

Contextualizing Educational Disparities in Health: Variations by Race/Ethnicity, Nativity, and County-Level Characteristics

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ABSTRACT Educational disparities in health are well documented, yet the education–health relationship is inconsistent across racial/ethnic and nativity groups. These inconsistencies may arise from characteristics of the early life environments in which individuals attain their education. We evaluate this possibility by investigating (1) whether educational disparities in cardiometabolic risk vary by race/ethnicity and nativity among Black, Hispanic, and White young adults; (2) the extent to which racial/ethnic-nativity differences in the education–health relationship are contingent on economic, policy, and social characteristics of counties of early life residence; and (3) the county characteristics associated with the best health at higher levels of education for each racial/ethnic-nativity group. Using data from the National Longitudinal Study of Adolescent to Adult Health, we find that Black young adults who achieve high levels of education exhibit worse health across a majority of contexts relative to their White and Hispanic counterparts. Additionally, we observe more favorable health at higher levels of education across almost all contexts for White individuals. For all other racial/ethnic-nativity groups, the relationship between education and health depends on the characteristics of the early life counties of residence. Findings highlight place-based factors that may contribute to the development of racial/ethnic and nativity differences in the education–health relationship among U.S. young adults.

KEYWORDS Education • Race/ethnicity • Health disparities • U.S. counties • Young adulthood

Introduction

Educational attainment is a significant determinant of health (Conti et al. 2010; Hummer and Lariscy 2011; Montez et al. 2019; Zajacova and Lawrence 2018). In recent years, educational disparities in health in the United States have widened as a result of improvements in health among the most educated and declining life expectancy among the least educated (Case and Deaton 2015; Hayward et al. 2015; Zajacova and Lawrence 2018). Given the robust relationship between education and health, education is often conceptualized as the “great equalizer”—a resource that may help all individuals attain a comparable quality of life (Downey et al. 2004; Torche 2011).

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Yet, accumulating evidence documents inconsistencies in this relationship, particularly by race/ethnicity and nativity. For example, educational attainment has a muted or nonsignificant association with health among minoritized groups, especially Black Americans (Assari et al. 2017; Beltrán-Sánchez et al. 2016; Boen 2016; Fuller-Rowell et al. 2015; Kimbro et al. 2008; Williams et al. 2016). Moreover, evidence that several Hispanic and immigrant subgroups have comparable or better health outcomes than their higher educated White and native-born counterparts is inconsistent with the idea that highly educated groups uniformly have better health than less educated groups (Larisey et al. 2015; Markides and Rote 2015; Ruiz et al. 2016).

Explanations for these heterogeneous relationships between education and health by race/ethnicity and nativity generally focus on individual-level factors, such as increased exposure to interpersonal discrimination and psychosocial resources developed in response to the stressors of navigating higher education environments (Destin and Debrosse 2017; Hudson et al. 2013; James et al. 1987; Miller et al. 2016). Selection effects may also explain better health outcomes among foreign-born Hispanic populations relative to their native-born and White counterparts (e.g., Kennedy et al. 2015; Riosmena et al. 2013). Other work, however, highlights the importance of contextual factors for the education–health relationship by documenting state-level variation in educational disparities in adult health and mortality (Montez and Berkman 2014; Montez, Zajacova, and Hayward 2017; Montez et al. 2019). While important, this line of work does not investigate whether state-level contexts help to explain racial/ethnic differences in the association between educational attainment and health. Also missing from prior research is the consideration of contextual factors across smaller geographic units, such as counties of residence in childhood or adolescence. The examination of early life contexts is critical, as these conditions shape developmental trajectories and patterns of (dis)advantage and influence health, directly or indirectly, across adulthood (Friedman et al. 2015; Montez and Hayward 2011, 2014; Warner and Hayward 2006; Zajacova et al. 2015).

This study advances our understanding of the relationship between educational attainment and health by investigating whether higher education is associated with better young adult health across different early life county environments. We ask:

Do educational disparities in cardiometabolic risk vary by race/ethnicity and nativity among Black, Hispanic, and White young adults?

To what extent are observed differences in the education–health relationship by race/ethnicity and nativity dependent on the economic, policy, and social (dis)advantages of the county in which young adults lived as children or adolescents?

In which early life contexts do racial/ethnic-nativity groups experience the best health at higher levels of education?

Assessing the association between education and health across different early life county contexts provides new evidence of factors that may modify the association between higher educational attainment and better health in young adulthood, a life stage that is particularly dynamic and unhealthy for more recent cohorts (Harris 2010; Masters et al. 2018). This study offers unique insight into potential place-based mechanisms that generate differences in the education–health relationship by race/ethnicity and nativity across early adulthood.

Background

Educational Disparities in Health by Race/Ethnicity and Nativity

Individuals with higher levels of education experience healthier and longer lives than those with lower levels of education (Sasson and Hayward 2019; Zajacova and Lawrence 2018). This relationship is often attributed to the forms of economic, human, and social capital that generally accompany educational attainment and can be translated into health-promoting resources, such as income, knowledge, and healthy behaviors (Hayward et al. 2015; Phelan and Link 2015; Zimmerman et al. 2015). Yet, accumulating evidence documents inconsistencies in the education–health relationship, especially among minoritized racial/ethnic groups and those not born in the United States. For example, the association between education and health tends to be nonsignificant or weaker for Black adults and, to a certain extent, Hispanic adults relative to Whites across a variety of physical health outcomes, including self-rated health, birth outcomes, body-mass index, disability, and inflammation (Assari et al. 2017; Boen 2016; Colen et al. 2006; Farmer et al. 2021; Fuller-Rowell et al. 2015; Kimbro et al. 2008). Furthermore, racial/ethnic disparities in health exist at every level of educational attainment (Braveman et al. 2010; Williams et al. 2016) and are often widest at the highest levels of education (e.g., Cummings and Braboy Jackson 2008; Hargrove 2018). Additionally, studies document that Hispanic and immigrant groups tend to exhibit more favorable health and mortality outcomes than their White and native-born counterparts despite lower average educational attainment (Goldman et al. 2006; Hummer et al. 2007; Markides and Rote 2015; Ruiz et al. 2016).

Collectively, existing evidence suggests a weaker or nonexistent relationship between educational attainment and health for several U.S. population groups. These findings, coupled with the fact that the studies that initially established and validated this relationship either exclusively utilized White samples or pooled all racial/ethnic groups, underscore arguments that educational disparities among non-White groups remain an empirical question (Pearson 2008). This is particularly true for young adults, as prior work on the education–health relationship tends to focus on middle and older adulthood. While important, results from studies of middle-aged or older adults may be subject to selective mortality bias, as the least educated may have died by middle adulthood. Furthermore, focusing on middle-aged adults does not provide information about when educational disparities in health initially emerge. Better insight into health disparities in young adulthood would provide opportunities for interventions that can maximize the benefit of educational attainment across the life course.

