Mechanisms of Neighborhood Disadvantage and Health

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Introduction

There is a demonstrated link between neighborhood conditions and health, such that living in poor communities is associated with a number of adverse health outcomes, including poor physical and mental health (Robert 1999; Winkleby et al 2006; Anderson 1997). While most of the literature in this area uses cross-sectional data, life course theories of health development maintain that early life conditions, including neighborhood context, have long-term effects on later life health outcomes (Hertzman and Boyce 2010; Mayer 2009; Poulton et al 2002). Indeed, recent studies have begun to link neighborhood context in early life to health outcomes later in adulthood (Johnson and Schoeni 2011; Wickrama et al 2012). However, less attention has been paid to *how* neighborhood disadvantage operates to affect health, leaving a black box of unexplained mechanisms.

Stress may underlie one pathway by which contextual disadvantage affects health over the life course. On the individual level, stressors related to low economic status may cumulate over time to contribute to health disparities (Pampel et al 2010; Baum et al 1999; Krueger and Chang 2008). Chronic stress exposure has been linked to biological mechanisms that can lead to poor health outcomes (Cohen et al 2006; Ockenfels et al 1995; Gunnar et al 2001; Hertzman and Boyce 2010). Several researchers have theorized that stress processes operate at the neighborhood level as well, affecting all residents above and beyond individual risk (Elliot 2000l, Boardman 2004). How neighborhoods increase psychosocial stress is unclear. Violence and lack of safety in disadvantaged neighborhoods likely contribute to stress processes at the neighborhood level which, in turn, influence health at the individual level, though empirical evidence is lacking (Mujahid et al 2008b, Sundquist et al 2006). Integration into the neighborhood may also be lower in disadvantaged neighborhoods, preventing the positive health benefits of being socially integrated (Mujahid et al 2008a; Elliot 2000; Smith and Christakis 2008). The built environment further restricts healthy lifestyles in disadvantaged neighborhoods with less access to physical exercise and healthy food choices, fewer parks, less walkability, and less affordable and fresh food (Evans 2004; Gordon-Larsen et al 2006). Finally, disadvantaged neighborhoods tend to stress parenting roles and time with children, especially when parents work, reducing parental responsiveness, which increases mental and physical health risks of children (McLoyd 1998).

This paper uses data from the National Longitudinal Study of Adolescent Health (Add Health) to investigate the mechanisms underlying the relationship between neighborhood context in early life and health in young adulthood. Our health outcome focuses on cardiovascular health, using blood pressure as a measure of cardiovascular disease risk. We first explore how neighborhood disadvantage in adolescence is related to systolic and diastolic blood pressure and hypertension in adulthood fifteen years later. We then adjust for individual SES and risk factors for hypertension. The focus of our analysis and main contribution to the literature in this area is our investigation of two sets of theoretical mechanisms: those that operate at the individual and family level (parenting, depression, health behaviors); and those that operate at the neighborhood level (crime/safety, neighborhood integration, built environment). Using a longitudinal life course framework we explore the extent to which these mechanisms explain the relationship between neighborhood disadvantage in adolescence and blood pressure in young adulthood.

Study Design and Methods

Figure 1 shows our conceptual model. We measure neighborhood disadvantage during the sensitive period of adolescence and examine its link to blood pressure in young adulthood. Following life course theory and exploiting the longitudinal data in Add Health, we explore the mechanisms of neighborhood disadvantage that occur during the sensitive period of adolescence as well as in early adulthood to explain this linkage. We hypothesize and test four sets of mechanisms underlying the relationship between

neighborhood disadvantage and blood pressure: neighborhood/safety characteristics, parenting responsiveness, built environment and health behaviors.

Hypotheses

1) High levels of neighborhood disadvantage in adolescence are associated with high blood pressure in young adulthood, even after we adjust for individual risk factors.
2) The following mechanisms are associated with stress processes inherent in disadvantaged neighborhoods, which produce a biophysiological response of elevated blood pressure in young adulthood:
    a. Disadvantaged neighborhoods are associated with high crime, less perceived safety, weak communities ties and less neighborhood social integration, which increase hypertension risk.
    b. Parental responsiveness and involvement in adolescents' lives will be lower in disadvantaged neighborhoods, increasing hypertension risk.
    c. The built environment of disadvantaged neighborhoods contains fewer parks, recreation centers, restricted walkability, less access to healthy food and greater access to fast food, increasing hypertension risk.
    d. The physical and social environment of disadvantaged neighborhoods tends to promote poor health behaviors that continue over the life course and increase risk of hypertension.

