronic skin condition that appears like an itchy*

rash]   0□ No   1□ Yes   7□ No response

Vitiligo (Vit-i-LI-go)? *[if asked, a condition that results in loss of pigment in patches of*

skin]   0□ No   1□ Yes   7□ No response

Cancer[154]

Have you ever been told by a doctor that you had a type of cancer or malignant tumor?

0□ No   1□ Yes

[If Yes] Where in the body, or what organ, did the cancer or tumor start?

_____

Other Physical Health Conditions

Do you have any other chronic medical condition?   0□ No   1□ Yes

 [If Yes] Please specify what condition:

_____

Mental Health Conditions

Depressive Disorders[154]

Has a doctor or other healthcare provider EVER told you that you have a depressive

disorder (including depression, major depression, or minor depression)?

0□ No   1□ Yes   7□ No response

Other mental health conditions

Do you have any other chronic medical condition?   0□ No   1□ Yes

 [If Yes] Please specify what condition: _____

APPENDIX C: CHAPTER THREE INTERVIEW QUESTIONS

Depressive Symptoms

Depressive Symptoms Questions[181]

Now, I am going to ask you some questions about your mood. When answering these questions, please think about the past 2 weeks. You may answer (1) Very often, (2) Sometimes or Occasionally, or (3) Never.

Over the last 2 weeks, how often have you had little interest or pleasure in doing things?

1□ Very often   2□ Sometimes/Occasionally   3□ Never   7□ No response

Over the last 2 weeks, how often have you felt down, depressed or hopeless?

1□ Very often   2□ Sometimes/Occasionally   3□ Never   7□ No response

Over the last 2 weeks, how often have you had trouble falling asleep, staying asleep or sleeping too much? *[example of sleeping too much: I am always late for work because I can't get out of bed, I don't want to do anything but sleep.]*

1□ Very often   2□ Sometimes/Occasionally   3□ Never   7□ No response

Over the last 2 weeks, how often have you felt tired or had little energy?

1□ Very often   2□ Sometimes/Occasionally   3□ Never   7□ No response

Over the last 2 weeks, how often have you felt bad about yourself or that you were a failure or had let yourself or your family down?

1□ Very often   2□ Sometimes/Occasionally   3□ Never   7□ No response

Neighborhood Stressors

Knowledge of Neighborhood Crime[98, 99]

To your knowledge, did any of the following occurred in your neighborhood during the past six months:

A fight in which a weapon was used?	1□ **Yes**	0□ **No**
A violent argument between neighbors?	1□ Yes	0□ No
A gang fight?	1□ Yes	0□ No
A sexual assault/rape?	1□ Yes	0□ No
A robbery or mugging?	1□ Yes	0□ No

Personal Experience with Violence

While you have lived in this neighborhood, have you experienced violence, such as a mugging, physical fight, or sexual assault, against you or any member of your household anywhere in your neighborhood?   1□ Yes   0□ No

Feeling Unsafe[101, 149]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem:

Feeling unsafe in your home?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe while out alone on the street during the day?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Feeling unsafe alone during the night?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Slow police response or police protection?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

Poor Neighborhood Conditions[101, 149]

The next set of questions is about the conditions of your neighborhood. I will ask you about something people may think is a problem in your neighborhood, and you respond with either (0) No opinion, (0) No problem, (1) Minor problem, (2) Serious problem.

Property damage?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Poor lighting on the streets at night?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Graffiti on buildings and walls?	0□ No problem/No opinion	1□ Minor problem	2□ Serious problem
Irregular trash pickup?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Poor city services?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Litter, trash or broken glass on sidewalks?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem
Vacant or abandoned houses, storefronts and lots?	0□ No problem/ No opinion	1□ Minor problem	2□ Serious problem

***Social Cohesion*[23]**

Now I will read four statements and you choose the response that best represents your agreement about what I said. The options are: (1) Strongly agree, (2) Agree, (3) Neither agree nor disagree, (4) Disagree, (5) Strongly disagree. These statements are about your neighborhood and the people who live here.

People are willing to help their neighbors.

1□ Strongly agree 2□ Agree   3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

This is a close-knit neighborhood

1□ Strongly agree 2□ Agree   3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

People in this neighborhood can be trusted.

1□ Strongly agree 2□ Agree   3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

People in this neighborhood don't get along with each other.

