



## Long-term health implications of school quality



Rebecca N. Dudovitz<sup>a,\*</sup>, Bergen B. Nelson<sup>a</sup>, Tumaini R. Coker<sup>a,b</sup>, Christopher Biely<sup>a</sup>,  
Ning Li<sup>c</sup>, Lynne C. Wu<sup>a</sup>, Paul J. Chung<sup>d,b</sup>

<sup>a</sup> Department of Pediatrics, David Geffen School of Medicine at UCLA, 10833 Le Conte Ave. 12-358 CHS, Los Angeles, CA, 90095, USA, MC: 175217

<sup>b</sup> RAND Health, RAND Corporation, 1776 Main St, Santa Monica, CA, 9040, USA

<sup>c</sup> Department of Biomathematics, University of California Los Angeles, BOX 951766, 5222 Life Sciences, Los Angeles, CA, 90095-1766, USA

<sup>d</sup> Fielding School of Public Health and Department of Pediatrics, David Geffen School of Medicine at UCLA, 10833 Le Conte Ave. 12-358 CHS, Los Angeles, CA, 90095, USA, MC: 175217

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### ABSTRACT

**Objective:** Individual academic achievement is a well-known predictor of adult health, and addressing education inequities may be critical to reducing health disparities. Disparities in school quality are well documented. However, we lack nationally representative studies evaluating the impact of school quality on adult health. We aim to determine whether high school quality predicts adult health outcomes after controlling for baseline health, socio-demographics and individual academic achievement.

**Methods:** We analyzed data from 7037 adolescents who attended one of 77 high schools in the United States and were followed into adulthood from the National Longitudinal Study of Adolescent to Adult Health. Selected school-level quality measures—average daily attendance, school promotion rate, parental involvement, and teacher experience—were validated based on ability to predict high school graduation and college attendance. Individual adult health outcomes included self-rated health, diagnosis of depression, and having a measured BMI in the obese range.

**Results:** Logistic regressions controlling for socio-demographics, baseline health, health insurance, and individual academic performance demonstrated that school quality significantly predicted all health outcomes. As hypothesized, attending a school with lower average daily attendance predicted lower self-rated health (Adjusted Odds Ratio (AOR) 1.59,  $p = 0.003$ ) and higher odds of depression diagnosis (AOR 1.35,  $p = 0.03$ ); and attending a school with higher parent involvement predicted lower odds of obesity (AOR 0.69,  $p = 0.001$ ). However, attending a school with higher promotion rate also predicted lower self-rated health (AOR 1.20,  $p < 0.001$ ).

**Conclusions:** High school quality may be an important, but complex, social determinant of health. These findings highlight the potential inter-dependence of education and health policy.

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## 1. Introduction

Educational attainment is a powerful predictor of lifelong health (Winkleby and Frank, 1992; Eide and Showalter, 2011). More years of education are associated with longer life expectancy and lower rates of depression and obesity (Cutler and Lleras-Muney, 2006, 2010; Cohen et al., 2013). While the causal pathway linking education and health has not been established, studies suggest several

mechanisms such as improved health literacy, higher income, more work-related benefits, healthier social networks, and improved social standing. (Cutler and Lleras-Muney, 2006; Herd, 2010; Dewalt et al., 2004; Mazzonna, 2014). Given this evidence, addressing inequities in education may be critical to reducing health disparities (Mechanic, 2002).

Although numerous studies describe these associations between education and health at the individual and interpersonal levels, few address associations at the organizational and community levels. Hence it remains unknown whether higher quality schools contribute to healthier populations (Walsemann et al., 2013). School quality may influence each of the pathways through which educational attainment is hypothesized to impact health. High school (HS), for instance, might offer a critical

\* Corresponding author.

E-mail addresses: [rdudovitz@mednet.ucla.edu](mailto:rdudovitz@mednet.ucla.edu) (R.N. Dudovitz), [bnelson@mednet.ucla.edu](mailto:bnelson@mednet.ucla.edu) (B.B. Nelson), [tcoker@mednet.ucla.edu](mailto:tcoker@mednet.ucla.edu) (T.R. Coker), [cbiely@mednet.ucla.edu](mailto:cbiely@mednet.ucla.edu) (C. Biely), [nli@biomath.ucla.edu](mailto:nli@biomath.ucla.edu) (N. Li), [lynne.chang@gmail.com](mailto:lynne.chang@gmail.com) (L.C. Wu), [paulchung@mednet.ucla.edu](mailto:paulchung@mednet.ucla.edu) (P.J. Chung).

opportunity to shape long-term health trajectories as this near-universal exposure to school occurs during adolescence, a sensitive developmental period when many adult health-related behaviors commence (Liang & Chikritzhs,; Brook et al., 2013).

