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# School-Based Healthcare and Academic Performance: Implications of Physical Health Services for Educational Outcomes and Inequality

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ABSTRACT

Health and education are reciprocally related, and research indicates that unhealthy students are poorly positioned to learn. Providing services that prevent health problems or help students cope with existing health concerns is one way that schools intervene in the relationship between student background and educational outcomes. Providing health services on campus is theorized to promote educational goals by increasing access to services, improving health, and enhancing opportunities to learn. However, existing empirical tests of this relationship are rare and have important limitations. This paper uses data from Add Health, which identifies numerous services provided by schools across the U.S. Multilevel models test how availability of preventive or physical health services relates to adolescents' academic performance as well as implications for racial and socioeconomic educational inequality. Analyses consistently demonstrate that school provision of preventive/physical health services is positively related to youths' educational outcomes—including a higher GPA, lower odds of failing courses, and higher odds of graduating from high school—but also little evidence of differing associations across student subgroups. Additional results mitigate concerns that these relationships are biased by selection and offer evidence that increased opportunities to learn are one mechanism for the positive role of health services.

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# School-Based Healthcare and Academic Performance: Implications of Physical Health Services for Educational Outcomes and Inequality

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## Abstract

Health and education are reciprocally related, and research indicates that unhealthy students are poorly positioned to learn. Providing services that prevent health problems or help students cope with existing health concerns is one way that schools intervene in the relationship between student background and educational outcomes. Providing health services on campus is theorized to promote educational goals by increasing access to services, improving health, and enhancing opportunities to learn. However, existing empirical tests of this relationship are rare and have important limitations. This paper uses data from Add Health, which identifies numerous services provided by schools across the U.S. Multilevel models test how availability of preventive or physical health services relates to adolescents' academic performance as well as implications for racial and socioeconomic educational inequality. Analyses consistently demonstrate that school provision of preventive/physical health services is positively related to youths' educational outcomes—including a higher GPA, lower odds of failing courses, and higher odds of graduating from high school—but also little evidence of differing associations across student subgroups. Additional results mitigate concerns that these relationships are biased by selection and offer evidence that increased opportunities to learn are one mechanism for the positive role of health services.



*Key Words:* school effects, health, education, multilevel models, inequality, school health services

# School-Based Healthcare and Academic Performance: Implications of Physical Health Services for Educational Outcomes and Inequality

Sociological research on education generally acknowledges that factors outside of schools' control—family socioeconomic background in particular—can dwarf the role of school factors in their average influence on students' academic outcomes. Student health problems are one such factor that stems from outside the school's purview yet can interfere with education. Health and education are highly interdependent dimensions of young people's development (Haas 2006; Ross and Wu 1995), and health issues may pose distractions, interruptions, and impediments that put students in a poor position to learn. Given their extensive contact with youths, schools are often seen as a uniquely accessible location to target young people's health, by providing healthcare services on campus. Due to the negative effect poor health has on education, school-based provision of healthcare may also promote schools' academic mission. Moreover, health disparities are a source of educational stratification, which implies that reducing health inequality could reduce educational disparities as well (Crosnoe 2006). Prior research has not established whether schools' attempts to meet student health needs also serve an educational function or whether school health provision disproportionately benefits certain groups. This paper examines whether school-based routine and preventive health services predict higher academic performance, as well as their role in ameliorating educational inequality. It takes up this question using nationally representative data, contributing to understanding patterned relationships between school-based service provision and academic outcomes that are generalizable beyond individual school sites or programs.

I address four limitations in current literature on the relationship between school health service provision and students' academic outcomes. First, previous studies have primarily used small samples, typically evaluating interventions designed for highly disadvantaged populations

of schools and students. These are important instances to study, but they are likely not generalizable to what we would see in a diverse sample of schools. Second, existing work seldom accounts for the broader educational context that surrounds school-based services, which risks confounding the role of service provision with the influence of other school features that also impact academics. Third, existing studies typically ignore how school-based provision of services could matter differentially for different groups of students, such as students who lack other access to healthcare or face educational disadvantages, even though there is a theoretical basis for expecting school-based services to address issues stemming from and associated with poverty (Ladd 2012). That insurance cannot alone improve access is a key reason why the Affordable Care Act included funds for school health clinics, making school healthcare provision a timely concern. (Notably, however, the continued appropriation of these funds has been contested in Congress). And fourth, the types of services offered are not necessarily clear in prior work. Other studies usually examine the presence of a school clinic or nurse and do not directly test the provision of routine and preventive health services.[1]

The National Longitudinal Study of Adolescent Health (Add Health) measures several services that schools across the United States provide. I identify schools offering any routine or preventive/physical healthcare—services geared toward overall student well-being—including treatment for minor illnesses, physical exams, diagnostic screenings, immunizations, and nutrition services. I focus on these types of services because they address the needs of many students, while filling a void most acutely experienced by students who lack health and educational resources. Moreover, they have received little prior attention, especially compared to mental health services, whose academic effects have been examined recently (see, for example, Reback 2010 and Carrell and Hoekstra 2014).[2] I address three goals. First, I examine how the

availability of these services at school predicts students' academic performance in both the short- and long-term, analyzing multiple educational outcomes to assess the consistency of the results and controlling for an extensive set of school contextual variables. Second, I test whether the relationship between service provision and academic outcomes is explained by increased opportunities to learn, which serves to substantiate or undermine the theorized mechanism of action. Third, I test whether school provision of these services predicts academic performance more strongly for subpopulations facing educational disparities and potential unmet health needs—specifically, subgroups defined by race, family income, and health insurance status.