Data and Measures

We use Add Health, a nationally representative study begun in 1994-1995 with a cohort of students in grades 7 – 12 (Wave I) with three additional waves of data, in 1996 (wave II), 2001-2002 (Wave III) and 2008-2009 (Wave IV) when the original cohort was between 24 – 32 years old. As shown in Figure 1, we use data from Waves I, III, and IV in our longitudinal model. All multivariate analyses will adjust for demographic characteristics (i.e., age, sex, race, immigrant status and family structure), and socioeconomic status in adolescence (parental education and income) and young adulthood (own education and income).

Blood Pressure

Blood pressure measures come from the biomarkers data collected at Wave IV of the study, when respondents were between the ages of 24 and 32. We model systolic blood pressure (SBP) and diastolic blood pressure (DBP) as linear dependent variables. We create a dichotomous indicator of hypertension if respondents' measured systolic or diastolic blood pressure exceeds the clinical definition of hypertension (SBP > 140; DBP > 90), they report being diagnosed with hypertension, or they were taking anti-hypertensive medications at the time of Wave IV.

Neighborhood Disadvantage

Our main independent variable is an index constructed to measure neighborhood disadvantage (NDI) using five census-tract level measures from Wave I of Add Health: proportions of female-headed households, individuals living in poverty, high-school dropouts, individuals receiving public assistance and residents unemployed. For each of these five measures, a tract is considered disadvantaged if it falls in the highest quartile of all tracts. To find a respondent's NDI, we sum the number of measures on which the individual's tract is disadvantaged. Thus, NDIs range from 0 (no disadvantage) to 5 (high disadvantage).

Mechanisms: Neighborhood Characteristics

We use contextual data appended to Add Health via geocodes of respondents' residence at Waves I and III, including crime rates (at the county level) and indicators of the built environment (e.g., walkability, number of parks, recreation centers, fast food restaurants, etc). We also use individuals' responses regarding their perceptions of neighborhood, including a measure of safety, happiness in their neighborhood, whether neighbors looked out for one another, talking to neighbors and knowing neighbors.

Parental Responsiveness

Parental responsiveness is reported by the adolescent and measured by a parenting behavioral index and a parent-child relationship index. The behavioral index measures whether the parent or the child make

most of the decisions about the adolescents' life in such domains as curfew, diet, clothes, TV watching and friends. The quality of the parent-child relationship is measured by the degree of closeness, warmth, satisfaction and communication in the relationship.

Health Behaviors

We include three dichotomous measures of unhealthy behaviors during the transition to adulthood: obesity (having a BMI >30), smoking (consume one or more cigarette per day), and physical inactivity (no reported bouts of activity in the past week).

Preliminary Results

Table 1 presents the descriptive statistics of the variables used in analysis. The mean systolic blood pressure of the sample is 125.35, and the mean diastolic blood pressure is 79.62. Over one quarter of the young adults are hypertensive (26.93%). The average level of NDI in Wave I is 1.15, suggesting most adolescents lived in little or no disadvantage. An illustrative set of mechanisms are shown in the bottom panel (we do not have all mechanisms coded at this point).

Table 2 presents the association between neighborhood disadvantage and each outcome variable, adjusted for age, sex and race/ethnicity. These bivariate results document a longitudinal correlation between neighborhood disadvantage in adolescence and elevated diastolic blood pressure and hypertension fifteen years later in adulthood. The heart of our paper will be exploring potential mediating mechanisms that explain this relationship in this early stage of the adult life course.

We examine the bivariate relationship between the mechanisms we currently have coded and NDI in Table 3 to establish the mediating potential of these mechanisms. Results for these mechanisms suggest potential mediating effects such that disadvantaged neighborhoods increase crime, reduce perceptions of safety and neighborhood integration, and increase poor health behaviors in young adulthood, all hypothesized to be associated with blood pressure.

Discussion

We document a significant association between neighborhood disadvantage in adolescence and diastolic blood pressure and hypertension adjusting for age, sex, and race. This bivariate association over 15 years is substantial and deserves further investigation. We introduce here some preliminary analysis of possible mechanisms that mediate the relationship between adolescent neighborhood disadvantage and adult cardiovascular health.

As expected, higher neighborhood disadvantage is associated with lower neighborhood integration, higher crime and less perceived safety. However, talking to and knowing one's neighbors work in the opposite direction than we hypothesize. It appears that talking to and interacting with neighbors may not be protective of stress, but rather a stressful event in itself. Talking to neighbors may be a better indicator of neighborhood problems that require discussion rather than positive neighborhood integration and as such may be associated with stress and higher blood pressure.

