INEQUALITY IN CONTEXT:
Neighborhood Environments and their Effects on Educational Health Gradients

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Background

Education is a salient predictor of health, defined broadly, in the United States (U.S) (Montez and Friedman 2015). Indeed, individuals with advanced credentials—particularly those with a college degree or higher—experience longer life-spans (e.g., Hummer and Hernandez 2015); decreased risk of developing various chronic and progressive conditions (e.g., Sharp and Gatz 2012; Vargas et. al. 2000); and increased emotional and psychological functioning (e.g., Erickson et. al. 2016) than their less highly-educated peers. Educational disparities in health have, alongside educational disparities in welfare more generally, persisted in the U.S for decades and become *more* acute with time (Masters 2012; Pew Research Center 2014). The consistent, substantial and intensifying role that education plays in stratifying U.S health positions this social-input as a critical point of investigation for population health scientists.

In parsing *educational gradients in health*—or the patterns described above, of more highly educated individuals generally experiencing elevated well-being—researchers have uncovered an elaborate, interactive structure. A single educational gradient indeed does not generalize across the U.S population; how much an individual benefits from additional education is dependent an individual's precise social-location (Walsemann et. al. 2013).

Among studies that document variable educational gradients across the U.S population, some of the most informative are those that clarify the role of context (Hayward et. al. 1997; Montez et. al. 2017; Montez and Berkman 2014). Researchers working in this area have posited that contextual environments are implicit in the process that underlies educational health effects. Indeed, education is theorized to participate in health by offering individuals a set of resources (e.g., additional income; steady employment; elevated feelings of control over one's own life) that can be used to ward off multiple, external health-challenges (Phelan et. al. 2010; Mirowsky and Ross 2003). If education protects health by *guarding* against otherwise health-damaging exposures, then how—and how much—education matters for health may be inextricably linked to the social, physical, and cultural contexts that individuals contend with. Pronounced spatial variation in educational gradients has indeed been shown to manifest across U.S states (Montez et. al.

2017); regions (Monte and Berkman 2014); urban-rural counties (Hayward et. al. 1997); and European nations with varying welfare-regimes (Cambois et. al. 2016).

In this paper, to help develop ideas of how context and education interact to produce health, I will examine how educational gradients in physical and emotional wellbeing manifest across a salient level of geographic organization that has not yet been analyzed—*the neighborhood.* Neighborhood environments represent among the most immediate, health-relevant, contextual spaces in which individuals operate and thus contextual profiles that individuals contend with on a daily basis. Describing how individuals of different levels of education experience the *same* neighborhood health risks—and, conversely, resources—is an important step in further understanding how context intersects with education to influence health.

Data

Data for this project comes from the Chicago Community Adult Health Study (CCAHS) ($n = 3,105$ adults) (House et. al. 2012). *Educational attainment* (A), the focal treatment, will be defined according to whether a respondent held at least a Bachelor's degree at the time of interview. *Health outcomes* (Y) will included a measure of general health status (i.e., self-rated health); mental health (i.e., depressive symptomatology); and physical health (i.e., waist circumference). 343 distinct *neighborhood clusters*, which represent a Census of neighborhoods in the Chicago area, are defined in CCAHS. Gaps in health between college and non-college educated individuals will be assessed in conjunction with several scale summaries of these neighborhood spaces ($\mathbf{Z}$)—including *neighborhood physical hazards*, a composite measure of the intensity of environmental hazards in a particular neighborhood cluster, and *neighborhood institutional quality*, a summary of the availability of neighborhood-level goods and services in a cluster. Additional measures ($\mathbf{X}$)—such as race, gender, and age—will be included as controls.

Data will be modeled using a series of Bayesian multilevel logistic regression models. Models will take the general form of $Y \sim f(A * Z_i, \mathbf{X}, \mathbf{Z}_{(j-i)})$, with a random intercept for each neighborhood cluster. Approximate leave-one-out cross-validation (Vehtari et. al. 2017) will be used to check for the appropriateness of the cross-level interaction—i.e., if a college degree's health effect depends on a respondent's neighborhood characteristics. All analyses will be preformed in the rstanarm package (Stan Development Team 2016) in the R statistical programming language (R Core Development Team 2018). All priors will be weakly informative, pointed to 0, to help regularize estimates.

Preliminary Results and Expectations

Exploratory analyses, displayed in Figure 1, shows that while college-educated individuals typically live in more advantageous and safer neighborhoods than their non-college educated peers, individuals of both educational-levels experience varying neighborhood conditions. Figure 2 also shows that college and non-college educated respondents often occupy the same neighborhood clusters in these data.
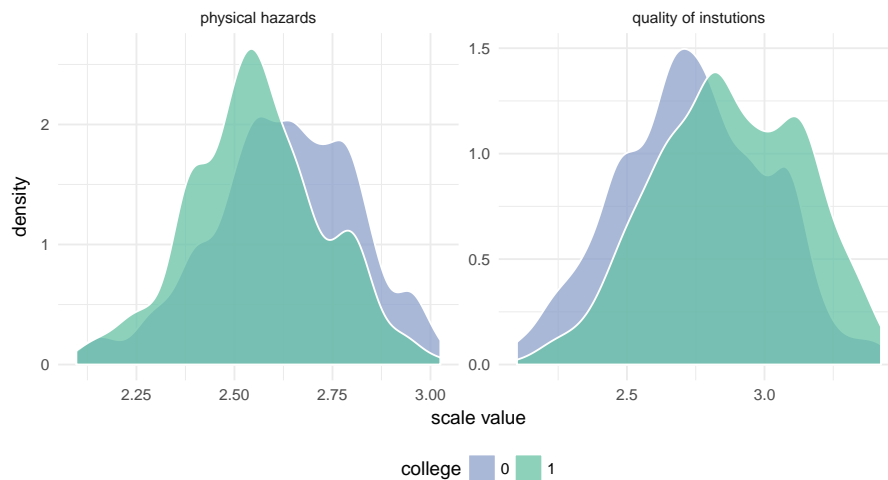