An important concern is that the schools that provide health services and the students who attend such schools are different in unobserved ways that also relate to academic performance. Controlling for many measures of schools' academic environment and level of advantage in the multilevel models testing the paper's main relationships helps to mitigate—but does not eliminate—concerns about selection on unobservable characteristics. To provide insight into potential selection, I precede the main analysis with an investigation into how numerous school and student-body characteristics predict the presence of services. Selection concerns are undercut by the fact that provision of services is relatively uncorrelated with numerous indicators of school quality, including measures of socioeconomic composition and academic experience. The main results consistently show a positive relationship between availability of services and academic performance: Offering preventive/physical health services at school predicts a higher grade point average (GPA), a higher chance of passing all courses, and a higher chance of high school graduation. However, these relationships are generally uniform across student subgroups, rather than offering the greatest benefit to those in the greatest need of health services.

**Health and Education**

Health problems have been shown to hinder academic success, and scholastic difficulty also often precedes health concerns, suggesting a reciprocal relationship (Haas 2006; Ross and Wu 1995). Research from Washington State indicates a nearly linear increase in the likelihood of having low grades for each additional health risk a student reports (Dilley 2009). And experiencing poor health in childhood or adolescence predicts lower eventual attainment (Haas 2006; Haas and Fosse 2008; Jackson 2009). Although children and adolescents may experience fewer major health problems than other segments of the population, even minor health concerns and manageable chronic conditions impede concentration and interfere with education (Needham, Crosnoe, and Muller 2004), especially if left untreated.

**School-Based Health Services**

Many schools attempt to address their students' health needs. Local control of schools as well as state differences in supported programs results in heterogeneity in the types of health services schools offer, as well as in their quality and staffing (Lear 2002). Although state mandates establish minimum health guidelines which schools must fulfill (Brener et al. 2007; Lear 2002), schools can range from merely complying with requirements (or even failing to minimally comply), to offering a modest set of services, to offering an array of services in a comprehensive school-based health center, or SBHC. Although SBHCs are relatively uncommon (Brener et al. 2007), they are the most researched model for providing healthcare in schools, and thus provide the majority of our insight into expected effects. Studies examining SBHCs—typically full-scale clinics providing a range of physical and mental health services (Dryfoos 1995; Gustafson 2005; Silberberg and Cantor 2008)—provide evidence that comprehensive school-based healthcare improves access, receipt of services, and measures of health status (Allison et al. 2007; Federico et al. 2010; McNall, Lichty, and Mavis 2010; Wade et al. 2008).

Although advocates assert that providing health services in schools bolsters educational success, relatively little research examines academic as opposed to health outcomes (Geierstanger et al. 2004; Ladd 2012). For example, McCord et al. (1993) find mixed results for how SBHC presence and use relates to absences and positive effects on staying in school and eventual graduation. Kisker and Brown (1996) find a small advantage among students attending schools with SBHCs in progression through school compared to a national sample of youth; they analyze attendance and drop out rates for SBHC students, but do not compare them to other groups. A more recent study finds that SBHC use predicts better attendance and GPA gains, but that improved attendance results primarily from medical visits whereas improved GPA results primarily from mental health visits (Walker et al. 2010)—with "medical" versus "mental health" visits identified based on the type of practitioner rather than the type of service received. Other research examining staffing finds that having a full-time nurse reduces health-related dismissals, and in school districts where school nurses are more available, children appear to exhibit greater well-being, lower absenteeism, and higher high school graduation rates (Maughan 2003).

Beyond the small number of studies, existing work is limited in several ways that raise questions about the external and internal validity of current findings. Generalizability is limited because most studies focus on one site, city/district, or program, often evaluating interventions designed for highly disadvantaged or specifically needy populations (e.g. Kisker and Brown 1996; McCord et al. 1993). Findings from these contexts are useful in identifying potential effects of services for students who need them most. But both the health and educational disadvantages experienced by these populations are atypical for adolescents generally, and the implemented services and school environments are atypical of the broader population of schools.