Proposed Explanations

A common explanation for the muted or nonsignificant association between education and health among Black adults is that educational attainment can increase exposure to interpersonal discrimination or other unique race-related stressors, especially as individuals gain access to higher socioeconomic contexts across education, work, and housing domains (Hardaway and McLoyd 2009; Hudson et al. 2012; Hudson et al.

2016; Von Robertson et al. 2016; Wingfield 2010; Wingfield and Wingfield 2014). Moreover, given historical and contemporary barriers to higher education faced by Black and Hispanic populations in the United States, those who are able to achieve higher levels of education generally do so at a cost to their physical well-being (Brody et al. 2013; Feagin and McKinney 2005; Gaydosch et al. 2018). These costs stem from the need to sustain more physical, cognitive, emotional, and psychological effort than put forth by White individuals (Cole and Omari 2003; Colen et al. 2018; Hudson et al. 2016). Prior work also suggests that educational gradients in health among foreign-born Hispanic populations are shallower than the documented gradients among their White and U.S.-born Hispanic counterparts. These patterns are often a result of more favorable health outcomes among foreign-born Hispanic adults with low educational attainment relative to individuals of other racial/ethnic groups with similarly low levels of education (e.g., Goldman et al. 2006; Kimbro et al. 2008). Sociocultural factors (e.g., engagement in healthy behaviors, higher levels of social support) and health selection effects in the case of immigrant groups help to explain better health among Hispanic individuals with lower levels of education (Abraido-Lanza et al. 2005; Antecol and Bedard 2006; Crimmins et al. 2007; Lariscy et al. 2015).

Finally, inconsistencies in the relationship between education and health may stem from the nonequivalence of socioeconomic indicators across race/ethnicity (Williams and Collins 1995). Traditional educational attainment measures do not account for the structural features or characteristics of the communities in which education is achieved. For example, self-reports of the highest level of education one has attained do not capture differences in how surrounding environments may facilitate or hinder residents' ability to achieve high levels of education and translate education into health-promoting resources. Given that place-based resources are often stratified on the basis of the racial/ethnic composition of communities, the contexts wherein minoritized racial/ethnic and immigrant groups begin their educational trajectories likely differ from those of White individuals. The nonequivalence of the meanings of education measures, in addition to arguments of sustained effort put forth by minoritized populations to achieve higher levels of education, points to the importance of studying how different contexts modify the education–health relationship *within* racial/ethnic-nativity groups. Examining both between-group and within-group comparisons will help lead to a better understanding of the education–health relationship for different population subgroups, as each comparison provides unique types of information.

Importance of the County Context

While a long tradition of research documents the importance of place in generating social inequalities in health (Montez, Hayward, and Wolf 2017; O'Brien et al. 2020; Sewell 2016; Woolf and Braveman 2011), scholars have highlighted the need for research that evaluates how contextual factors generate and sustain educational disparities in health (Zajacova and Lawrence 2018). Indeed, the contexts in which educational attainment occurs can facilitate or impede individuals' abilities to convert higher levels of education into health-protective resources. Several studies have documented differences in the education–health relationship across states for outcomes such as disability and mortality (Montez, Zajacova, and Hayward 2017; Montez et al.

2019). Less work has considered the role of other geographic entities in shaping educational disparities in health in young adulthood.

An important geographic entity to consider is the county. Counties are tasked with the provision and administration of state services and regulations, making them primarily responsible for meeting the needs and demands of their residents. Services targeting important determinants of health, such as health care, affordable housing, air pollution, education, and job opportunities, may therefore vary based on the political processes, available resources, and zoning laws in a given county (Marando and Reeves 1991; McLaughlin and Stokes 2002). Thus, counties play an important role in the acquisition and distribution of health-promotive resources. Moreover, given that minoritized racial/ethnic groups disproportionately occupy low socioeconomic strata in the United States, they are also more likely to interact with and rely on county and local government structures for social services to meet their basic needs, such as housing and health care (Herd and Moynihan 2019; Sered and Norton-Hawk 2014). County characteristics may therefore be particularly consequential for the magnitude of the relationship between educational attainment and health among minoritized racial/ethnic groups. While prior research links county-level characteristics to health and mortality (Chambers et al. 2018; Dwyer-Lindgren et al. 2017; Jia et al. 2009; O'Brien et al. 2020), the extent to which educational attainment is associated with better health across different county environments remains unclear.

The Role of County Context Across the Life Course

The present study focuses on the role of three specific aspects of early life counties: economic, policy, and social contexts. These characteristics are important structural determinants of health, as they are shaped by systems of inequality, such as structural racism, and reproduce patterns of stratification along racial/ethnic lines (Solar and Irwin 2010). The interplay between county contexts and stratification systems influences not only the distribution of health-related risks and resources, but also the nature of educational attainment processes. For example, the extent to which schooling is characterized by obstacles versus opportunities may be associated with health returns to education in young adulthood across racial/ethnic-nativity groups. Further, minoritized racial/ethnic and immigrant groups may be particularly sensitive to surrounding economic, political, and social contexts in early life, as historical and contemporary racialized processes (e.g., redlining, voter suppression) shape these place-based characteristics and produce additional disadvantages for these groups, including lack of employment opportunities, exposure to employer discrimination, exposure to air pollution, and decreased funding for schools (Pager and Shepard 2008; Rothstein 2017; Tessum et al. 2021; Viruell-Fuentes et al. 2012).

The economic contexts of counties, as documented by prospects for future economic mobility, are relevant for health (O'Brien et al. 2020; Venkataramani et al. 2016). Counties that facilitate upward mobility or make socioeconomic attainment easier—both objectively and perceptually—might provide greater access to educational opportunities and mitigate the need for, or potentially harmful consequences of, sustained or high-effort coping strategies. For example, counties with more economic opportunities may attenuate the need for high-effort coping, resulting in similar

relationships between education and health across racial/ethnic-nativity groups. Similarly, in counties where employment prospects are high, the labor market rewards of educational attainment are more salient. Moreover, in counties in which there is a more equitable distribution of income, there may be greater access to health-protective factors for all residents regardless of educational attainment.

Policy characteristics—reflected in the amount that county governments invest in residents' education or health—may directly shape opportunities for educational advancement, as well as the ability to translate educational attainment into health-promoting resources as adults (e.g., Woolf and Braveman 2011). Similar to future opportunity prospects, actual or perceived investment in one's community may reduce the potentially negative aspects of educational attainment processes, especially for minoritized racial/ethnic groups. Furthermore, policies and economic opportunities in a given county might shape the perceived importance of education for health and well-being (e.g., Montez et al. 2019), therein influencing selection into higher education.