Last, obesity and physical activity are positively correlated with neighborhood disadvantage. These are also two of the most important risk factors for high blood pressure, suggesting that health behaviors may be an important pathway through which adolescent neighborhood disadvantage continues to impact blood pressure outcomes in early adulthood.

Future Analytic Plans

We are in the process of completing the measurement of additional mechanisms including depression at Waves I and III, parental responsiveness at Wave I, and built environment measures at Waves I and III. We will examine how these mechanisms are related to our neighborhood disadvantage index, NDI, at Wave I to complete Table 3. We will then conduct multivariate analysis by first controlling for demographic and socioeconomic status at Wave I (parental SES) and at Wave IV (respondent). Modeling will proceed by entering into our regression equations theoretical sets of mechanisms (individual, family, neighborhood) and according to life stage (adolescent mechanisms at Wave I, then transition to adulthood

mechanisms at Wave III—mainly depression, health behaviors, neighborhood crime and built environment).

We anticipate that the built environment and health behaviors will be the most important mechanisms explain the link between neighborhood disadvantage and blood pressure on both theoretical and empirical (some preliminary analysis) grounds. However, we expect that the importance of the timing of mechanisms will vary according the mechanism in relation to blood pressure outcomes and the results will be illuminating. For example, having less access to physical exercise and healthy lifestyles in ones' neighborhood during adolescence because of the physical environment may set health trajectories that endure with consequences for cardiovascular health 15 years later in young adulthood; whereas mental health in young adulthood may be more important for adult cardiovascular health than depression in adolescence.

Our paper is one of the first to explore the mechanisms of neighborhood disadvantage with a rich longitudinal set of individual, family, and neighborhood indicators that illuminate underlying stress processes related to neighborhood context. We will furthermore make unique contributions on how the timing of stress response mechanisms matter in the development of health risks in young adulthood.