Existing work is also limited in its approach to drawing causal inferences. Many studies

acknowledge that the conditions that would most cleanly identify causal effects (some sort of random assignment) do not exist (as remains the case in the present study). However, even within plausible analytical designs, most studies fail to consider how schools with services might differ from those without them and other selection issues. Studying how one school feature relates to students' performance without considering school context more holistically risks confounding the role of service provision with the influence of other school features that we should expect to also influence academic outcomes. Walker et al. (2010) improve upon previous efforts at causal inference in this literature by using propensity score analysis to construct comparison groups of SBHC users and non-users, accounting for several potentially confounding student characteristics. Yet they too do not consider how other school-level factors besides SBHC presence might influence academic outcomes and bias their estimates of SBHC effects across schools. Even though non-school factors primarily drive achievement, research shows that schools have important effects on student outcomes, operating through factors such as school organization and resources, characteristics of the student body, and teacher characteristics (e.g. Carbonaro and Covay 2010; Condron and Roscigno 2003; Crosnoe 2009; Lee and Burkam 2003; Owens 2010; Rice 2010). These features influence schools' instructional capacity and their academic and social environment. School health services occupy a notable middle ground between family and school effects, because they primarily act on students' health, typically considered a characteristic of student background, with which schools must merely cope rather than hope to influence. So they present an interesting case for studying contextual effects on young people's outcomes. Existing research likely suffers from omitted variables bias in not measuring other school factors; moreover, studies rarely even discuss the school context beyond services when interpreting their results.

In addition to bringing a sociological perspective to this typically practitioner-oriented field, Needham, Crosnoe, and Muller (2004) address a few of these limitations in a small part of their study examining whether the relationship between student health and course failure depends on school context. They use nationally representative data (also Add Health) and test one interaction between student health and whether the school offers non-athletic physical exams on site. They find that health status is an important predictor of course failure; they also find that absenteeism is a crucial mediating factor in the relationship between health and academic achievement. But they do not find that on-campus physicals alter the relationship between health and course failure. (It is possible that student health is endogenous, as it could have been influenced by the availability of school-based physicals.) Their paper takes a useful step toward a more generalizable analysis of the role of school health services in academic performance. However, this paper seeks to study health service provision and school context more comprehensively. It is not clear that non-athletic physicals would be the most or only important service in improving academic outcomes. In this study, I take multiple preventive and physical health services into consideration. Also, Needham et al. (2004) only include a couple of Add Health's school environment variables. I control for several measures of school advantage as potential confounders. Additionally, I employ these numerous school features in a test for selection in which schools offer services.

**Mechanisms for the Effect of School-Based Services on Academics**

If school health services play an educational role, it is likely through a series of mediating pathways: by enhancing health knowledge and access, improving student health, and augmenting the capacity to learn. The contemporary rationale behind providing healthcare in schools—especially in high schools—is that despite teenagers' generally good health, adolescents may not

be strongly tied to traditional health care institutions, so co-locating health services on school campus improves access by reducing barriers stemming from insurance, transportation, or confidentiality concerns (Brindis et al. 2003; Fothergill and Ballard 1998; Gustafson 2005). Developmentally, adolescents are also at a stage to begin taking more independent steps to manage their health. Studies on the comprehensive SBHC model demonstrate that students attending middle and high schools with SBHCs are more likely to make health maintenance visits and receive scheduled immunizations than students without SBHC access (Allison et al. 2007; Federico et al. 2010; McNall et al. 2010), despite being a disproportionately disadvantaged and uninsured adolescent population. They make more visits and experience longer visits (providing time to screen for health risks) than students with only HMO access (Kaplan et al. 1998). In addition to specific services, students may gain information that helps them be healthier in the future. Even students who do not visit school health services might reap spillover effects from an environment of better health (Kisker and Brown 1996; McNall et al. 2010).

If health services are located on school premises, it should be easier to get treatment for pain that is distracting in class, to receive an early diagnosis and prevent health-related absences, or to get immunizations or tests that might otherwise require a doctor's visit during school hours. By improving well-being, health services may augment students' ability to function well at school. The deleterious effect of poor health on educational outcomes seems to operate at least partially through the effect of health on educational participation (Jackson 2009; Needham et al. 2004). Illnesses may cause absences that reduce the time in class necessary to learn (Haas 2006). Additionally, school-based health services may ease the burden on educators by improving school climate and students' readiness to learn (Geierstanger and Amaral 2005; Reback 2010).

Much in the same way schools intervene through the subsidized lunch program to both

reduce hunger and augment students' ability to learn, providing health services at school may especially affect health and education for the neediest children (Rothstein 2004), indicating a potential role in reducing inequality. Numerous health conditions disproportionately impact children of color and from low-income backgrounds (Crosnoe 2006; Currie 2005; Dilley 2009; Rothstein 2004). Poorer health and the cumulative disadvantage of multiple chronic health problems among these groups contribute to disparities in achievement and growth (Crosnoe 2006; Rothstein 2004). Since school-based health services have been shown to reach underserved populations and expand access to care (Juszczak, Melinkovich, & Kaplan 2003; Kaplan et al. 1998), school-based services may disproportionately benefit low-income and racial minority students, as well as other students who lack alternative healthcare options (Wade et al. 2008). On the other hand, Jackson's (2009) findings on which racial and socioeconomic groups suffer worse educational outcomes as a result of poor health indicate that the most advantaged have the most to lose (Jackson 2009). This finding raises the possibility that it is actually not the most disadvantaged groups who would derive the most benefit from health enhancements. This theoretically ambiguous empirical literature along with policy arguments that healthcare should be provided in schools in order to reduce educational disparities (e.g. Rothstein 2004) motivate testing whether there are heterogeneous effects of school health services.

