



New evidence of the effects of education on health in the US: Compulsory schooling laws revisited



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ABSTRACT

Estimating the effects of education on health and mortality has been the subject of intense debate and competing findings and summaries. The original Lleras–Muney (2005) methods utilizing state compulsory schooling laws as instrumental variables for completed education and US data to establish effects of education on mortality have been extended to several countries, with mixed and often null findings. However, additional US studies have lagged behind due to small samples and/or lack of mortality information in many available datasets. This paper uses a large, novel survey from the AARP on several hundred thousand respondents to present new evidence of the effects of education on a variety of health outcomes. Results suggest that education may have a role in improving several dimensions of health, such as self reports, cardiovascular outcomes, and weight outcomes. Other results appear underpowered, suggesting that further use of this methodology may require even larger, and potentially unattainable, sample sizes in the US.

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1. Introduction

The statistical associations between education and health outcomes are among the most robust and replicated in the social sciences. However, until recently, most research did not attempt to address issues of reverse causality and omitted variables cited by Fuchs (1982), among others. The relationship between education and mortality has been of specific interest. A well known article by Lleras–Muney (2005) suggested the use of compulsory schooling laws in the early 20th century in the US as a way to allow causal effects to be estimated. The findings were important and large—one additional year of schooling was suggested to reduce 10-year mortality rates among older individuals by over 6 percentage points. Many studies have now used compulsory schooling laws in the US and many European countries, with a much more complicated set of findings. Mazumder (2011) reviews this literature and suggests that much of the more recent research shows little evidence of causal effects, particularly outside of the US. This has been puzzling given the many theorized pathways linking education to health and mortality, such as income, knowledge, occupation, etc. A

drawback in comparing results across countries is the large amount of variation in the context—differences in laws, time periods, health care settings, populations—which could in part explain differences in results.

A limited role of education on mortality in Europe, though, does not necessarily eliminate the potential role in the US. However, in attempting to focus back on the US context and examine their potential robustness and mechanisms, researchers confront several obstacles. Few datasets in the US are sufficiently large to undertake these analyses with the requisite power. However, even explorations unable to definitively show mortality effects may be able to provide evidence for or against mechanisms between education and mortality.

This paper utilizes untapped data from the epidemiology literature that surveyed several hundred thousand elderly respondents from the US in the 1990s. The focus of the survey was on diet and health outcomes and the respondents have been linked to the national death index. Information on state and year of birth allows compulsory schooling laws to be used as instruments for completed schooling to examine the effects of education on mortality and health outcomes. Findings suggest that education may have a role in improving several dimensions of health, such as self reports, cardiovascular outcomes, and weight outcomes. Other results appear underpowered, suggesting that further use of this methodology may require even larger, and potentially unattainable, sample sizes in the US.

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2. Background literature

Beginning with Angrist and Krueger (1991), economists and other social scientists have utilized state and year variation in compulsory schooling (and related) laws as an instrumental variable for estimating impacts of education on later outcomes. The main idea is to leverage differences across states and over time (i.e. quasi-natural experiments) in a set of laws meant to induce educational attainment increases in these cohorts. In particular, in the early to mid 1900s, states adjusted their laws related to child labor and compulsory schooling, which dictate a minimum and maximum age between which school attendance is required, a minimum period of attendance, penalties for non-compliance of the laws, and exemption conditions. The argument is that these laws forced adolescents to stay in school longer than they would have otherwise, particularly adolescents who would have dropped out of school (and likely would have limited impacts on those who planned on attending college). Evaluations of these laws have suggested that only three aspects had an impact on educational attainment—the dictated school entry age, the age at which a child could get a work permit and leave school, and whether the state required children with work permits to attend school part-time (Lleras-Muney, 2002).

Lleras-Muney (2005) extended the typical labor market outcomes analysis using this approach to focus on health outcomes. In particular, using grouped regressions and Census data, Lleras-Muney presented relatively large effects of schooling on mortality. These results have been extended by Mazumder (2008, 2010) who questions the ability to detect effects on mortality with even large datasets like the Census due to the relatively small size (5%) of the population who seemed to be impacted by the laws. Even with these concerns, Mazumder (2008) uses individual SIPP data and shows effects for self rated health. The SIPP also contains information for individuals between ages 60–83, which suggests positive selection into the sample on education and health, likely biasing the results against finding health improvements.

