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Original article

Does academic achievement during childhood and adolescence benefit later health?

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ABSTRACT

Purpose: Educational disparities in health persist after adjustment for income and occupation, suggesting that other purely cognitive and psychosocial mechanisms may be involved. Unlike occupation- or income-mediated effects, effects of cognitive and psychosocial gains—as reflected in academic achievement—may be apparent even before schooling is completed.
Methods: We used data spanning 10 years on a national U.S. cohort of 2546 children aged 3–14 years at baseline to estimate the effects of academic achievement, measured by standardized tests of cognitive achievement, on future health. We used marginal structural models to address potential mutual influence of achievement and health on each other over time.
Results: One SD higher academic achievement 1997–2002 was associated with a lower prevalence of poorer health status in 2007 in girls (prevalence ratio = 0.87 [(95% confidence interval) 0.78–0.97]) but not in boys (prevalence ratio = 0.96 [0.86–1.08]). Higher achievement was also weakly associated with lower body mass index and less psychological distress among girls only.
Conclusions: Academic achievement may benefit future health but a number of questions remain unanswered, including reasons for the gender differences and how academic achievement–related health disparities may progress over the life course and interact with other social determinants of health.

It is often hypothesized that education affects health through its effects on occupation and income [1,2]. However, education-related health disparities persist after adjustment for income and occupation [3]. This suggests that other processes, including purely cognitive and psychosocial benefits of the learning process, may be involved. If these mechanisms are important, students who more successfully make cognitive and psychosocial gains—for example, as reflected in their academic achievement—may enjoy better health even before they complete their schooling and socioeconomic sequelae manifest. Higher academic achievement may reflect cognitive gains that help students better understand and act on information about healthy behaviors such as eating a healthy diet, exercising, not smoking, or hand washing [3,4]. It may also benefit health through psychosocial mechanisms by fostering higher self-esteem, a greater sense of personal control, the patience and time preference to invest in healthier behaviors, more social integration and social support, or a peer group with more healthful behavioral norms [5–7].

These mechanisms are in contrast to occupation- or income-mediated effects, which would not appear until students enter the workforce. Understanding them could be an important tool for reducing health disparities by fostering educational practices that maximize future health benefits regardless of students' future economic circumstances. Yet relatively few studies have investigated how academic achievement relates to health and most have used cross-sectional data or short follow-up times [8–16]. We used three waves of data spanning 10 years on a national cohort of children aged 3–14 years at baseline to estimate effects of academic achievement on health during the schooling process.

Our primary health outcome was self-rated global health status, a relevant health measure for young populations among whom serious medical conditions are rare [17–19]. Self-rated health status is correlated in adolescents and young adults with disability, health services use, physical and mental health, and health behaviors [19–22]. In secondary analyses we examined two additional health outcomes, body mass index (BMI) and psychological distress, which might contribute to an association between academic achievement

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and health status. Low or high BMI and psychological problems have both been associated with poorer self-rated health status in national samples of young people [17,19,21] and with poorer academic achievement [9,11,12,16].

An important challenge is the possibility of reverse causation: students' health may influence their success in school. Poor health may affect students' ability to attend school regularly, pay attention in classes, complete assignments, interact with peers and teachers, or invest in long-term educational goals [23–25]. Figure 1 shows this theorized mutual influence of health and academic achievement on each other over time. This presents a methodological challenge in longitudinal analyses because health during follow-up (health at time 2 in Fig. 1) both mediates the health effect of prior achievement and confounds the effect of future achievement (i.e., is a time-dependent confounder). Therefore, adjusting for health during follow-up may create overadjustment bias while failing to do so may create confounding bias. We addressed potential time-dependent confounding in academic achievement–health associations by using marginal structural models (MSMs) [26].

We hypothesized that a history of higher academic achievement decreases the risk of poor health among adolescents and young adults. We also hypothesized that conventional models adjusting for health during follow-up underestimate the effect of academic achievement on health. Finally, based on stronger associations observed among girls in previous studies on this topic [8,14,16], we hypothesized that there are sex differences in effects of academic achievement on health.