Last, the social aspects of a county are indicated, in part, by the educational attainment of county residents. The degree to which residents are highly educated may not only signal surrounding job opportunities or economic conditions, but also influence the meaning of education for health. The level of education of county residents might influence expectations or aspirations of educational attainment that may or may not be fulfilled. Whether such expectations or aspirations are achieved could lead to unique types of stressors, such as goal-striving stress (e.g., Mouzon et al. 2019) or identity threat (e.g., Geronimus et al. 2016; Pearson 2008), which could weaken the education–health relationship.

A life course perspective helps to describe how and why county contexts experienced in early life may have persistent consequences on the education–health relationship across adulthood. An important pathway is through the accumulation of risks and resources (Ferraro et al. 2016). Early life environments may set trajectories of strain or stress that are experienced across one's educational career, which can take a cumulative physiological toll. For example, children living in socioeconomically disadvantaged neighborhoods, particularly children of color, may experience structural barriers to accessing education, limiting their ability to attain high levels of education or secure the income and employment benefits traditionally associated with higher education. Achieving high levels of education in the face of such barriers may come at a cost to energy reserves and bodily systems (Brody et al. 2013; James et al. 1983).

The Present Study

This study investigates whether and how early life contexts modify educational disparities in young adult health across and within racial/ethnic-nativity groups. The theories and research outlined thus far lead to the following hypotheses corresponding with our three research questions:

Hypothesis 1: While higher levels of education will be associated with better health for all racial/ethnic-nativity groups, the education–health relationship

will be stronger among White and foreign-born Hispanic young adults than among Black and U.S.-born Hispanic young adults.

Hypothesis 2: The education–health relationship will be most comparable across racial/ethnic-nativity groups in counties characterized by economic, policy, and social advantages.

Hypothesis 3: Across all early life county environments, higher educational attainment will be associated with better health among White young adults. Higher educational attainment will be associated with better health for Black and Hispanic young adults relative to their less educated counterparts of the same race/ethnicity and nativity status only when they are exposed to advantaged county environments in early life.

This study advances prior work in several ways. First, we examine educational disparities in young adulthood, a critical stage in the life course wherein health trajectories have already begun, and are continuing, to diverge (Hargrove 2018; Harris 2010). Results will provide insight into whether and how the characteristics of places that shape educational attainment in early life are associated with health disparities that persist across the life course. Furthermore, younger cohorts have worse cardiovascular health than older cohorts had at the same age (e.g., Masters et al. 2018; Preston et al. 2018). Thus, this study focuses on an important population whose health may be compromised in ways not experienced in previous cohorts.

Second, we utilize biological indicators of health. While life course theory motivates the study of health as an ongoing process that unfolds as individuals age, it is challenging to measure health in young individuals because chronic diseases are generally not yet manifest, and mortality is rare. Biomarkers of objective physical health risk present an opportunity to capture underlying variation in health in young adult populations (Harris and McDade 2018; Harris and Schorpp 2018). Finally, by examining how educational disparities vary by race/ethnicity, nativity, and county characteristics, results provide insight into factors that may enhance or hinder the association between higher education and better health.

Data and Methods

Sample

We use data from Waves I and IV of the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative study of U.S. adolescents in grades 7–12 at baseline in 1994–1995 (Wave I: $N=20,745$). Follow-up data were collected in 1996 (Wave II: $N=14,738$), 2001–2002 (Wave III: $N=15,170$), and 2008–2009 (Wave IV: $N=15,701$). Add Health used a multistage, stratified, school-based, cluster sampling design (Harris et al. 2019). Our analytic sample consists of individuals who participated in Waves I and IV; identify as non-Hispanic White, non-Hispanic Black, or Hispanic; and have valid sampling weights and Wave IV biomarker data. Further exclusions due to missingness on Wave I county measures (98 cases) resulted in a final analytic sample of 13,316.

Table 1 Definitions of high risk for individual biomarkers

Biomarker	High Risk Definition
Waist Circumference	88 cm or more in women; 102 cm or more in men
Triglycerides	Values in the highest decile of the measured triglycerides distribution
HDL Cholesterol	Values in the lowest two deciles of the measured HDL cholesterol distribution for women; values in the lowest decile of the measured HDL cholesterol distribution for men
LDL Cholesterol	Values in the highest decile of the measured LDL cholesterol distribution
Glycosylated Hemoglobin	Greater than 5.6% of hemoglobin molecules are glycosylated, or taking a diabetic drug treatment
Blood Pressure	Greater than or equal to 130 mm Hg systolic blood pressure, or greater than or equal to 85 mm Hg diastolic blood pressure, or taking an antihypertensive drug treatment
C-reactive Protein	Greater than or equal to 3.0 mg/liter

Measures

Outcome

Cardiometabolic risk (CMR) is measured at Wave IV, when respondents were aged 24–32, and is a summary measure comprising seven physiological indicators representing biological functioning of the metabolic, inflammatory, and cardiovascular systems: waist circumference, triglycerides, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, glycosylated hemoglobin, blood pressure, and C-reactive protein (CRP). Each biomarker is dichotomized using pre-defined disease risk cut points (Table 1) and summed to create a continuous risk score, ranging from 0 to 7 (Harris et al. 2017).

Predictors of Interest

Our predictors of interest include race/ethnicity (Wave I), nativity (Wave I), educational attainment in adulthood (Wave IV), and characteristics of the county that respondents lived in during childhood or adolescence (Wave I). *Self-identified race/ethnicity* is measured by respondents' choice of racial/ethnic category: non-Hispanic White, non-Hispanic Black, and Hispanic. *Nativity* is assessed as whether the respondent was born outside of the United States. Given that few Black and White respondents were born outside of the United States in the Add Health cohort, we assess differences by nativity only among Hispanics. Thus, four racial/ethnic-nativity groups are considered: non-Hispanic U.S.-born Blacks (hereafter referred to as Black), U.S.-born Hispanics, foreign-born Hispanics, and non-Hispanic U.S.-born Whites (hereafter referred to as White). *Educational attainment* is measured as a dummy variable: 0 = less than a four-year college education and 1 = a four-year college education or more.

We examine characteristics of the counties in which Add Health respondents lived during Wave I (Belsky et al. 2019). Economic features are captured by indicators of future prospects for economic opportunity: absolute mobility, unemployment, and

the Gini coefficient. Absolute mobility and the Gini coefficient come from Opportunity Insights (Chetty and Hendren 2018; Chetty et al. 2014). Investigators from Opportunity Insights compiled data from deidentified federal income tax records, providing information on the incomes of more than 40 million children and their parents between 1996 and 2012. Importantly, the “children” in these data are part of the 1980–1982 birth cohort, which overlaps with the Add Health cohort, as most Add Health respondents were born between 1977 and 1982.