**The Current Study**

This study contributes to the literatures on school-based health services and on schools' role in academic outcomes and inequality. Unlike prior studies on school-based health services and academic outcomes, it analyzes a nationally representative sample instead of single cases or models. It also examines a broad range of preventive and physical health services instead of more ambiguous interventions such as clinic or nurse presence. It studies how service provision

predicts overall academic performance, but also examines the extent to which the relationship is mediated by one plausible mechanism and differential effects for subgroups of students. Finally, unlike prior research, this study includes an extensive set of other school measures.

Specifically, the paper uses two short-term outcomes (GPA and passing all courses) and one long-term outcome (high school graduation) to address three research questions:

Research Question 1: Does school provision of preventive/physical health services predict higher academic outcomes on average?

Research Question 2: Does students' opportunity to learn (health-related absences) account for the relationship between health services and academic performance?

Research Question 3: Is the relationship between health services and performance larger for students who are non-white, low-income, and lack private insurance?

Using dependent variables at multiple time points helps to establish the temporal ordering that school-based service provision preceded student performance and attainment. Cognizant of potential limitations in a survey-based approach, this study also models the provision of health services as a function of other school characteristics to shed light on the possibility of omitted variables bias in the estimates of the relationship between services and student outcomes.

**Data**

*Sample*

This study uses data from Add Health linked to the Adolescent Health and Academic Achievement Study (AHAA). Add Health used a stratified school-based sampling design to select 80 high schools and 52 feeder middle schools. At Wave 1, during the 1994-1995 school year, school administrators provided responses about the school and all students present completed in-school surveys. Approximately 18,000 students then participated in in-depth

interviews and are nationally representative of adolescents who were in 7th through 12th grade during 1994 to 1995. At Wave 3, administered in 2001 to 2002 (when respondents were 18 to 26 years old), AHAA collected official high school transcript data for about 12,000 Add Health sample members (91 percent of the Wave 3 sample). AHAA also extends the data on the initial school sample with variables drawn from national school datasets. This study uses Add Health Wave 1 school administrator and in-school data as well as additional school variables in AHAA to measure school characteristics, Add Health Wave 1 student and parent in-home interviews to measure student background, and Add Health/AHAA Wave 3 administrative data from student transcripts to provide educational outcomes at multiple points in time.

Several features of Add Health make it advantageous for this study. Most significantly, at Wave 1 Add Health asked school administrators whether several different health services were offered on school grounds; as a result, the presence of preventive services can be gauged based on a range of offerings rather than reflecting a single specific service. Additionally, in robustness checks I can control for the presence of other types of health services. Add Health also includes data on many features of the school site, environment, faculty/staff, and student body. Given that previous research on school health service provision has not accounted for other characteristics of schools, these data are an important advantage. The official records from students' transcripts allow for a nuanced analysis of students' educational outcomes. My analyses include schools that completed a school administrator questionnaire, had valid school administrator weights,[3] and had students who participated in in-home interviews.[4] Students are in my analysis if they have valid transcript sample weights and their school also is part of the school sample.

Add Health only measured school service provision in Wave 1 and AHAA only collected high school transcripts. This means students' grade level at Wave 1 constrains what data are

available from AHAA for each of my outcomes. I create two analytic samples depending on the timing of the dependent variable:

*Wave 1 High Schoolers Sample.* The first analytic sample only includes adolescents who were in grades 9-12 at Wave 1. The two outcomes analyzed for this "High Schoolers" sample, GPA and passing all courses, are based on grades at the end of the 1994-1995 school year— the year in which schools reported the health services they provide. Since AHAA only includes high school transcripts, 1994-1995 outcomes can only be analyzed for Wave 1 high schoolers (since 1994-1995 outcomes for middle schoolers would have been recorded on middle school transcripts, which AHAA did not collect). This analytic sample consists of 7,951 students in 86 schools. In these analyses, the sample can be considered to have had access to school-based services at a time point prior and proximate to their educational outcomes.

*Wave 1 All Grades Sample.* The second analytic sample includes the 7$^{th}$ and 8$^{th}$ graders from Wave 1 in addition to the high schoolers, as long as they have an exit status reported on their transcript. This sample is used for analyzing high school graduation as the outcome. By Wave 3, all Add Health students had passed the age of "timely" high school graduation, and thus have an exit status reported on their transcripts no matter what grade they were in in 1994-1995 when health service data was collected. This "All Grades" sample consists of 11,170 students in 127 schools. In analyses of high school graduation, the sample can be considered to have had access to school-based services at some point in their adolescence prior to graduation.