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Figure 1: Conceptual Model

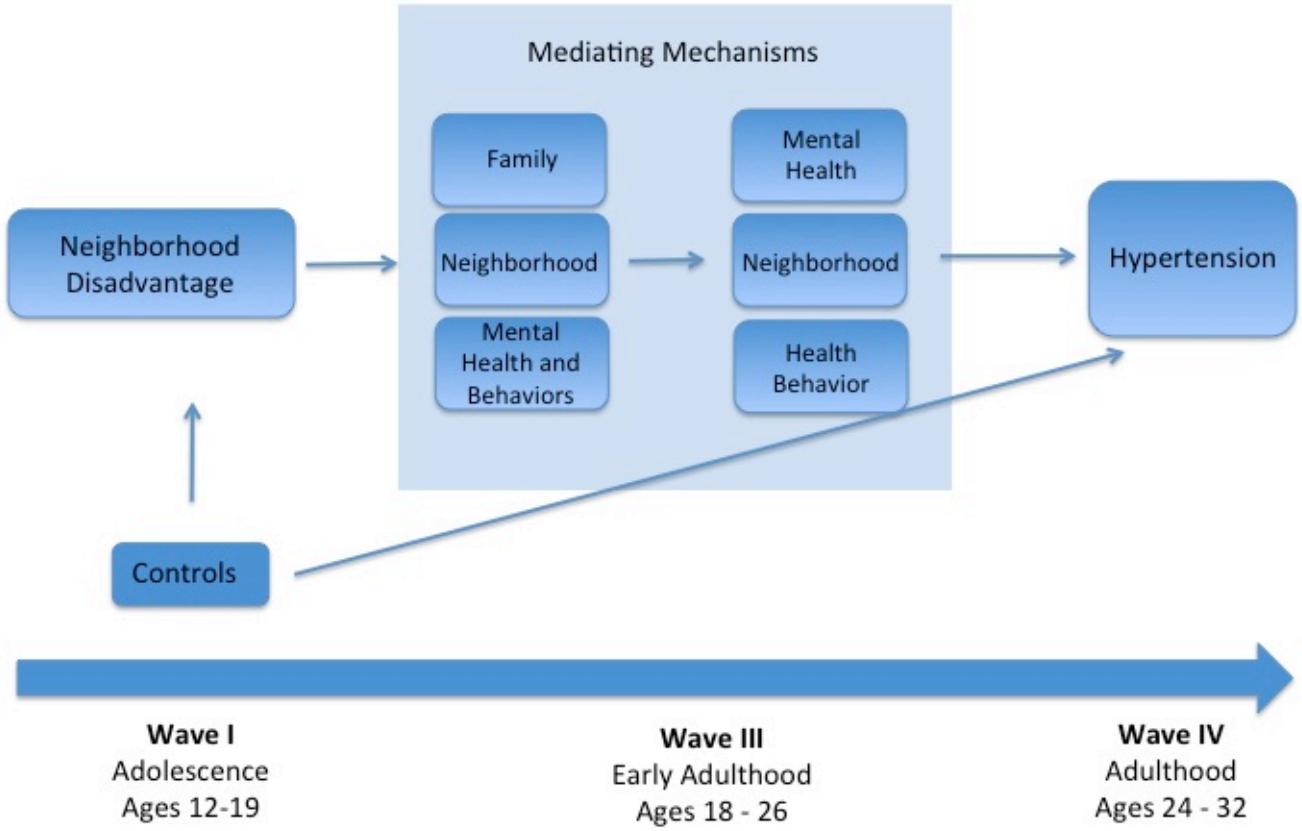

Table 1: Descriptive Statistics

	Mean	Standard Error
Blood Pressure, Wave IV (ages 24-32)		
Systolic BP	125.350	0.223
Diastolic BP	79.616	0.172
Hypertension	0.269	0.007
Neigh Disadvantage Index, Wave I	1.148	0.128
Individual-level Controls		
Age Wave IV	28.257	0.120
White	0.678	0.030
Black	0.160	0.022
Asian	0.036	0.008
NA/ Other	0.0036	0.001
Hispanic	0.123	0.018
Female	0.477	0.007
First Generation	0.045	0.008
Second Generation	0.111	0.011
Third Generation	0.844	0.018
Two Biological Parents	0.579	0.013
Step Parent	0.12	0.006
Single Parent	0.226	0.010
Other Family Structure	0.034	0.003
Parent - Less than HS Education	0.120	0.011
Parent - HS Education	0.297	0.012
Parent - Some College	0.206	0.008
Parent - College+	0.377	0.017
Parent Income - Under Poverty Line	0.137	0.011
Parent Income Near Poverty	0.173	0.008
Parent Income Not Poor	0.488	0.019
Parent Income Missing	0.202	0.010
Married, Wave IV	0.484	0.014
Adult Income - Under Poverty Line	0.111	0.007
Adult Income Near Poverty	0.193	0.007
Adult Income Not Poor	0.631	0.013
Adult Income Missing	0.064	0.005
Adult - Less than HS Education	0.081	0.007
Adult - HS Education	0.165	0.009
Adult - Some College	0.432	0.009
Adult - College+	0.321	0.017
Neighborhood-level Controls		
Proportion NH Black (10%)	1.423	0.172
Proportion NH Hispanic (10%)	0.751	0.121
Mechanisms		
Crime and Safety Wave I		
Feels Safe in NH	0.901	0.007
Crime Rate	733.672	54.892
Neighborhood Integration Wave I		
Happy in NH	0.720	0.009
Neighbors Look Out For Each Other	0.734	0.009
Talked to Neighbor in Past Month	0.793	0.008
Knows Neighbors	0.736	0.012
Health Behaviors Wave IV		
Obese	0.367	0.010
Physically Inactive	0.145	0.005
Smoker	0.237	0.010

Table 2: Relationship between Neighborhood Disadvantage Index and Blood Pressure[+]

	Coefficient/ Odds Ratio	Standard Error/ 95% Confidence Interval
Systolic BP	0.205	0.173
Diastolic BP	0.227*	0.111
Hypertension	1.062*	1.010 – 1.117

*** p < 0.001, ** p < 0.01, * p < 0.05
+ adjusted for age, sex, and race/ethnicity

Table 3: Relationship between NDI and Mediating Mechanisms

	Odds Ratio (CI)
Crime and Safety	
Feels Safe in NH	0.753***
	(0.709 - 0.800)
Crime Rate (OLS Coefficient/ SE)	128.3***
	(21.91)
Neighborhood Integration	
Happy in NH	0.881***
	(0.841 - 0.922)
Neighbors Look Out For Each Other	0.922***
	(0.880 - 0.966)
Talked to Neighbor in Past Month	1.084**
	(1.033 - 1.138)
Knows Neighbors	1.103**
	(1.035 - 1.175)
Health Behaviors	
Obese	1.122***
	(1.081 - 1.165)
Physically Inactive	1.119***
	(1.069 - 1.170)
Smoker	1.008
	(0.942 - 1.078)

*** p < 0.001, ** p < 0.01, * p < 0.05