Within the Opportunity Insights data, *absolute mobility* is calculated as the mean rank (in the national child income distribution) of children whose parents were at the 25th percentile of the national parent income distribution. Higher values of this measure correspond to greater economic opportunity for mobility in one’s county of residence. The *Gini coefficient* indicates the amount of parental income inequality within U.S. counties. Higher values indicate more income inequality. *Unemployment* is assessed as the proportion of county residents who are unemployed.

The policy features of counties are captured by county per capita direct expenditure on *education* and *health and hospitals*. Social features are assessed as the proportion of county residents (*aged 25 or older*) with *low educational attainment* (i.e., no high school diploma or equivalency). Measures of unemployment, county government expenditures, and educational attainment of residents come from the 1990 census (Billy et al. 1998).

Controls

All models control for individual-, family-, and school-level characteristics to address potential confounding of selection into neighborhoods and of the education–health relationship. Individual characteristics include *sex* (0 = male; 1 = female); *age* at Wave IV; and *self-rated health* at Wave I (on a scale of 1–4, ranging from excellent to fair/poor). Family socioeconomic characteristics are captured with measures of *parental education*, ranging from less than eighth grade (coded as 0) to professional training beyond a four-year college or university (coded as 9), and *household receipt of government assistance* (0 = no; 1 = yes) in Wave I. To retain cases, we use information from both the parent and in-home questionnaires to construct the family characteristic measures.

School-level factors include the *percentage of teachers with a master’s degree* and an index of *school disadvantage* composed of five indicators that were aggregated to the school level: the proportion of households receiving welfare, the proportion of parents with less than a high school education, the proportion of unemployed parents, the proportion of single-parent households, and the proportion of non-White students. Items were dichotomized on the basis of respondent inclusion in the top quartile and summed to create a school disadvantage index.

Analytic Strategy

We estimate a series of Poisson regression models to address the research questions. Equation (1) is the basic form of each model. It estimates the log of the expected

count of CMR for individual i as a function of a binary measure of education (CLPS for college plus) and covariates contained in the \mathbf{b}_2 vector:

$$\log(\mu_i) = \mathbf{b}_0 + \mathbf{b}_1 \text{ CLPS} + \mathbf{b}_2 \text{ covariates}, \quad (1)$$

where $\mu_i = E(y_i)$ is the expected count value of CMR for individual i .

To address our first research question, we regress CMR on interactions between race/ethnicity–nativity and educational attainment. This model evaluates the extent to which the education–health relationship varies by race/ethnicity and nativity. All groups are compared with White adults.

To address our second research question, we stratify the above model by advantaged county contexts (e.g., high mobility, more investments, low proportions of low-educated residents) and disadvantaged contexts (e.g., low mobility, fewer investments, high proportions of low-educated residents). To determine advantaged versus disadvantaged county contexts, we dichotomize county measures at race/ethnicity-specific 75th percentiles. Given the high degree of racial residential segregation that exists in the United States (Rothstein 2017), the distributions of county characteristics vary tremendously by race/ethnicity. Consequently, there is not much overlap in the distributions between racial/ethnic groups, especially between Black and White young adults. These patterns may also differentiate definitions of “highly mobile” or “highly educated” counties across groups. Race/ethnicity-specific cut points help to facilitate an investigation of more meaningful categories of early life (dis)advantages for all groups.

Stratifying the models by place allows us to assess whether racial/ethnic–nativity differences in the association between education and health depend on specific characteristics of early life counties. Indeed, place is a fundamental cause of health inequality, shaping opportunities for educational attainment, socioeconomic mobility, and health (Williams et al. 2019). As such, the mechanisms that link education to health in more advantaged counties likely vary from the mechanisms that link education to health in less advantaged counties. In these models, White adults who lived in relatively similar county contexts in early life serve as the reference group.

To address our third research question, we estimate the association between educational attainment and CMR *within* racial/ethnic–nativity groups across different county contexts. We stratify models by race/ethnicity, nativity, and county characteristics, and examine educational disparities in CMR. We take this approach because, given stark racialized experiences in the United States, it is unlikely that the covariates in the models described earlier have equivalent consequences for all groups. That is, associations with *multiple* variables in our analysis vary qualitatively by race/ethnicity (and likely nativity), making it difficult to base conclusions solely on between-group analyses that assume covariates have similar relationships with health among all groups. Stratifying the models by race/ethnicity and nativity in addition to county contexts allows us to identify the types of contexts in which education may have a particularly strong (or weak) association with health for each population subgroup. Respondents with less than a college degree who lived in a given county context during childhood or adolescence are compared with their higher educated counterparts who lived in counties with similar characteristics.

All analyses use *svy* commands in Stata 16.1, which adjust the standard errors for clustering at the school level. These commands also incorporate sampling weights

to account for the unequal probability of selection and other design effects. To retain as many cases as possible, we use multiple imputation by chained equations (MICE) on the analytic sample described earlier. MICE is a flexible imputation technique that produces a series of regression models, which impute missing values conditional upon the other variables in the data set (Azur et al. 2011). Ten imputed data sets for the total analytic sample, as well as for each racial/ethnic-nativity group, were created to conduct the analyses.

We also conducted a series of robustness checks, including (1) controlling for the length of time (in years) respondents lived in the residence reported at Wave I and (2) examining relationships among three categories of educational attainment and health: high school or less (reference group); more than high school/some college; and college or more. These analyses (available upon request) yielded similar findings and substantive conclusions as reported here. Moreover, ancillary analyses estimated models using absolute measures of county (dis)advantage rather than race-specific levels, which also produced similar results. While these ancillary analyses rely on a subset of minoritized racial/ethnic groups—as racialized systems of inequality limit the ability of Black and Hispanic Americans to access the same spaces as White individuals—the results indicate that even the few Black adults and, to an extent, U.S.-born Hispanic adults who were exposed to the same county conditions and levels of economic, policy, and social (dis)advantages as Whites did not experience comparable levels of CMR at higher levels of education. Given the small proportion of minoritized groups living in the same places as White individuals, we employ and present models using race-specific levels of county (dis)advantage to better capture the reality and consequences of racial segregation in the United States.

Results

Table 2 summarizes the descriptive characteristics of the analytic sample. Relative to their White counterparts, Black and U.S.-born Hispanic young adults had higher CMR scores, were less likely to have at least a four-year college degree, and tended to live in counties characterized by higher levels of income inequality during childhood and adolescence. Furthermore, Black young adults generally lived in more disadvantaged counties during childhood or adolescence compared with their White counterparts, as indicated by fewer opportunities for upward social mobility, a higher proportion of residents who were unemployed or had less than a high school diploma, and less government spending on education. Aside from differences in income inequality, U.S.-born and foreign-born Hispanics tended to live in similar counties in Wave I as White individuals. Foreign-born Hispanics had similar levels of CMR as their White counterparts, yet were less likely to have completed a college degree.

