Children and Youth Services Review 32 (2010) 231–238

Contents lists available at ScienceDirect

Children and Youth Services Review

journal homepage: www.elsevier.com/locate/childyouth

The relation between children's health and academic achievement

Eric R. Eide [a,*], Mark H. Showalter [a], Dan D. Goldhaber [b]

[a] Brigham Young University, Department of Economics, Provo, Utah, 84602, United States
[b] University of Washington, Center on Reinventing Public Education, 2101 N. 34th Street, Suite 195, Seattle, WA 98103-9158, United States

ARTICLE INFO

Article history:
Received 4 June 2009
Received in revised form 25 August 2009
Accepted 26 August 2009
Available online 3 September 2009

Keywords:
Child health
Academic achievement
Quantile regression

ABSTRACT

We investigate the relation between a variety of health conditions and test scores for children and adolescents using data from the Child Development Supplement of the Panel Study of Income Dynamics. In addition to estimating how health conditions are associated with test scores 'on average,' our statistical methodology estimates this association at different points of the conditional test score distribution. Such information could be crucial for policy purposes because the relation between health and academic achievement may be different for students at the bottom and top of the test score distribution. We find that several health conditions are highly negatively correlated with math and reading test scores, both on average and at different points of the achievement distribution. Given the current education policy environment where schools are shifting resources to conform to state and federal requirements on test scores and other outcomes, the results suggest caution in cutting resources from the traditional role of schools in monitoring a wide set of health outcomes.

1. Introduction

Children with poor health have lower educational attainment, lower social status, worse adult health outcomes, and a higher likelihood of engaging in risky behaviors than their healthy peers (Case, Lubotsky, & Paxson, 2002; Case, Fertig, & Paxson, 2005; Jones & Lollar, 2008). A particularly potent conduit through which childhood health is linked to adult outcomes is education. Poor health impedes educational progress because a student with health problems is not prepared to fully engage in or take advantage of learning opportunities at school or at home (Hanson, Austin, & Lee-Bayha, 2004).

Schools have long recognized the relation between student health and educational progress, and have played a role in diagnosing and treating student health conditions related to vision, hearing, and speech impairments, as well as asthma, mental disorders, and more recently obesity (Council of Chief State School Officers, 1998). Research from the medical community confirms that common health conditions can have negative consequences on children's ability to learn. Vision problems in children are associated with developmental delays and often require special education and additional services beyond childhood (Centers for Disease Control, 2004). Children with asthma miss more days of school than children without asthma, and experience restrictions in other daily activities, such as play and sports (Newacheck, 2000). Significant hearing loss among children can interfere with phonological and speech perception abilities required for language learning, which subsequently can lead to low academic performance, especially in reading (National Institutes of Health, 1993). Children with speech impairments score lower on reading tests than children in non-impaired comparison groups (Catts, 1993).

Further research from social scientists and others, using a variety of data sets and statistical methodologies, confirms the findings from the medical community. Spernak, Schottenbauer, Ramey, and Ramey (2006) find that, among former Head Start children, those with poor general health have significantly lower achievement scores than children in good general health in third grade, but no differences in achievement scores in kindergarten. Sigfúsdóttir, Kristjáansson, and Allegrante (2007) explore the relation between health behavior and academic achievement in Icelandic school children. They find body mass index (BMI) was most strongly associated with academic achievement, followed by diet and physical activity. Datar and Sturm (2006) and Datar, Sturm, and Magnabosco (2004) find that being overweight is associated with lower test scores in elementary school. In contrast, Grossman and Kaestner (2008) find that in general, children who are overweight or obese have test scores that are about the same as children with average weight.[1] Sabia (2007) and Ding, Lehrer, Rosenquist, and Audrain-McGovern (2006) both find a negative correlation between being overweight and grade point average. Currie and Stabile (2006) find that Attention Deficit Hyperactivity Disorder (ADHD) has large negative effects on test scores and

* Corresponding author. Tel.: +1 801 422 4883; fax: +1 801 422 0194.
E-mail addresses: eide@byu.edu (E.R. Eide), showalter@byu.edu (M.H. Showalter), dgoldhab@u.washington.edu (D.D. Goldhaber).

[1] It is not clear why some studies find a negative correlation between overweight/obesity and test scores, while others do not. Reconciling these results is beyond the scope of this paper, and is an area for further research.

0190-7409/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.childyouth.2009.08.019

schooling attainment, while Ding et al. (2006) find that depression can lead to a substantial decrease in grades. As schools invest in their students' health through the diagnosis and treatment of these health conditions, students' educational achievement can likely be improved.

In recent years education policy makers have focused on accountability-based education reforms that are intended to improve student educational outcomes. Most prominent among these education reforms is The No Child Left Behind Act (NCLB), which requires all traditional public school students, including defined sub-groups (e.g. race/ethnicity), to reach academic proficiency by the 2013–2014 school year. Progress is tracked by state-wide standardized tests to all students, and schools must demonstrate improvement towards minimum competency targets, or Adequate Yearly Progress, in test scores. Schools that do not improve test scores are subject to a variety of sanctions, including in the most extreme cases restructuring or closure. In principle the threat of sanctions against the school provides incentives for failing schools to improve (Springer, Houck, and Guthrie, 2008).