1□ Strongly agree 2□ Agree   3□ Neither agree nor disagree   4□ Disagree 5□ Strongly disagree

Responses for the last question were reverse coded.

Noise Count, Emotional Responses, and Sleep Disturbance

When at home, are there noises that regularly bother you?   0□ No   1□ Yes

[If yes,] Please, can you tell me what noises bother you?

[For each source of noise checked on list ask the following questions]:

How does *[fill in noise]* make you feel?

Do you ever lose sleep because of *[fill in noise]*?

	Noise	Feeling	Sleep
1□	Street traffic		0□ No 1□ Yes
1□	Trucks		0□ No 1□ Yes
1□	Noisy neighbors		0□ No 1□ Yes
1□	People talking or shouting in the street		0□ No 1□ Yes
1□	Jets, airplanes, helicopters		0□ No 1□ Yes
1□	Trains		0□ No 1□ Yes
1□	Emergency vehicle sirens		0□ No 1□ Yes
1□	Car alarms		0□ No 1□ Yes
1□	Cars playing loud music		0□ No 1□ Yes
1□	Loud music		0□ No 1□ Yes
1□	Other: _____		0□ No 1□ Yes
1□	Refused		0□ No 1□ Yes

Individual Stressors

Physical Health Conditions

Diabetes[154]

Have you ever been told by a doctor that you have diabetes?

[If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"]

  1□ Yes

  2□ Yes, but female told only during pregnancy

  3□ No

  4□ Pre-diabetes or borderline diabetes

  7□ No response/Don't know/Not sure

Cardiovascular Disease[154]

Has a doctor, nurse, or other health professional EVER told you that you

had any of the following?

(Ever told) a heart attack, also called a myocardial infarction?

0□ No   1□ Yes   7□ No response

(Ever told) angina or coronary heart disease?   0□ No   1□ Yes   7□ No response

(Ever told) a stroke? 0□ No   1□ Yes   7□ No response

Asthma or Respiratory Disease[154]

     Have you EVER been told by a doctor, nurse, or other health professional that

you had asthma? 0□ No   1□ Yes   7□ No response

[If yes] Do you still have asthma? 0□ No   1□ Yes

Has a doctor or other health professional EVER told you that you had emphysema or some other respiratory disease? 0□ No   1□ Yes   2□ Emphysema   3□ Other _____ 7□ No response

Arthritis[154]

Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia? 0□ No   1□ Yes 7□ No response

Hypertension[154]

Have you EVER been told that you had hypertension (hy-per-ten-shun), also called high blood pressure?

[Interviewer instruction: If person says "high normal blood pressure", "borderline hypertension" or "prehypertension" code "No" below].

[If "Yes" and respondent is female, ask: "Was this only when you were pregnant?"]

1□ Yes

2□ Yes, but female told only during pregnancy

0□ No [Go to next section]

7□ Don't know/Not sure

9□ No response

Skin Conditions[154]

Psoriasis (sore-eye-asis)? *[if asked, a chronic skin condition that appears like an itchy rash]*   0□ No   1□ Yes   7□ No response

Vitiligo (Vit-i-LI-go)? *[if asked, a condition that results in loss of pigment in patches of skin]* 0□ No 1□ Yes 7□ No response

Cancer[154]

Have you ever been told by a doctor that you had a type of cancer or malignant tumor?

0□ No 1□ Yes

[If Yes] Where in the body, or what organ, did the cancer or tumor start?

_____

Other Physical Health Conditions

Do you have any other chronic medical condition? 0□ No 1□ Yes

[If Yes] Please specify what condition:

_____

Disability

Are you currently working? 0□ No 1□ Yes

[If No]: Are you currently not working for pay because you are *[Read and check all that apply:*

1□ Retired

1□ Disabled (1□ permanent disability, 1□ temporary disability)

1□ In school

1□ Caring for others at home

1□ Working in a family business without pay

1□ Working in exchange for goods (food, lodging, or other barter)

1□ Laid off

1□ Quit job

1□ Other (Specify):

Financial Events[182]

The following questions ask about events in your life that may have contributed to feeling stress. You may answer Yes or No to each question. In the last year…