Although less than a decade old, the use of compulsory schooling laws to examine the effects of education on health has now become very common in the literature. Indeed, there are at least two reviews of the literature available (Oreopoulos and Salvanes, 2011; Mazumder, 2011). Oreopoulos and Salvanes (2011) extend the evidence of the effects of education to a variety of non-pecuniary outcomes not often examined. In their review, the authors find effects of education on income, occupational prestige, welfare participation, teenage childbearing, marital status, voting behavior, and life satisfaction. Mazumder (2011) focuses on the education-health/mortality connections and is more pessimistic in his assessment. Supporting Mazumder's assessment, many examinations of this methodology outside of the US have resulted in clear, null results on many health outcomes, especially mortality.

One of the cleanest is by Clark and Royer (2010) who study compulsory schooling laws in Britain and use a regression discontinuity design. In this case, the school leaving age policies in 1947 and 1972 impacted the attainment of about 15 percent of the population (age 16). The authors show the fraction of individuals who completed fewer than 10 years of education fell by 50% and that these increases in schooling were tied to wages. However, the results for mortality are non-existent and the authors show (through simulations) that the findings are not an issue of limited statistical power. They also find no effects on self-reported health (contrary to Mazumder, 2008 in the US), weight, smoking, vitamin use, or high blood pressure status.

More generally, most studies outside the US have found little or no benefit of schooling using compulsory schooling laws as

instruments (Braakmann, 2011 for the UK, Meghir et al., 2011 for Sweden, Albouy and Lequien, 2009 for France). However, van Kippersluis et al. (2011) use an RD design with Dutch data and show evidence of mortality reductions associated with schooling (Mazumder, 2011 provides additional discussion). This heterogeneity in estimates across contexts may be important. They suggest the possibility that differences in the particular aspects of the compulsory schooling laws, the birth cohorts of interest, and differences in the potential effects of education on other life outcomes (e.g. earnings) could produce differing results across countries, including the US. Unfortunately, unlike many of the countries in the Mazumder review, the US does not have large registry data to enlist in the analysis. To this point, most relevant datasets, such as the NHIS or NHANES, are likely far too small for precise estimates. This paper focuses on the US context but overcomes this data limitation by utilizing a novel epidemiological dataset of several hundred thousand individuals from the 1990s and the birth cohorts 1925–1945. Results from these data are suggestive of educational impacts on a range of health outcomes in old age for those most likely affected by the compulsory schooling laws.

3. Data and empirical methods

This paper uses novel data from the NIH/AARP Diet and Health Study (Schatzkin et al., 2001). In 1995–96, food frequency questionnaires were mailed to over 3.5 million members of the American Association of Retired Persons (AARP) who were aged 50–69 and resided in one of eight states: California, Florida, Pennsylvania, New Jersey, North Carolina, and Louisiana as well as Atlanta, Georgia and Detroit, Michigan. While all states are represented in the analysis, some states are over-represented. For example, respondents born in Pennsylvania are over 23% of the analysis sample. This feature of the data is a potential limitation with the current study, though most alternative datasets are also not state-representative (NHANES, etc). These areas were selected based on their having cancer registries certified to as having at least 90–95% completeness of case ascertainment as well as having large AARP membership for cost minimization.

The baseline questionnaire focused on diet questions, including 124 food items with portion sizes and 21 questions on nutrient intake, health questions, such as family history of illness, physical activity and medical conditions, and also contained information on sociodemographic characteristics, including race, sex, marital status and date of birth. The mailings resulted in nearly 620,000 responses (17.6%), nearly 570,000 provided useable data. I show below that the useable data is quite similar to the NHIS, both in summary statistics and in baseline regression relationships among variables.

Fortunately, the survey asked respondents for their social security number, allowing matches to state of birth. This allows merging information by state and year for compulsory schooling laws. Because the birth cohorts in the survey range between 1925 and 1945 and thus the individuals were age 15 between 1940 and 1956, this paper uses the laws recently examined in Oreopoulos and Salvanes (2011) that includes more recent changes than other studies (e.g. Lleras-Muney, 2005). Although individuals resided in one of eight states in 1995/6 the state-of-birth data covers all 50 states and DC.

A potential issue with using state of birth rather than state of residence (at age 14) is misclassifying exposure to compulsory schooling laws. This misclassification would reduce the estimates in the first stage (though the F-statistic is still strong in the results presented in the paper). If the migration is random with respect to the compulsory schooling laws, then this measurement error

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