*Key Dependent and Independent Variables*

*Health Service Provision*. In Wave 1, each school administrator was asked about 16 different health services and whether each is "provided on school premises." Among these, I identified services representing routine preventive or physical health services: treatment for

minor illnesses and injuries, athletic physicals, non-athletic physicals, immunizations, nutrition or weight loss programs, and diagnostic screenings. These are the services that would most likely address common health concerns, aid general health maintenance, and influence students' overall physical well-being. Add Health includes data on other health-related services that are better characterized as mental/emotional health, drug/alcohol abuse, or family planning services, and are not included.[5] I create an indicator of service provision if any of the physical or preventive health services is provided on school grounds. It sacrifices information to collapse all measured services into one indicator, but these services represent broad categories and it is not clear that overlap could not exist between them (for example, a physical exam could include screening for certain diagnoses). A school's broader attention to preventive and physical health needs is likely to be more consequential than whether a specific type of service is offered. Importantly, results remain robust to specifying health service provision based on the number of services, providing an extensive service environment, and controlling for the presence of other types of services—alternative specifications which I discuss in more detail following the main results.

Panel A of Table 1 shows the number of sample schools as well as weighted percentages providing any service and offering each individual physical health service for both analytic samples of schools. Not surprisingly, "treatment for minor illnesses and injury" is most common, provided by roughly half of schools. Athletic and non-athletic physicals are also fairly common, offered by 20 to 40 percent of schools. Nutrition and weight loss programs, immunizations, and diagnostic screenings are more rare, but are available in a modest number of schools.

[Table 1 about here]

*Academic Performance and Attainment*. The two dependent variables only available for high schoolers are (1) a continuous measure of grade point average (GPA) across all grades the

student received in the 1994 to 1995 school year and (2) an indicator that the adolescent passed all of his or her courses in the 1994-1995 school year (that is, that the student did not fail any courses). These two measures capture educational performance across a broad range of academic achievement, as well as a more extreme outcome (course failure). My third dependent variable, available for all students, is high school graduation status. This measure is a longer-term and consequential marker of educational success.

*School Controls*

Panel B of Table 1 displays descriptive statistics for all school characteristics in both analytic samples. These include basic organizational features (size, type, urbanicity, region), as well as several variables that indicate a more advantaged or disadvantaged student body (racial composition, students with at least one college-educated parent, students eligible for free or reduced-price lunch). Additionally, I capture schools' academic quality (teacher experience; average daily attendance rate, a proxy for funding; percent of students testing below grade level; percent of students in a college preparatory program).[6] Lastly, I also measure two state-specific policies: whether the state funds school-based health centers and whether the state requires schools to offer school health nurse services.

*Student Controls*

I control for a number of student background characteristics, including sex, race, language and immigration indicators, and measures of socioeconomic status. Additional controls account for three aspects of the adolescents' education: grade level, and whether the student received special education services in the past year or help from a parent on a school project in the last four weeks. Descriptive statistics for both analytic samples of students are in Table 2.

[Table 2 about here]

**Methods**

My analysis utilizes random intercept models with HLM, which corrects for clustering of students within schools and allows data to be weighted at both levels to adjust for Add Health's complex sampling design, making the results nationally representative. The analyses to answer RQ1 test how school-based preventive/physical health services relate to student GPA, course failure, and high school graduation. Indexing individuals with *i* and schools with *j*, I estimate either the following linear or logistic student level model depending on the outcome variable:

(Student Eq. 1) $$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + r_{ij}$$

(Student Eq. 2) $$Logit(Y_{ij}) = \beta_{0j} + \beta_{1j}X_{ij}$$

In both cases, *X* represents a vector of student-level controls and $\beta_1$ is a vector of coefficients. Then a school-level equation predicts the random intercept $\beta_{0j}$ as a function of *S*, an indicator for preventive/physical health services offered, and *W*, a vector of school-level controls:

(School Eq. 1) $$\beta_{0j} = \gamma_{00} + \gamma_{01}S_j + \gamma_{02}W_j + u_{0j}$$

where $\gamma_{02}$ is a vector of coefficients and $\gamma_{01}$is the primary coefficient of interest.

Model 1 approximates previous studies by controlling for student characteristics and only considering health service provision at the school level—providing a baseline for understanding whether accounting for other school features alters the health service-academic performance relationship. Model 2 adds school characteristics. For each educational outcome, Model 2 answers RQ1 by providing evidence for how availability of preventive/physical health services predicts academic performance when numerous potential confounding factors are taken into account. Model 3 then adds an indicator for whether the student had any health-related absences in the previous month, answering RQ2 by testing whether opportunities to learn are a mechanism through which school-based services benefit academic performance.

To test whether service provision provides the most educational benefit to subgroups of students facing educational disparities and potential unmet health needs (RQ3), I remove the absences mediator and build on Model 2 by adding cross-level interactions between service provision and student race, family income, and insurance status (Models 4, 5, and 6, respectively, for each academic outcome). The student-level equation is similar to what it was before for each respective dependent variable, with *M* being a student covariate tested for an interaction:

(Student Eq. 3) $Y_{ij} = \beta_{0j} + \beta_{1j}M_{ij} + \beta_{2j}X_{ij} + r_{ij}$

(Student Eq. 4) $Logit(Y_{ij}) = \beta_{0j} + \beta_{1j}M_{ij} + \beta_{2j}X_{ij}$

At the school-level, the equation for $\beta_{0j}$ is identical to the School Equation 1 above, but the student-level coefficient(s) on *M* is predicted by *S*, the health services indicator:

(School Eq. 2) $\beta_{1j} = \gamma_{10} + \gamma_{11}S_j$

The coefficients on school health service provision are the main focus, so the school intercept and the relationship between the student covariate and academic performance are both modeled as a function of school services, but these coefficients do not vary randomly.