Few studies investigate whether selected school-level characteristics are associated with adult health. Accumulation of educational advantage, such as attending a HS with a higher proportion of wealthy or white students, has been associated with a lower risk of health-related work limitations later in life (Walsemann et al., 2008). Higher per pupil spending during adolescence has predicted better self-rated health in adulthood (Johnson, 2010). Finally, improvements in school quality—measured by changes in pupil-teacher ratio, teacher salary, and length of the school year—have been associated with lower levels of adult disability and stronger associations between educational attainment and self-rated health, obesity, and mortality among black students attending Southern schools before and after segregation (Frisvold and Golberstein, 2011, 2013).

These studies suggest that school quality constitutes an important driver of adult health outcomes and health disparities. However, there are no representative, longitudinal studies to systematically examine aspects of HS quality and long-term health in the context of modern U.S. society (Walsemann et al., 2013). The current study uses longitudinal, nationally representative data to determine whether HS quality is associated with adult health after controlling for individual, family, neighborhood, and school contextual factors.

## 2. Methods

We analyzed data from the National Longitudinal Study of Adolescent Health (Add Health). This is a nationally representative sample of 20,745 adolescents in grades 7–12 in the United States during the 1994–95 school year (Klein, 1997), followed into adulthood with four in-home interviews, the most recent in 2008, when the sample was ages 24–34. Participants were recruited using a stratified random sample of all US high schools. Eighty high schools and 65 feeder schools were enrolled in the study. Wave I (collected in 1994–1995) included in-school and in-home participant surveys, as well as an in-home parent survey. Additionally, a school administrator was surveyed from 79 of the 80 sample high schools. Wave IV (collected in 2007–2008) consisted of a follow-up interview for 15,500 of the initial participants.

We sought to identify whether measures of HS quality were associated with adult health, controlling for other contextual factors. Hence we restricted our sample to participants in grades 9–12 at Wave I who attended a sample HS for which the school administrator survey was available, and who completed the Wave IV survey (Fig. 1). The resulting analytic sample includes 7037 students from 77 high schools.

### 2.1. School quality measures

The literature is mixed regarding how to define HS quality (Card and Krueger, 1996; Hanushek, 2004). Given that the primary goal of schools is to produce a more educated population, we selected school-level measures previously associated with improved academic outcomes. To validate this approach, we tested whether these measures were associated with HS graduation and college attendance in our sample, after controlling for socio-demographics.

### 2.2. Average daily attendance

School-wide average daily attendance is associated with improved academic performance, even for students without

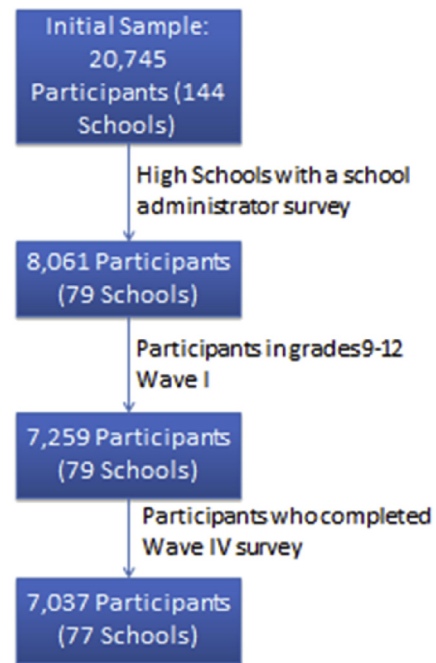


Fig. 1. Definition of analytic sample.

individual absenteeism (Roby, 2004; Lamdin, 1996; Gottfried, 2011). High absentee rates are hypothesized as a marker for low student and family accountability and may result in teachers taking time from instruction to remediate absentee students. (Gottfried, 2011; Lazear, 2001). In Add Health, school administrators estimated the school's average daily attendance level. Due to the response distribution, we collapsed the original 5-category variable into a 3-level variable with the categories of 75%–89%, 90%–94% and  $\geq 95\%$ . A sensitivity analysis using the original variable yielded similar results.

### 2.3. Student promotion rate

Grade retention and school drop-out rates, both of which are associated with poor academic outcomes at the classroom and school levels, have also been used as measures of HS quality (Rumberger and Thomas, 2000; Gottfried, 2013). Low school promotion rates may be a marker for a school's inability to engage or support struggling students (Lee and Burkam, 2003). School administrators reported the proportion of students in each grade who were held back and the proportion of students in each grade who dropped out of school during the 1993–1994 school year. Correlation between these variables was moderate to high and so, due to concerns for colinearity, we used these responses to calculate the percentage of students in each grade who either were promoted on to the next grade or completed HS and averaged this rate over all grades taught in each school to generate the overall student promotion rate. For ease of interpretation, we standardized the promotion rate such that 1 unit corresponds to 1 standard deviation. A sensitivity analysis using the average grade retention and drop-out rates in separate models yielded similar results.

### 2.4. Parental involvement

School-level parental involvement is positively associated with academic outcomes (Griffith, 1996). One marker for parental involvement is parent participation in school organizations, such as

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