Do Educational Disparities in CMR Vary by Race/Ethnicity and Nativity?

Figure 1 displays results from the model estimating an interaction between race/ethnicity-nativity and educational attainment (see online Appendix Table 1, column 1). Having at least a college education was related to lower predicted CMR for

Table 2 Weighted means and proportions of study variables, by race, ethnicity, and nativity

Variable	U.S.-born Whites	U.S.-born Blacks	U.S.-born Hispanics	Foreign-born Hispanics	Range
Outcome					
Cardiometabolic risk (CMR)	1.78 (.03)	2.10* (.04)	2.06* (.06)	1.78 (.07)	0–6
Education					
College degree or more	.33 (.02)	.22* (.03)	.18* (.02)	.22* (.04)	—
County Characteristics					
Absolute mobility	41.96 (.47)	38.13* (.40)	42.40 (.31)	42.34 (.36)	33–55.7
Proportion of residents unemployed	.07 (.00)	.08* (.00)	.07 (.00)	.07 (.00)	.03–.15
Gini coefficient	.41 (.01)	.51* (.01)	.50* (.02)	.56* (.02)	.22–.76
Per capita expenditure on education (in US\$)	683.21 (15.19)	634.92* (18.52)	701.16 (18.11)	685.29 (18.75)	2.54–2,281.68
Per capita expenditure on health (in US\$)	139.34 (15.96)	121.18 (19.43)	173.90 (18.39)	160.79 (21.32)	0–839.84
Proportion of residents with less than a H.S. diploma	.25 (.01)	.29* (.01)	.23 (.01)	.26 (.02)	.05–.61
Controls					
Female (Wave I)	.49 (.01)	.51 (.01)	.51 (.02)	.51 (.04)	—
Age (Wave IV)	28.28 (.12)	28.30 (.22)	28.33 (.19)	28.98* (.29)	24–34
Self-rated health (Wave I)	2.10 (.02)	2.11 (.02)	2.21* (.03)	2.12 (.06)	1–4
Parental education (Wave I)	6.07 (.10)	5.36* (.19)	4.51* (.02)	3.55* (.29)	0–9
Household receipt of government assistance (Wave I)	.07 (.01)	.22* (.02)	.19* (.02)	.17* (.02)	—
Percentage of teachers with M.A. or higher (Wave I)	51.58 (2.53)	48.61 (3.58)	49.21 (3.85)	49.11 (5.33)	0–95
School disadvantage (Wave I)	0.66 (.10)	2.09* (.23)	1.86* (.31)	2.76* (.50)	0–5
<i>n</i>	7,920	3,060	1,789	547	

Notes: Range represents the documented range among the entire analytic sample; standard errors are shown in parentheses. H.S. = high school. M.A. = master's degree.

* $p < .05$ (difference from Whites)

U.S.-born Hispanic, foreign-born Hispanic, and White young adults compared with their counterparts with less education. For Black young adults, higher levels of education were not associated with lower levels of CMR—that is, there was not a significant educational difference in CMR among Black respondents. Moreover, Black

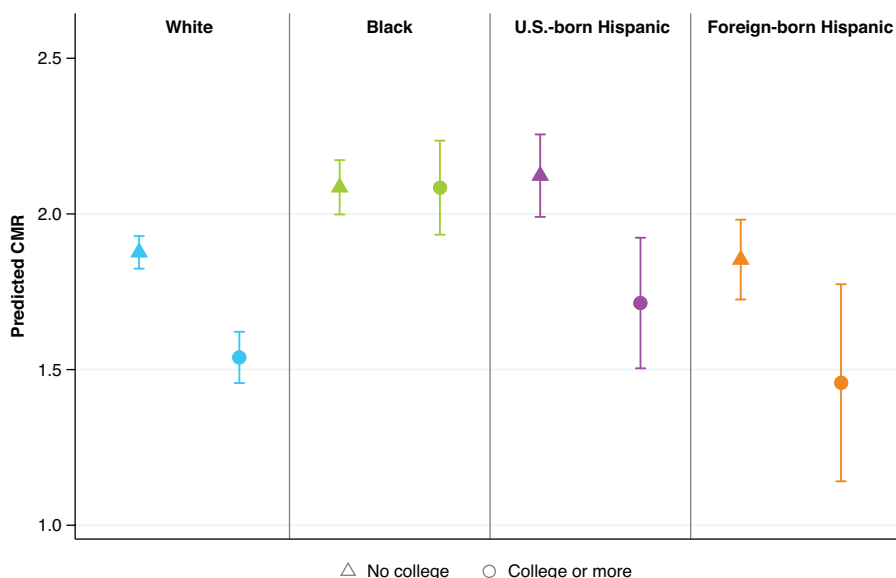


Fig. 1 Predicted cardiometabolic risk scores by education level, according to racial/ethnic-nativity subgroup. Results are from Poisson regression models (see the online Appendix Table 1, column 1). All models control for age, sex, self-rated health, parental education, household receipt of welfare, percentage of teachers with a master's degree or higher, and school disadvantage. CMR = cardiometabolic risk.

adults who attained high levels of education had higher predicted CMR scores than their White and Hispanic counterparts with similar levels of education. These results provide partial support for Hypothesis 1.

Are Racial/Ethnic-Nativity Differences in the Education–CMR Relationship Contingent on the Economic, Policy, and Social Contexts of Childhood Counties?

Figure 2 summarizes results from models that are stratified by county characteristics (see online Appendix Table 1, columns 2–7). Across the 12 contexts characterized by high or low levels of economic, policy, and social advantages, there are nine contexts in which the education–health relationship significantly differs for Black adults compared with White adults: counties with low absolute mobility, high and low unemployment, high and low income inequality, low per capita spending on education, low per capita spending on health, and high and low proportions of residents with low education. In these contexts, attaining a college degree or more was associated with a smaller reduction in CMR for Black young adults relative to their White counterparts with a similar level of education. In counties characterized by high absolute mobility, high per capita spending on education, and high per capita spending on health and hospitals, the association between greater educational attainment and lower CMR was comparable among Black and White young adults (**Figure 2**, left column, rows 1, 4, and 5). Conversely, results suggest that the education–CMR relationship was similar for U.S.-born and foreign-born Hispanic young adults relative