*Missing Data*

All schools provided complete data on health service provision. I impute missing control variables using multiple imputation by chained equations.[7] I dropped the very small number of respondents missing transcript data on outcomes based on AHAA's missing data indicators.

## Results

### *Addressing Selection*

An important limitation in research of this kind is the possibility that omitted factors are related to both student outcomes and the presence of health services at school. In the case of health service provision, we may be especially worried about two opposing possibilities: that

services are predominantly offered in the most advantaged schools, where students have many resources, or that they are predominantly offered in the most disadvantaged schools, where students have the highest need. Potential differences between schools with and without services are one reason to control for measures of school quality and advantage in my main analyses. However, available measures are finite and the possibility of unmeasured differences remains.

Despite being unable to account for unmeasured differences across schools, I can test for the likelihood of these differences. If schools with and without services appear different on available measures, they are more likely to differ in unmeasured ways as well. That is, if health services are only offered in certain types of schools, it should cause us to question whether these controls are sufficient to capture the most relevant dimensions of quality/advantage and whether there is common support to compare schools with and without services. To assess this, I precede my main models with an investigation of how various school characteristics relate to the availability of health services at school, to detect what kinds of selection may be operating. These analyses treat health service provision as the dependent variable in school-level bivariate and multivariate logistic regression models that predict the provision of preventive/physical health services on campus using all measured school characteristics, including measures of academic quality[8] and student body composition.

Across bivariate and multivariate models with both school samples, the only school characteristic that significantly predicts school provision of physical health services is the percent of teachers who have been at the school 5 or more years—schools with a higher percentage of veteran teachers are more likely to offer preventive health services on campus. (Full model results are presented in Appendix A, Table A1.) Since less experienced teachers are disproportionately concentrated in high-poverty schools (Rice 2010), this finding may indicate

that preventive/physical health services are offered in a more advantaged set of schools. However, several non-significant results in Table A1 run counter to this conclusion. For instance, the percent of new teachers is also positively related to the presence of services. The percent of students in a college preparatory track and percent of students with college-educated parents both proxy for a more advantaged, higher-achieving school, but across models the coefficients on these two variables are negative. Furthermore, in the multivariate model, schools with a higher percent of students eligible for free or reduced-price lunch are more likely to offer services.

By marginally significant standards ($p < 0.10$), there are regional differences in where schools offer preventive and physical health services: schools in the Northeast and West regions of the U.S. are more likely to offer this type of service, relative to the South. This may be due to regional differences in the acceptability of providing social services to youth in schools, but does not appear to be due to differences in state policies for school health: neither state policy variable is significantly related to physical health service availability.

In summary, there are few significant predictors of physical health service presence, and the signs of the coefficients in the models do not paint a clear picture of whether schools offering this type of service are more or less advantaged, or higher or lower achieving. To test the possibility that *both* types of selection occur—that services are offered at the most and least advantaged schools, but not in the middle—I included squared terms to test for non-linearity in the coefficients on percent of the student body testing below grade level, percent of the student body in college prep classes, percent of the student body with a college-educated parent, and percent of the student body eligible for free or reduced-price lunch. In no case were these alternatives significant or even substantively large, nor did they ever alter the pattern of results. Finally, I examined the distributions of the percent of the student body with a college-educated

parent and eligible for free lunch for schools that do and do not offer physical health services, confirming that my data include schools that do and do not offer services across the distribution of both of these key markers of socioeconomic advantage/disadvantage.

As noted, selection on these particular school characteristics is not a primary concern; they are the same set of observable covariates that are controlled in the main models below. Rather, unobserved aspects of school quality are the main selection threat. However, finding that numerous *measured* school characteristics are not strongly predictive of service presence suggests that it is less likely that *unmeasured* characteristics are. These results suggest that there is not a prototypical school context that offers preventive/physical health services, particularly along the dimensions of school advantage or academic quality. It is impossible to completely rule out the possibility that unobserved school factors are important predictors of schools' likelihood of providing services, but since a large number of potentially confounding school factors are not, this initial investigation gives the impression that we should not expect strong selection problems to exist, and indicates that the main models of this paper should be interpreted in light of this enhanced understanding of the potential (or lack thereof) for selection.

***Main Multilevel Models Predicting Academic Performance***

For each measure of academic performance I estimate three models. Model 1 estimates the relationship between provision of preventive/physical health services and academic outcomes when only student characteristics are controlled. Model 2 examines how the relationship changes when both student and school characteristics are controlled, most directly answering RQ1. Finally, to address RQ2, Model 3 adds an indicator representing whether the student had any health-related absences in the previous month as a partial test that school-based health service provision relates to academic performance by increasing students' opportunities to learn.