Did you go deeply in debt?	0▢ No	1▢ Yes
Did your income decrease by a lot?	0▢ No	1▢ Yes
Did you go without necessary food because you didn't have the money to pay for it?	0▢ No	1▢ Yes
Did you go without necessary clothing because you couldn't pay for it?	0▢ No	1▢ Yes
Did you miss a rent or mortgage payment because you couldn't pay for it?	0▢ No	1▢ Yes
Did the utility or phone company threaten to cut off your service because you couldn't pay the bills?	0▢ No	1▢ Yes
Was your telephone turned off?	0▢ No	1▢ Yes
Was your heat or electricity turned off?	0▢ No	1▢ Yes

Housing events[182]

The following questions ask about events in your life that may have contributed to feeling stress. You may answer Yes or No to each question. In the last year…

Did a friend or relative move into your home?	0▢ No	1▢ Yes
Did a friend or relative move out of your home?	0▢ No	1▢ Yes
Did you have trouble with your neighbors?	0▢ No	1▢ Yes
Did you move?	0▢ No	1▢ Yes
Did rats, mice or insects bother you in your home?	0▢ No	1▢ Yes

Legal Events[182]

The following questions ask about events in your life that may have contributed to feeling stress. You may answer Yes or No to each question. In the last year…

Did you have legal problems?	0□ No	1□ Yes
Did anyone in your family get arrested?	0□ No	1□ Yes
Did anyone in your family go to jail after a conviction?	0□ No	1□ Yes

Feeling Insecure with Immigration Status

Do you feel secure about your immigration status?　0□ No　1□ Yes　7□ No response

Are you a citizen of the United States?　0□ No　1□ Yes　7□ No response

Do you consider yourself an immigrant?　0□ No　1□ Yes　7□ No response

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CURRICULUM VITAE

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EDUCATION

2008   B.S.   Biology, Brigham Young University, Provo, UT

2010   M.P.H.   Global Health Promotion, Brigham Young University, Provo, UT

2015   Ph.D.   Environmental Health, Boston University School of Public Health,

Boston, MA

Dissertation: *Neighborhoods and Health: Exploring the Effects of*

Physical, Social, and Cultural Stressors in an Environmental

Justice Community

AWARDS

2009   Mary Lou Fulton Chair Award, Brigham Young University, Provo,

UT

2010   Simmons Center for Cancer Research Center Fellowship, Provo,

UT

2010 – 2012   National Institute of Health Training Grant, Boston University

School of Public Health, Boston, MA

PROFESSIONAL MEMBERSHIPS

2008 –   American Public Health Association (APHA)

2014 –   International Society for Environmental Epidemiology (ISEE)

WORK EXPERIENCE

2006 – 2007	Undergraduate Research Assistant
	Department of Microbiology and Molecular Biology, Brigham
	Young University, Provo UT
2008 – 2009	Health Education Technician
	Safety/Injury Prevention and Health Promotion, Utah County
	Health Department, Provo, UT
2008 – 2010	Graduate Research Assistant
	Brigham Young University, Provo, UT
2009	Environmental Protection Agency Volunteer Intern
	Pediatric Environmental Health, Environmental Protection Agency
	Region 8, Denver, CO
2010	Graduate Research Fellow
	Simmons Center for Cancer Research, Provo, UT
2011	Graduate Research Assistant
	Exposure Biology Research Group, Boston University School of
	Public Health, Boston, MA
2011 – current	Graduate Research Assistant
	Chelsea STAR Project, Boston University School of Public Health,
	Boston, MA
May – August 2012	Biostatistician
	Tufts Medical Center, Boston, MA

May – July 2014   Biostatistician

                       Brigham and Women's Hospital, Boston, MA

PUBLICATIONS

Ou, J, Thygerson, SM. Risk factors for work-related injuries among university student employees. Industrial Health. 50(5): 445-449. 2012.

Thygerson SM, **Ou J**. Characterizing university and college student employee injuries: Methods and challenges. Occupational Medicine & Health Affairs. 1(4): 121-125. 2013.

IN PROGRESS

Ou, JY, Levy, JI, Peters, JL, Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK. Park access, community violence, and physical activity in an urban community.

Ou, JY, Peters, JL, Levy, JI, Bongiovanni, R, Rossini, A, Scammell, MK. The relationship of physical, social, and cultural factors with self-rated health in an environmental justice population.

Ou, JY, Peters, JL, Levy, JI, Bongiovanni, R, Scammell, MK. Associations of neighborhood and individual stressors with depressive symptom in a low-income urban community.