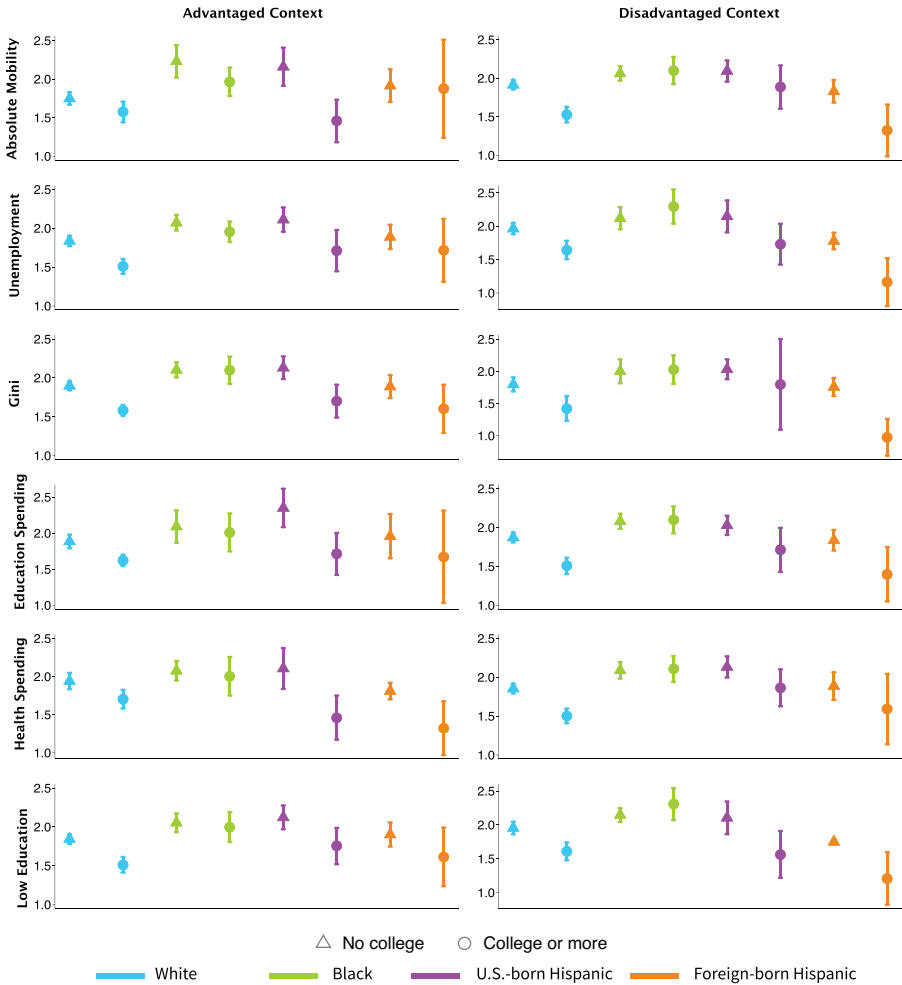


Fig. 2 Predicted cardiometabolic risk scores by education level, according to racial/ethnic-nativity subgroup and county context. Results are from Poisson regression models stratified by advantaged (high mobility, low unemployment, low income inequality, high spending on education and health, and low proportion of residents with low education) and disadvantaged (low mobility, high unemployment, high income inequality, low spending on education and health, and high proportion of residents with low education) county contexts (see the online Appendix Table 1, columns 2–7). All models control for age, sex, self-rated health, parental education, household receipt of welfare, percentage of teachers with a master’s degree or higher, and school disadvantage. CMR = cardiometabolic risk.

to Whites regardless of the characteristics of their childhood counties. There is one exception for each group. The association between education and CMR was stronger for U.S.-born Hispanics and foreign-born Hispanics relative to Whites when respondents lived in counties characterized by a high level of absolute mobility (Figure 2, left column, row 1) and a high level of income inequality (right column, row 3), respectively, during childhood. Collectively, these results provide support for Hypothesis 2.

In Which Contexts Do Racial/Ethnic-Nativity Groups Experience the Highest Benefits of Educational Attainment?

Table 3 presents results of educational disparities in CMR among racial/ethnic-nativity subgroups across different county environments (the online Appendix Figures 1–4 correspond to the **Table 3** models and plot predicted values of CMR for each education group within each county context). Across almost every type of environment, Whites with a college degree or more experienced lower levels of CMR than their less educated counterparts. There were, however, two exceptions. There was no significant educational disparity in CMR among Whites who lived in counties characterized by high levels of absolute mobility or by high per capita spending on health. Appendix Figure 1 further illustrates these results.

In contrast to the pattern for Whites, there were few significant differences in predicted CMR for Black young adults by education level. College completion was associated with significantly lower CMR only among those who lived in childhood counties with high absolute mobility, fewer unemployed or low-education residents, and high per capita spending on health. Appendix Figure 2 shows that the lowest levels of predicted CMR were observed among Black young adults who had completed college and who lived in counties characterized by high levels of upward mobility, low proportions of unemployed residents, and high spending on education.

Similar to the findings for Black adults, the education–CMR relationship differed across county contexts for U.S.-born Hispanics. In this subgroup, those who had a college degree or more exhibited reduced levels of CMR when living in early life county contexts of high absolute mobility, low levels of income inequality, or high per capita spending on education and health. Unlike for Black respondents, however, higher education was associated with better health for those growing up in counties with both high and low proportions of residents who are unemployed or who have less than a high school diploma. Predicted CMR values among U.S.-born Hispanics are plotted in Appendix Figure 3. As displayed there, the lowest levels of CMR were observed among U.S.-born Hispanics who had a college degree or more and lived in childhood counties characterized by high levels of mobility and high per capita spending on health.

The patterns documented among foreign-born Hispanic young adults diverged from those among Black and U.S.-born Hispanic young adults. Foreign-born Hispanics who had a college degree or more exhibited significantly lower levels of CMR relative to their lower educated counterparts only when living in counties characterized by low absolute mobility, high proportions of unemployed or low-educated residents, high income inequality, and low per capita spending on education. One exception was per capita spending on health, in which the educational disparity was significant only among those who lived in counties with high per capita spending on health during childhood or adolescence. Appendix Figure 4 indicates that while the lowest levels of CMR occurred in counties characterized by high levels of income inequality and higher proportions of low-educated residents, the predicted CMR scores for foreign-born Hispanics with and without a college degree were quite low, often lower than the score for highly educated White, Black, and U.S.-born Hispanic young adults. Taken together, these results provide partial support for Hypothesis 3.

