

Geo-Life Course Determinants of Educational Disparities in U.S. Adult Health

Blakelee Kemp and Jennifer Karas Montez

Educational attainment is one of the strongest social determinants of health among U.S. adults [1]. However, recent studies have shown that education is a stronger determinant in some areas of the country than in others. These studies have documented educational disparities in a host of health, disability, and mortality outcomes by U.S. state and find that the size of the disparity varies markedly across states [2, 3]. Interestingly, the disparities vary mainly because these outcomes differ across states for low-educated adults. In contrast, a college degree appears to act as a protective “personal firewall” across state contexts.

Given that it has only recently been shown that the educational gradient is stronger in some parts of the country than in others, the reasons for the variation are poorly understood. The few studies that have speculated about them have focused on areas’ current socioeconomic and policy environments [2, 3]. For instance, the educational gradient in mortality may be weakest in U.S. states that have higher minimum wages, supplemental Earned Income Tax Credits, and higher tobacco taxes, as these contexts are particularly beneficial for low-educated adults. The cross-state pattern in the gradient is consistent with this hypothesis [3].

Missing from the small but growing number of studies on the topic is an explicit consideration of historical context, life course dynamics, and their interplay. Historical factors such as the secular increase in educational attainment during the 20th century, compulsory schooling laws [4], the diffusion of new food, medical, and computer technologies [5], and improvements in epidemiologic environment [6] rolled out quite unevenly across the country. These factors may have left an indelible imprint on individuals’ health from very early in the life course and affected their educational attainment. Importantly, these historical shifts may have had different consequences for the educational attainment and health of individuals depending on when in the life course they experienced those shifts. In addition, the policy environments of U.S. states have been diverging since the early 1980s in ways that affect the importance of education for health. This study takes a historical and life course approach to understanding why educational disparities in health vary across areas of the United States, for which cohorts the disparities vary, and which historical or contemporary circumstances explain the variation.

Aims

Using data on US-born adults aged 50 and older in the 1998-2014 waves of the Health and Retirement Study, we examine how educational disparities in cardiovascular disease (CVD), disability, and mortality vary across geographic areas of the United States. We focus on the nine

Census-defined divisions (for ease, we refer to these as regions) as they are the smallest geographic area for which we can robustly estimate the disparities. Because much policy making is conducted at the U.S. state level, the policy variables we use reflect that level of geography.

We extend previous work on how the disparities vary across the U.S. in several ways. First, we examine how the prevalence *and incidence* of the disparities vary across regions, which is critical for understanding when in the life course the disparities emerge and how they evolve with age. Second, we assess the extent to which regional variation in the disparities is anchored in childhood circumstances that can influence both educational attainment and adult health. We include specific policies of childhood state of residence (e.g., compulsory schooling laws) and individual circumstances such as childhood health. Third, we examine how the relative importance of childhood and adulthood region of residence on the disparities has changed across birth cohorts. By addressing these issues for several outcomes (CVD, disability, mortality) with distinct etiologies and epidemiological histories, we can assess the robustness of the findings and glean additional insights. Our study centers on three main questions:

1. *How do educational disparities in the prevalence and incidence of adult CVD, disability, and mortality vary across regions?* We first estimate disparities in prevalence (of CVD and disability) across region of residence, net of region of birth, for adults aged 50-59 to assess the degree to which regions have already influenced the disparities among middle-aged adults. We then estimate educational disparities in incidence to assess whether regions shape how the disparities subsequently grow, shrink, or persist with age.
2. *To what extent is regional variation in the disparities rooted in childhood and/or adulthood circumstances?* We examine childhood circumstances that may have influenced the amount of education an individual attained (e.g., U.S. state laws on compulsory schooling and length of the school year; individuals' childhood health and family socioeconomic conditions), as well as adulthood circumstances that may affect the importance of education for health (e.g., U.S. state laws on minimum wage).
3. *How has the importance of regions in shaping educational disparities in CVD, disability, and mortality changed during the past century?* We contrast the findings for cohorts born during 1924-1930 and those born 1931-1941 to assess whether the influence of regions on the disparities have become stronger or weaker over time and whether the relative importance of region of birth or residence has changed as well.

Data and Methods

This study uses nine waves of data (1998-2014) from the Health and Retirement Study, a panel survey of adults over the age of 50. The study began in 1992 and adds new cohorts every six

years. Our analytic sample includes 29,781 US-born individuals across all six HRS cohorts. The three outcomes are cardiovascular disease (self-report of a doctor diagnosis), disability (difficulty with any one of ten activities of daily living or instrumental activities of daily living), and all-cause mortality. The main exposures of interest are educational attainment, region of residence, and region of birth. Educational attainment is captured by three categories: less than high school, high school credential (GED or diploma), and more than high school.

We include several measures of childhood circumstances. Individual-level measures are self-reported childhood health and socioeconomic conditions. We dichotomize childhood health into unfavorable (which includes fair and poor) and favorable (good, very good, and excellent). We dichotomize socioeconomic conditions into adverse (parents were economically worse off than others) and not adverse (parents were similar to or better off than others). Contextual measures include key state-level policies and conditions: compulsory schooling laws and the length of the school year when the individual was 16 years of age, and the infant mortality rate during their year of birth as an indicator of the epidemiological environment.