Methods

Study population

We used publicly available data from two supplementary studies to the Panel Study of Income Dynamics (PSID), a longitudinal study of a representative (after weighting) sample of U.S. families started in 1968 [27]. The Child Development Supplement (CDS) began in 1997 with a sample of 3563 children drawn from PSID families with a child aged 0–12 years in calendar year 1997, with up to two children chosen per family. Black and low-income families were oversampled. Subsequent study waves were conducted in 2002–2003 and 2007–2008. The primary interviewee is the participant's primary caregiver, in more than 90% of cases the child's biological mother. The children themselves are also interviewed; interview content varies by the child's age. The Transition Into Adulthood (TA) Study, started in 2005, comprises young adults who "aged out" of the CDS by turning 18 and finishing or leaving high school. All questions in the TA are answered by the participants themselves. We combined data from the 1997 CDS, the 2002–2003 CDS ("2002 CDS"), and either the 2007–2008 CDS ("2007 CDS") or the 2007 TA to create a longitudinal sample with three waves of interviews spanning 10 years. The analysis sample, including only children who were at least 3 years old and enrolled in a childcare center or school at baseline, was 2546 children aged 3–14 years by the time their baseline interviews were completed and 14–24 years at the third interview (Fig. 2).

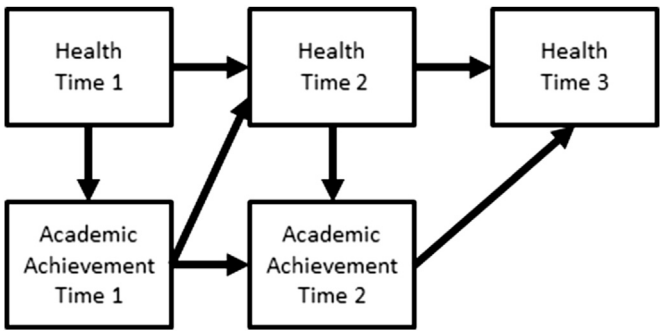

Fig. 1. Assumed causal structure of health and academic achievement. Academic achievement is assumed to be influenced by health at each time-point, and in turn to influence health at future time-points.

Measures

The primary outcome was 2007 health status, with prior health status treated as a time-dependent confounder (Fig. 1). We dichotomized the five-point scale into "very good" (excellent or very good) and "poorer" (good, fair, or poor). We chose this dichotomization instead of excellent, very good, or good versus fair or poor because the number of participants with fair or poor health was very small, particularly in the earlier study waves (e.g., 3% in 1997). Ordinal logistic regression models provided consistent results but the data violated the proportional odds assumption. Because the survey questionnaire content varied depending on the age of the participant, the measure was reported by the participant in 2007 but by the primary caregiver in 1997 and 2002. We also included measures of perinatal health (low birth weight [<88 ounces] and the primary caregiver's assessment of the child's health at birth) as baseline confounders.

As with health status, the outcomes of interest for the secondary analyses of BMI and psychological distress were the 2007 measures, with prior measures treated as time-dependent confounders. BMI (kilogram per square meter) was calculated from height and weight. Baseline height was reported by the participant's caregiver; baseline weight, 2002 height and weight, and 2007 height and weight for CDS participants were measured by the interviewer; 2007 height and weight for TA participants were self-reported. Psychological distress was measured using the K6 nonspecific psychological distress scale developed for use in the U.S. National Health Interview Survey [28]. Because the K6 was administered in the TA but not the CDS, analyses using the K6 were limited to participants aged 18 years or older in 2007 ($n = 1475$). For the same

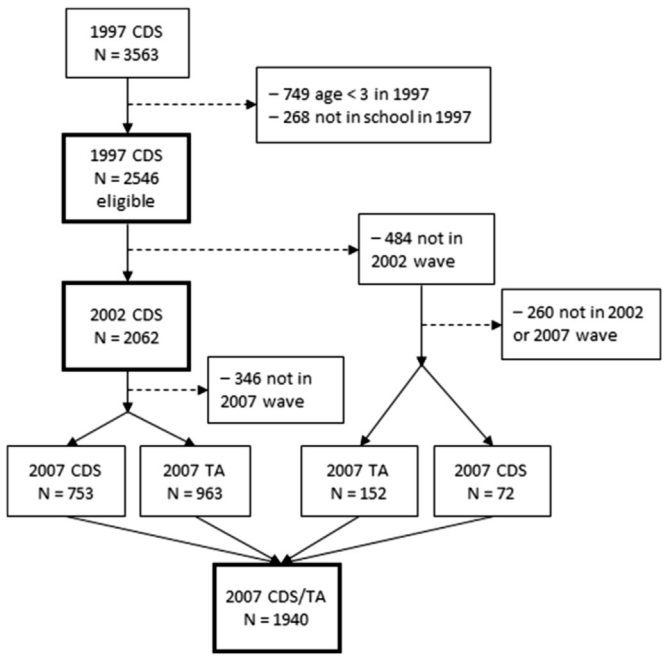

Fig. 2. Study sample from CDS and TA supplemental studies to the PSID, 1997–2007.