Table 3 Poisson regression results of educational disparities in cardiometabolic risk among racial/ethnic-nativity subgroups, by county-level characteristics

	Absolute Mobility		Proportion Unemployed		Gini Coefficient		Per Capita Expenditure on Education		Per Capita Expenditure on Health		Proportion of Residents With Less Than a H.S. Diploma	
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
U.S.-born Whites (n=7,920)												
College degree or more	-0.046*	-2.00***	-1.47***	-1.59***	-2.10*	-1.46***	-1.14**	-1.81***	-0.72	-1.185***	-0.181***	-1.52***
	(.047)	(.036)	(.034)	(.040)	(.081)	(.028)	(.035)	(.040)	(.045)	(.037)	(.043)	(.039)
Constant	-529	-024	-739*	.102	-228	-197	-480	-071	.394	-335	-221	-140
	(.404)	(.248)	(.305)	(.270)	(.399)	(.247)	(.392)	(.254)	(.386)	(.258)	(.366)	(.261)
n	2,002	5,918	2,004	5,916	1,875	6,045	2,489	5,431	2,113	5,807	2,170	5,750
U.S.-born Blacks (n=3,060)												
College degree or more	-2.35***	-0.63	-0.09	-1.47**	-1.11	-0.85†	-1.59†	-0.75	-1.143*	-0.67	.040	-1.57**
	(.069)	(.049)	(.074)	(.049)	(.091)	(.049)	(.094)	(.049)	(.072)	(.054)	(.057)	(.052)
Constant	-505	.128	.308	-127	870†	-277	.550	-123	-576	.264	-178	.122
	(.607)	(.310)	(.419)	(.349)	(.453)	(.308)	(.557)	(.330)	(.420)	(.343)	(.472)	(.327)
n	712	2,348	767	2,293	852	2,208	744	2,316	978	2,082	883	2,177
U.S.-born Hispanics (n=1,789)												
College degree or more	-3.96***	-0.79	-1.83*	-2.14*	-0.75	-2.25**	-3.24**	-1.61†	-3.24**	-1.135†	-2.44*	-2.02*
	(.121)	(.072)	(.081)	(.091)	(.158)	(.074)	(.101)	(.088)	(.117)	(.073)	(.120)	(.080)
Constant	.328	.375	.777	.045	-803	.471	.997	.166	.201	.334	1.004	.145
	(.676)	(.462)	(.850)	(.401)	(.611)	(.466)	(.762)	(.439)	(.761)	(.487)	(1.005)	(.433)
n	491	1,298	477	1,312	651	1,138	712	1,077	631	1,158	359	1,430
Foreign-born Hispanics (n=547)												
College degree or more	-1.45	-3.66**	-4.56***	-1.44	-6.17***	-2.20	-2.03	-3.24*	-3.23**	-1.199	-4.14***	-2.21
	(.272)	(.133)	(.151)	(.156)	(.017)	(.135)	(.277)	(.139)	(.111)	(.197)	(.097)	(.160)
Constant	-868	1.065	3.073**	-5.69	2.597***	.641	1.354	.661	1.31	.069	2.113***	.009
	(1.103)	(.874)	(1.073)	(.585)	(.478)	(.900)	(1.579)	(.817)	(.793)	(.872)	(.495)	(.712)
n	101	446	262	285	300	247	130	417	292	255	249	298

Notes: Logged expected count values of CMR are presented; standard errors are shown in parentheses. All models control for age, sex, self-rated health, parental education, household receipt of welfare, percentage of teachers with a master's degree or higher, and school disadvantage.

†p < .10; *p < .05; **p < .01; ***p < .001

Discussion

Education is widely recognized as a powerful determinant of health, yet the literature provides inconsistent evidence as to whether the association between education and health is comparable across racial/ethnic and nativity groups. Whether and how characteristics of early life environments influence the educational attainment–health relationship in young adulthood across population groups also remains unclear. This information is needed to advance theories and evidence regarding social stratification and health in contemporary U.S. society. The present study is a first step toward this advancement.

Our findings support three major conclusions. First, consistent with accumulating evidence (Fuller-Rowell et al. 2015; Gaydos et al. 2018; Kimbro et al. 2008), Black young adults with high levels of education did not experience comparable reductions in CMR as their similarly educated White and Hispanic counterparts. In the context of past scholarship on the health consequences of social mobility among Black Americans, it is likely that the pathways to higher educational attainment are riddled with institutional barriers and increased exposure to psychosocial and environmental stressors. Such factors may reduce the ability of Black young adults to translate higher education into commensurate levels of income, occupational status, and neighborhood affluence (Adelman 2004; Patillo 2005; South et al. 2016; Williams et al. 2010) and may overactivate the body's stress response (Brody et al. 2013; James et al. 1983).

Second, there were few contexts in which the association between education and CMR was similar for Black and White young adults. Moreover, there were few contexts in which the education–CMR association differed between Hispanic young adults and their White counterparts. Notably, the educational disparity in CMR was similar for Black and wider for U.S.-born Hispanic young adults relative to Whites when respondents lived in counties characterized by high levels of absolute mobility and high per capita spending on health, respectively, during childhood. Such contexts may be more likely to provide resources for healthy living for all residents, regardless of eventual educational attainment.

Third, our results indicated that for minoritized racial/ethnic young adults and foreign-born young adults, the relationship between education and CMR depended on the characteristics of early life counties. Among Whites, however, the educational difference in health was robust, with higher education linked to better health regardless of the context in which they lived as children or adolescents. It is possible that given their relative advantages in U.S. society, there is less of a need for White Americans to expend psychological resources or employ high-effort coping strategies to attain socioeconomic resources (e.g., Pearson 2008), even in the face of contextual disadvantages experienced in early life.

There were, however, two exceptions for White individuals. Higher education was not associated with better health among those who lived in counties characterized by high levels of absolute mobility and high per capita spending on health. Comparison of predicted values of CMR across groups indicated that Whites with less than a college degree who lived in high-mobility contexts as children or adolescents had the lowest predicted CMR relative to their lower educated, White counterparts in other contexts. Their predicted CMR was even lower than that of Black and U.S.-born

Hispanic young adults with high levels of education across almost all contexts. Thus, there may be a potential floor effect of education for Whites who lived in highly advantaged contexts—that is, in environments that facilitate upward social mobility. For Whites who grew up in counties with high government expenditure on health, further exploration of results suggested that childhood health and school disadvantage accounted for the educational disparity, indicating the importance of early life factors for setting health trajectories in these contexts.