While accountability-based education reform as described above is intended to raise student achievement, it could actually lead to unanticipated negative health consequences for children, which in turn may lower future levels of achievement. When faced with the possibility of sanctions for inadequate progress on standardized tests, schools have an incentive to devote more resources towards core academic instruction and may therefore devote fewer resources towards costly non-academic pursuits, such as health care. For example, schools in the U.S. spend over $2 billion a year on school nurses (approximately 56,000 full-time school nurses with a median salary of $36,000), who play an important role in assessing student health conditions and promoting health at the school (Horovitz & McCoy, 2005), and recent reports suggest some schools have indeed scaled back health programs in order to devote more resources towards improving student test performance (Costante, 2002; Deutsch, 2000; Hanson et al., 2004). In a related line of inquiry, Chomitz et al. (2009), in summarizing other studies, report that 14% of school districts have decreased physical education (PE) time to accommodate more time for math and English, and that the percentage of students participating in PE has fallen from 41.6% in 1991 to 28.4% in 2003. These authors further find a statistically significant relationship between fitness and academic achievement, although the mechanisms underlying the relationship are not clear. For instance, there may be another variable not included in the analysis, such as family socioeconomic status or neighborhood poverty, that may be influencing both physical health and academic achievement.

In this paper we estimate how a variety of student health conditions are related to performance on standardized math and reading tests. The health conditions we study are asthma, speech impairment, hearing difficulty, vision problems, ADHD, and being either underweight or overweight. We use a two-fold estimation approach. First, we use Ordinary Least Squares (OLS) to estimate the relation between the health conditions and the conditional mean of the test score distribution. This tells us, on average, what the relation is between a health condition and test scores. However, just estimating the relation at the mean of the test score distribution may mask differences in the association between health conditions and test scores at other points in the test score distribution, for example at the 10th percentile (0.10 quantile) or the 90th percentile (0.90 quantile). For policy reasons it is important to understand the broader relation between health conditions and test scores because the policy response may differ depending on the type of student that is most affected.

The second part of our estimation approach uses a statistical technique called quantile regression to account for these possible differential relations between health conditions and test scores. Quantile regression estimates the effect of explanatory variables on the dependent variable at different points of the dependent variable's conditional distribution (that is, conditional on the other explanatory variables).[2] Our paper is the first to explore the relation between health conditions and academic achievement in such a broad way, accounting for both numerous specific health conditions and how those conditions are related to student achievement across the full distribution of achievement.

2. Data

We base our analysis on the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The PSID is a nationally representative panel of individuals and their families.[3] Begun in 1968, sampled individuals and families provide information on family composition, wealth, earnings, expenditures, employment, and a variety of other data. In 1997, the CDS was initiated by supplementing the PSID with additional information on families with children ages 0–12. The intent was to gather information to add to our understanding of the early formation of knowledge and skills. The CDS includes numerous variables describing the home and learning environment of the child: test scores in multiple subjects, behavioral assessments, learning resources, time use, and health status are a few examples. The CDS also gives detailed information on the primary caregiver.

The initial sampling of the CDS selected 2705 families from the PSID. 2394 families participated (88%), providing information on 3563 children ages 0–12. The information from this initial survey is known as CDS-I. A follow-up survey was conducted in 2002–2003 (CDS-II) on the CDS-I families. 2017 families (91%) were successfully interviewed, including 2908 children or adolescents ages 5–18. For this study, we use the results from the CDS-II data, along with some background information that was gathered in the CDS-I round of interviews. Using the CDS-II gives us the largest sample size possible with these data because the majority of respondents were enrolled in school. We also incorporate family background variables from the 2001 PSID interviews.

Our dependent variables are math and reading scores that we standardized to have a mean of zero and a variance of one. This standardization allows us to interpret the regression coefficients in standard deviation units. The test scores are the Woodcock–Johnson Revised Tests of Achievement (WJ-R), Form B (Woodcock & Johnson, 1989). Our math score comes from the Applied Problems subtest and our reading score comes from the Passage Comprehension subtest. [4] We use standardized math and reading scores as dependent variables because they are reasonable measures of how much students are learning in school, and therefore suggest how much worse off children with health conditions may be in terms of learning relative to their healthy peers.

The set of student health conditions that we use are chosen because they represent the types of health issues that schools typically try to diagnose and assist in treating. We include binary variables that equal one if the child's doctor or health professional diagnosed the child with asthma, speech impairment, hearing problems, serious vision problems, or ADHD (or hyperactivity or ADD). To be clear about what these health variables are measuring, in Appendix A we provide the wording of the health condition questions in the CDS questionnaire. Because these are binary variables, they measure the presence or absence of a particular condition, and do not measure the extent or seriousness of the condition. We also include binary variables for whether the child is in the 10th percentile of the age–gender specific BMI distribution, and if the child is at or above the 90th percentile of

[2] See Koenker and Hallock (2001) for an excellent overview of quantile regression. See Eide, Showalter, and Sims (2002) for an example of a paper using quantile regression to study education issues.

[3] See http://psidonline.isr.umich.edu for more information on the PSID.

[4] Since the WJ-R can be used for respondents from ages 2 to 90 years, items in the WJ-R are arranged by difficulty for all persons between those ages. The easiest questions are presented first and the items become increasingly difficult as the respondent proceeds through the test. The interviewer starts testing at the appropriate starting point based on education level of the child or youth as the general guideline. For additional details see http://psidonline.isr.umich.edu/CDS/cdsii_userGd.pdf.