Figure 1: Distribution of neighborhood scales among all individuals in the data. Green densities represent distributions among college educated individuals; blue-shaded densities give distributions among individuals without a degree.
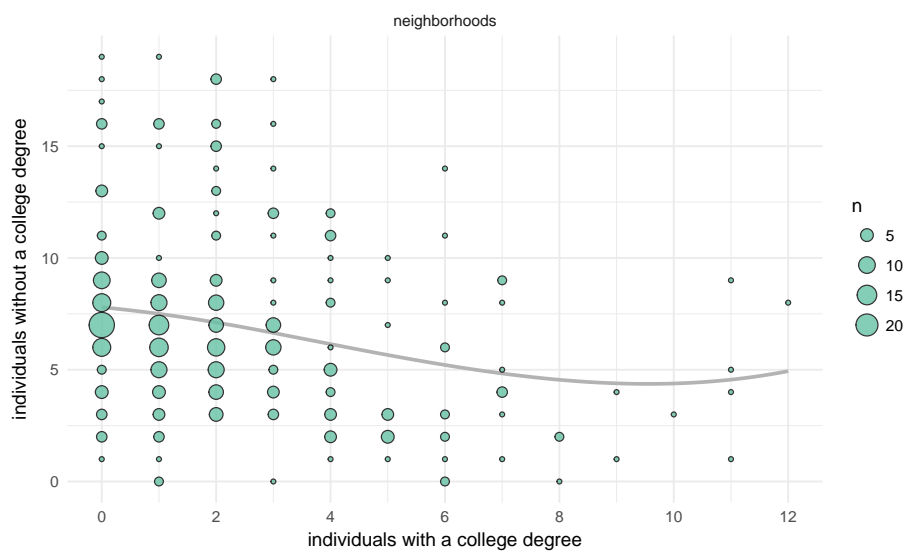

Figure 2: Count of neighborhoods with with x number of college educated individuals and y number of non-college educated individuals. The light-gray line represents a smoothed relationship among the two counts.

Preliminary model results, which examine how educational disparities in general health vary across different neighborhoods, show a strong interactive effect. Figure 3 shows that disparities in the probability of reporting *excellent/very good health* are more exacerbated in contexts where exposure to environmental hazards is high. Remarkably, this increase in disparity appears to be *entirely* a function of degrading health among non-college educated individuals; college educated respondents appear able to maintain the same level of health regardless of what level of neighborhood hazards they are exposed to.
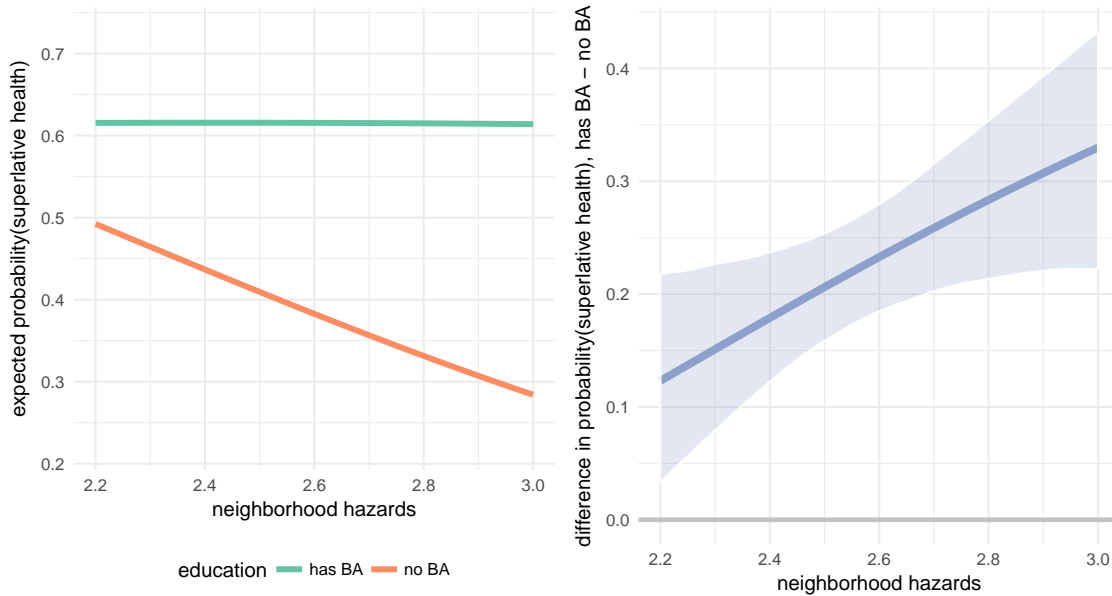

Figure 3: Predicted probability of excellent/very good health across varying levels of education and neighborhood hazards. 95% credible intervals are marked for the difference in predicted probabilities of self-rated health across education levels in the left-hand panel.

Figure 3 suggests that, as Montez et. al. (2017) discuss in their investigation of states, education can function as a buffer against negative environmental exposures. College educated individuals appear able to "build barriers" around themselves, to protect against highly hazardous, otherwise health-degrading immediate contextual-spaces.

I predict that similar patterns will be observed in the association among education, negative environmental exposures, and other health outcomes. How educational gradients manifest along spaces with varying *resources* is less clear and should be clarified by this study. Whether college-educated and non-college educated individuals rely on the positive aspects of their neighborhoods spaces in similar ways will be investigated.

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