For Black and U.S.-born Hispanic young adults, higher education was associated with better health primarily among those who lived in advantaged counties as children or adolescents, particularly in counties that facilitated opportunities for upward social mobility. Conversely, Blacks and U.S.-born Hispanics who lived in counties characterized by limited future opportunity prospects, fewer investments in residents, or higher proportions of low-education residents and who went on to attain high levels of education did not exhibit better health than their less educated counterparts. When contrasted with the findings that the education–health relationship in general is weaker for Black young adults, these patterns suggest that living in counties that provide more advantages and support to residents may help facilitate the translation of higher educational attainment into other forms of social, economic, and health capital for all racial/ethnic groups. Moreover, characteristics of early life counties may create specific cultures that shape the development of lifelong psychological and behavioral strategies for dealing with the stresses, strains, or opportunities of educational attainment (e.g., Krieger 2001). Those who grow up in disadvantaged contexts, for example, may be more likely to develop coping strategies characterized by resilience and persistence as they strive to acquire higher levels of education in the face of significant structural barriers. While leading to success in terms of educational attainment, such coping strategies may result in cumulative wear and tear on one's body, particularly for minoritized racial/ethnic groups (Brody et al. 2013; Gaydosh et al. 2018). Positive characteristics of early life counties, however, may alleviate the need for such individual coping strategies, resulting in better health for all residents who attain high levels of education.

For foreign-born Hispanics, results suggested a particularly strong relationship between educational attainment and health when individuals lived in relatively disadvantaged counties as children or adolescents. Such findings suggest that upward mobility—attaining high levels of education despite living in counties with fewer resources in early life—is associated with better health. Several possibilities may explain these patterns. First, it is likely that health-protective resources such as higher incomes and access to quality health insurance accompany higher levels of education. Second, perhaps achieving upward mobility, particularly as an immigrant to the United States, is linked to social-psychological factors that mitigate the harmful effects of stressors on health. While Hispanic American immigrants disproportionately occupy lower socioeconomic positions, there may be unique protective or buffering resources (e.g., social support, lower rates of smoking or binge drinking) available to this group within their receiving communities (Kimbrow 2009; Osypuk et al. 2009; Viruell-Fuentes et al. 2013; Zhang et al. 2015). Furthermore, prior work suggests that Hispanic Americans living in disadvantaged environments may compare their own circumstances to their lower SES Hispanic counterparts or individuals from their home country who did not migrate (Campbell et al. 2012; Wolff

et al. 2010). Such positive comparisons, which influence how individuals perceive, understand, and navigate their objective conditions and realities, may be linked to higher levels of self-esteem, greater sense of accomplishment, weaker perceptions of social devaluation, and lower physiological stress (Adler et al. 2000; Campbell et al. 2012; Cohen et al. 2008; McEwen and Gianaros 2010). Therefore, foreign-born Hispanics who live in disadvantaged counties in early life may experience fewer harmful consequences of stressors associated with attainment processes as a result of social comparison processes.

Findings from this study raise important questions regarding the link between educational attainment and health. First, to what extent are the associations documented here applicable for other indicators of physical, mental, and emotional well-being? Given the distinct pathways linking social factors to physical and mental health outcomes, it is possible that educational attainment is associated with better mental health in the same contexts in which education was not associated with better physical health. Second, what mechanisms might account for these patterns? While not explicitly examined here, we posit that early life counties (1) structure objective conditions that facilitate educational attainment and (2) may shape coping strategies that can diminish the health-promoting aspects of educational attainment. Other individual-level (e.g., stressors, social and personal resources) and contextual-level factors (e.g., school and workplace environments), however, also likely play a role. Such factors, including those we posited, should be evaluated in future research.

Third, what additional role might adult contexts have in shaping the link between education and health? Life course accumulation of risks and resources may further differentiate the consequences of educational attainment across various contexts. For example, it is possible that living in counties that differ drastically in demographic or socioeconomic characteristics from one's county of origin may be linked to feelings of isolation, disruption of supportive social networks, or increases in discrimination (Cole and Omari 2003; Hudson et al. 2016), all of which may further attenuate any health benefits associated with educational attainment. Last, given that systems of inequality such as racism and nativism do not operate independently of one another (e.g., Collins 2015; López and Gadsden 2016), other important social characteristics, such as gender, need to be incorporated into this line of research. Accumulating evidence suggests that pathways to health vary by intersections of race/ethnicity, nativity, and gender (Brown 2018; Brown et al. 2016; Hargrove 2018)—thus, it is possible that the relationships among education, place, and health depend on such intersections as well.

Limitations

This study has several limitations. First, small sample sizes precluded our ability to conduct independent analyses of other racial/ethnic and nativity groups, including Asian Americans, Native Americans, foreign-born Black and White Americans, and ethnic subgroups within the Hispanic population. Further, given the limited sample of foreign-born Hispanics, results for this group should be interpreted with caution as cell sizes are likely small. It will be important for future studies to explore the questions posed here using data sets with larger samples of foreign-born Americans.

Second, dichotomizing our county-level predictor variables by race-specific 75th percentiles likely reduced some of the variability in our predictors and obscured nonlinear relationships between our predictors and outcomes (Altman and Royston 2006). Yet, given the stark patterns of racial and socioeconomic residential segregation in the United States (Patillo 2013; Sharkey 2014), as well as our objectives to evaluate the role of advantaged versus disadvantaged counties, we believe our choice to dichotomize facilitates meaningful comparisons across the county-level contexts under examination in ways that better capture the realities of segregation in U.S. counties.

Third, while we did not have detailed survey data on the types of environments in which young adults lived prior to entering the Add Health study, approximately 95% of respondents remained in the same county between Waves I and II, when respondents were adolescents. Moreover, ancillary analysis suggested that our results are substantively robust to controlling for length of residence in respondents' Wave I location. Nonetheless, further analysis is needed to directly test whether movement prior to childhood or adolescence shapes educational attainment processes. Relatedly, examination of the characteristics of the schools in which young adults navigate is beyond the scope of the study, as we sought to provide initial documentation of trends in the education–health relationship by race/ethnicity, nativity, and county-level characteristics. Yet, it will be important for future research to examine school environments, as prior work suggests that risk (e.g., interpersonal experiences of discrimination) and protective factors (e.g., membership in social groups) experienced during educational attainment processes are key individual-level mechanisms that may shape the protective effects of education (Cole and Omari 2003; Griffith et al. 2019; Hardaway and McLoyd 2009; Hudson et al. 2013; Von Robertson et al. 2016).

Conclusion

This study advances prior scholarship by documenting educational disparities in health among racial/ethnic and nativity groups who lived in different economic, policy, and social environments during childhood or adolescence. Results suggest that the degree to which higher education is associated with better health among young adults is dependent on the intersection of race/ethnicity, nativity, and early life county characteristics. Importantly, counties act as key early life contexts that structure the extent to which educational attainment processes may strain or protect health for diverse population subgroups. By contextualizing educational disparities in health by race/ethnicity and nativity, this study provides insight into the place-based mechanisms that may differentiate the association between higher education and health for various groups in the United States. Such knowledge deepens our understanding of broader patterns of inequality and may contribute to appropriate interventions to address the differential impact of education on health. ■

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