We include several measures of adult circumstances. Individual-level measures include employment, income, partnership status, psychosocial well-being, and lifestyle indicators (smoking, alcohol consumption, obesity). Contextual measures include key state-level policies and conditions that can shape health, particularly for low-educated adults. These include state-level minimum wage, Earned Income Tax Credits (EITC), tobacco excise taxes, and unemployment rate. One complicating factor is the time-varying nature of these circumstances. To partially account for this, we operationalize them across the life course, retrospectively and prospectively. Taking EITC as an example, we create a binary variable indicating whether the person lived in a state that offered EITC when they were a young adult, another binary variable for EITC in middle adulthood, and a time-varying EITC measure for each year starting with their initial HRS interview. In a similar fashion, we will operationalize the individual-level variables. For example, we include a measure of employment history prior to entering the HRS, as well as a time-varying measure of employment starting with the initial interview year.

To address research question 1 (RQ1), we first examine prevalence. We include all US-born individuals aged 50-59 during the first wave, spanning 1998-2014, in which they appear in the data. We will estimate logistic regression model 1.0, where b_1 is a vector of education dummies; b_2 is a vector of dummies for region of residence; b_4 is a vector of covariates including age, sex, race/ethnicity, calendar year of interview, and region of birth. The b_3 coefficients will identify regions that have particularly large or small educational disparities.

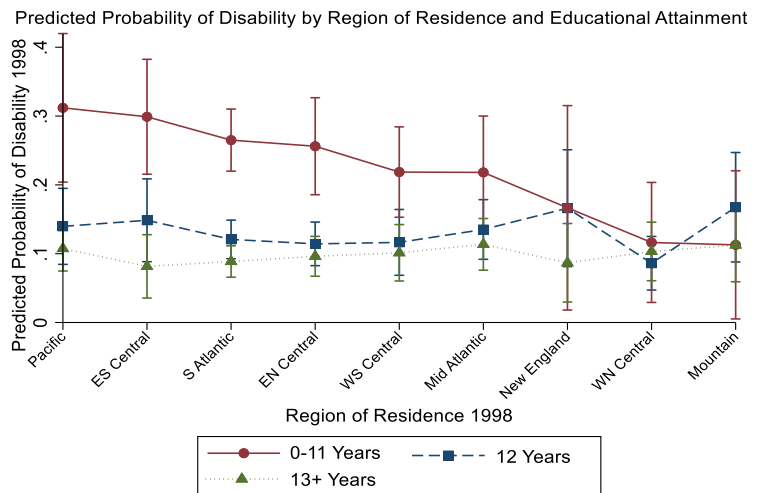
$$\ln(odds) = b_0 + b_1ed + b_2region + b_3ed * region + b_4covariates \quad [1.0]$$

To examine incidence of CVD and disability, we remove adults who reported these conditions at their initial interview. We then create a person-year file that contains an observation for each year the individual does not develop CVD (or disability) until their death or the end of 2014. In these models, we replace the year of initial interview covariate with year of current interview.

We address RQ2 in two main steps. We first include the four measures of childhood circumstances into model 1.0 and assess the extent to which they explain the regional variation in educational disparities. Statistically, this means we will assess whether those circumstances mediate the b_3 coefficients, using the “KHB” mediation method [7]. We then include the measures of adult circumstances and, again, formally assess their mediating role. For RQ3, we replicate the analyses for two groups of birth cohorts, those born 1924-1930 and 1931-1941.

Preliminary Results

For each of the nine regions, the figure to the right shows the predicted probability of having a disability by education level. For these preliminary analyses, we use the 1998 wave of the HRS and include US-born adults aged 50-59. As expected, the disparities are significantly larger in some regions than others. The East South Central region has the widest disparities: 9% of high-educated adults have a disability compared to 30% of low-educated adults. In sharp contrast, the disparity is non-existent in the West North Central region. Our analytic strategy will examine the reasons why educational attainment is more important for health in some regions than in others.



References

1. Galea, S., et al. Estimated deaths attributable to social factors in the United States. *Am. J. Public Health*, 2011, 101(8):1456-1465.
2. Montez, J.K., A. Zajacova, & M.D. Hayward. Disparities in disability by educational attainment across U.S. states. *Am. J. Public Health*, 2017, 107(7):1101-1108.
3. Montez, J.K., et al. Educational disparities in adult mortality across U.S. states: How do they differ and have they changed since the mid-1980s. *Demography*, 2019.
4. Goldin, C. & L.F. Katz. Mass secondary schooling and the state: the role of state compulsion in the high school movement, in *Understanding Long-Run Economic Growth: Geography, Institutions, and the Knowledge Economy*. D.L. Costa and N.R. Lamoreaux, Editors. 2011. pp. 275-310. University of Chicago Press and NBER.
5. Skinner, J. & D. Staiger. Technology adoption from hybrid corn to beta-blockers, in *Hard-to-measure goods and services: essays in honor of Zvi Griliches*. E.R. Berndt and C.R. Hulten, Editors. 2007. pp. University of Chicago Press: Chicago.
6. Cutler, D. & G. Miller. The role of public health improvements in health advances: the twentieth-century United States. *Demography*, 2005, 42(1):1-22.
7. Karlson, K.B., A. Holm, & R. Breen. Comparing regression coefficients between same-sample nested models using logit and probit: a new method. *Sociological Methodology*, 2012, 42(1):286-313.