TEACHING EXPERIENCE

Graduate Assistant at Boston University School of Public Health

2012 – 2014   EH 717 Introduction to Environmental Health

                       Fall, Spring, and Summer terms, class of 80 students, required

                       course for all MPH students

Undergraduate Teaching Assistant at Brigham Young University

2007 – 2008   PDBio 305 Essentials in Human Physiology

Fall, Winter, and Spring terms, class of 70+ students, required

coursework for all Biology and Nursing majors

Guest Lectures

2008   Social Work 631 Social Work and Family Law, Brigham Young

University, Provo, UT.

Topic: Social determinants of HIV/AIDS

2013 – current   EH 717 Introduction to Environmental Health, Boston University

School of Public Health, Boston, MA.

Topic: Environmental Epidemiology and Occupational Health

PRESENTATIONS

Posters

Ou, J, Thygerson, SM. *Risk Factors for Student Employee Injury*. Annual Meeting of the American Public Health Association. Denver, CO. November, 2010.

Thygerson, SM, **Ou, J.** *Characterizing University Student Employee Injuries: Methods and Challenges.* Annual Meeting of the American Public Health Association. Denver, CO. November, 2010.

Hayden, A, Madsen, C, Spires, M, Foulger, LA, Didenhover, **Ou, J,** Barnes, M. *Limited English Proficiency in Utah: The process of policy change to certify medical interpreters.* Annual Meeting of the American Public Health Association, Denver, CO. November 2010.

Thygerson, SM, Johns, G, **Ou, J**. *University student employees: What were they thinking?* University Risk Management and Insurance Association Conference. Portland, OR. September, 2011.

Ou, J. *Jet Fuel Exposure among U.S. Air Force Personnel: A Literature Review of Potential Immunotoxic Effects*. Environmental Health Research Retreat, Boston University School of Public Health, Chatham, MA. November 2012

Ou, J, Levy, JI, Peters, JL Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK. *Identifying the impact of neighborhood violence on green space utilization and physical activity.* Annual Meeting of the American Public Health Association, Boston, MA. November 2013.

Ou, J, Levy, JI, Peters, JL Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK. *Identifying the impact of neighborhood violence on green space utilization and physical activity*. Environmental Health Research Retreat, Boston University School of Public Health, Chatham, MA. November 2013.

Ou, J, Levy, JI, Peters, JL Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK. *Identifying the impact of neighborhood violence on green space utilization and physical activity.* Graduate Research Day, Boston University School of Public Health, Boston, MA. November 2013.

Ou, J, Levy, JI, Peters, JL Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK. *Which measuring stick: Analysis of park access measures and their associations with self-reported physical activity.* International Society for Environmental Epidemiology, Seattle, WA. August 2014.

Ou, J, Levy, JI, Peters, JL Bongiovanni, R, Garcia-Soto, J, Medina, R, Scammell, MK.

Environmental, social, and cultural factors associated with self-rated health.

International Society for Environmental Epidemiology, Seattle, WA. August 2014.

Oral Sessions

Ou, J. *Mapping Geographic Risk for Smoking using Cancer Incidence Rates.* Simmons

Center for Cancer Research Center, Provo, UT. August 2010.

Ou, J. *Endotoxin and Lung Cancer in Chinese Women: Is Estrogen a Modifier?* Gijs Van

Seventer Environmental Health Seminar, Boston University School of Public Health,

Boston, MA. May 2011.

Ou, J, Makey, C. *Introduction to Environmental Health Seminar: History of Insecticides*

and Overview of Three Major Classes. Gijs Van Seventer Environmental Health

Seminar, Boston University School of Public Health, Boston, MA. September 2011.

Ou, J. *Neighborhood Determinants of Community Health.* Gijs Van Seventer

Environmental Health Seminar, Boston University School of Public Health, Boston, MA.

February 2013.

Ou, J. *Social & Environmental Determinants of Physical Activity: Results & Lessons*

Learned. Gijs Van Seventer Environmental Health Seminar, Boston University School of

Public Health, Boston, MA. December 2013.

Ou, J. *It's a Beautiful Day in the Neighborhood: Neighborhood Social and*

Environmental Determinants of health. Environmental Health Research Retreat, Boston

University School of Public Health, Chatham, MA. November 2014.

Ou, J. *Neighborhoods and Health: Exploring the effects of Physical, Social, and Cultural Stressors in an Environmental Justice Community*. Dissertation Defense, Boston University School of Public Health, Boston, MA. April 2015.