**GPA in 1994 to 1995.** Panel A in Table 3 shows key coefficients from models with student GPA in the 1994 to 1995 school year as the outcome. Model 1 shows that with only student characteristics controlled, the relationship between physical health service provision and GPA is positive, though this result only borders on statistical significance. Once I account for potential confounding factors at the school level in Model 2, however, health service presence is significantly related to GPA, predicting a GPA over an eighth of a point higher for students attending schools that offer preventive services. In Model 3, absences are a significant predictor of lower GPA, and the health service provision coefficient is reduced by about 16 percent. Health service provision remains a significant predictor of GPA, suggesting that absences are one potential mechanism through which health service provision is related to higher GPA, but that they do not explain the entire relationship.

[Table 3 about here]

**No course failure in 1994 to 1995.** Displayed in Panel B of Table 3, the results from models predicting whether or not students passed all courses in the 1994 to 1995 school year—more of an extreme marker of educational performance than GPA—follow a similar pattern to the results for GPA. Model 1 shows a positive but not significant relationship when only student characteristics are controlled. Model 2, however, estimates a larger and statistically significant relationship between provision of preventive health services and no course failure when I account for numerous characteristics of students and schools. The health services coefficient of 0.536 translates into 71 percent higher odds ($e^{0.536}$) of a student passing all of his or her courses in a school providing any preventive/physical health services as compared to a school offering none. Finally, also paralleling the results for GPA, when absences are controlled in Model 3 the coefficient on health services is reduced slightly—about 7 percent—but remains significantly

related to passing all of one's courses, again indicating that absences are a partial mediator.

**High School Graduation.** Panel C of Table 3 shows key coefficients for high school graduation, a more consequential and long-term indicator of academic success. As with the previous two outcomes, health service provision at Wave 1 is consistently estimated to be positively related to graduating from high school. The relationship is largest and significant in Model 1, but continues to be at least marginally significant in Model 2 with a coefficient of 0.395 suggesting a 48 percent higher odds ($e^{0.391}$) of graduating for students attending schools offering preventive health services. Health-related absences negatively predict graduation in Model 3, but the coefficient on health services remains roughly the same.

Taken together, the results of the analyses summarized in Tables 3 provide evidence that students perform better in schools that offer preventive and physical health services. The findings are small to moderate in size and consistent across outcomes. They also show that health-related absences explain a portion of the relationship between service provision and academic outcomes.

**Differential Relationships for Student Subgroups.** Parallel disparities in health and educational outcomes by both race and socioeconomic status suggest that the educational improvements offered by school health service provision may disproportionately benefit certain groups of students. But there is not strong evidence to that effect in these data. Table 4 displays key coefficients for Models 4, 5, and 6, which build on Model 2 above by adding cross-level interactions between health service presence and student characteristics in predicting each educational outcome. Panel A shows results for interactions by student race. For each outcome, all of the interaction coefficients are small and not significant, indicating a constant relationship across racial groups. Displayed in Panel B, results for interactions between health service provision and family income again reveal no significant interactions; however, across outcomes

the interactions are negative. That suggests that on-campus provision of physical health services may give more of an educational boost to students from lower income families; however, these coefficients are noisy, so it may be that no difference by family income exists.

[Table 4 about here]

Finally, school provision of health services may most specifically benefit students who lack other healthcare options. Results testing this are shown in Panel C of Table 4, where models include interactions between physical health services and student insurance status, using indicators for whether the student has publicly-provided health insurance (Medicare or Medicaid) or no health insurance. These analyses provide limited evidence that students who have public health insurance may actually receive the biggest educational benefit when their schools offer health services. The interaction in Model 5, predicting no course failure, is significant and suggests that for students with public health insurance, their odds of passing all courses are three times higher if their school offers preventive health services ($e^{0.516+0.575}$). The coefficients for the public health insurance interactions in Model 4 for GPA and Model 6 for high school graduation, although not significant, both suggest a near doubling of the effect of health service provision. Counterintuitively, though, the non-significant interactions for no health insurance suggests that the role of health services is similar for students who have private insurance (the reference group) versus none at all.

***Alternative Specifications***

Given that Add Health measures 16 different health services schools provide, these data could be employed to study the role of individual services offered. Although I focus on a broader sense of schools' attention to students' physical health needs, researchers interested in specific service offerings might find Add Health data fruitful. An alternative approach to operationalizing

physical health provision broadly is to measure the number of services, rather than if any are offered. Models employing this type of specification result in qualitatively similar patterns (all positive relationships), but with coefficients of lower magnitude and with patterns of significance that are different across the three outcomes from the main models presented (results available from the author). I prefer a single indicator because a linear count of services methodologically treats the difference between zero and one service as equivalent to the difference between five and six; this seems like a faulty assumption. To understand whether the extent of service provision matters, though, I tested whether having a high level of services changes how provision of physical health services relates to academic outcomes in two ways: first, controlling for whether the school offers other types of services (mental health, reproductive health, and drub abuse services) in addition to physical health services, and second, controlling for an indicator of providing six or more services (the upper tail of the school services distribution in Add Health). These two models produce substantively similar results to those presented above.

**Discussion**

Providing health services gives schools the potential to address the distractions and interruptions caused by student health problems and therefore better serve educational objectives by increasing student opportunities to learn. Moreover, given the importance of individual background factors for academic achievement, ameliorating health risk factors gives schools the potential to lessen the importance of children's background for their eventual educational outcomes (Rothstein 2004). This paper brings empirical evidence to bear on the theoretical rationale that school provision of preventive and physical health services can enhance academic outcomes when implemented on a broad scale. Advocates of school-based health services have frequently argued that school health service provision bolsters educational success, but few

studies have examined this empirically, and fewer still have considered a broad population of students and schools (Geierstanger et al. 2004; Ladd 2012). This study used a nationally representative sample of schools and students to examine school provision of any type of preventive or physical health service—the most general category of health service, geared toward common student health concerns, physical health maintenance, and overall well-being.

This study is also distinctive for modeling the types of schools that provide health services and for accounting for potentially confounding school characteristics when assessing the relationships between health service availability and academic outcomes. Accounting more comprehensively for school context reveals that school provision of preventive and physical health services is significantly related to higher GPA and higher odds of passing all courses. I employ three dependent variables to assess the consistency of the results across different educational outcomes, finding that school-based provision of preventive and physical health services is consistently related to better academic performance, although the coefficients in models for high school graduation are only substantively large, not statistically significant. It is not surprising that I detect a clearer relationship between health service provision and both GPA and no course failure than for high school graduation. The first two outcomes are measured at the end of the same school year as we know that the school provided health services, so there is greater proximity between the "intervention" and the academic outcome. High school graduation is a consequential educational transition, but between Add Health's first wave and student graduation schools may have altered their service offerings or students may have switched to a school with a different service environment. Varying amounts of time have passed before high school graduation for students who were in different grades at Wave 1. Future research might examine whether steady provision of health services throughout schooling shows a clearer

relationship with attainment measures. Despite the lack of significance in models predicting graduation and controlling for school context, the estimates are consistent with the pattern that school provision of preventive health services is related to better educational outcomes.

My analysis is limited in its ability to provide estimates of causal effects, because with observational survey data there may be omitted factors that drive selection in which schools offer services or which students attend those schools. We should worry that results are biased upward if health services are only offered in the most advantaged schools. However, my analysis of the types of schools that offer preventive and physical health services found scant evidence of this. Instead, across numerous markers of school quality and student body composition, surprisingly few measures of advantage or disadvantage predict school service provision, suggesting that there is no prototypical school type that offers health services—at least not the preventive and physical health services considered here. Of course, I am limited to examining the observable school characteristics measured in Add Health. If unobservable characteristics lead schools to implement service programs (e.g. a well-connected principal who has relationships with non-profit organizations or university hospitals, which may seek to establish health services in schools), I will not capture these dynamics. Similarly, there could be unobserved selection in which students attend schools with services; for example, highly involved parents may seek out schools that offer health services because they want their children to have access to every opportunity for enhanced success. That I cannot rule out this type of selection combined with the fact that I cannot measure how service provision changes student outcomes over time poses a limitation to interpreting my results as representing causal relationships. However, I have included an extensive set of covariates at both the student and school level to attempt to mitigate this concern. If there were strong selection forces operating to place services in certain types of

schools, we would expect to find stronger and more consistent results in the models investigating selection on observables. Although a stronger capacity for causal inference is a limitation of this study, my test of school absences as a mediator bolsters the case that health services operate via at least one theorized mechanism to influence academic outcomes.

The positive pattern of health service provision predicting better academic performance reflects school-average results. This highlights another limitation of currently available survey data. Although there are pathways through which health service provision may benefit students who don't access the services directly (for example, by spreading health knowledge or peer effects on health behaviors), we would expect services to matter most for the students who use them. I cannot measure which students actually utilized services at school; future research should collect data identifying students who do and do not use campus-based services. This would illuminate the importance of *use* versus *presence,* and help to delineate the relative contributions of different ways in which health services contribute to higher average performance. It is worth noting, however, that smaller scale studies examining SBHCs have found high rates of service utilization among students who have access to health services at school (McNall et al. 2010).

Add Health also lacks data on the quality of provided services. Schools with ostensibly the same services may differ in their quality, and future research, perhaps using qualitative methods, could shed light on such differences. Another consequential mediator, perhaps the most fundamental of all, is actual student health and need for healthcare. I do not control for health status because student health measured at the beginning of Add Health could itself depend on the health service offerings at a student's school. However, longitudinal research that tracks student health and educational outcomes contemporaneous with the availability of services would enhance our understanding of how these two crucial components of adolescent well-being are

influenced by health service provision.

Another objective of this study was to test whether school provision of services differentially relates to academic outcomes for racial and socioeconomic subgroups of students, but I do not find strong evidence of this. Models including interactions suggest that the relationship is uniform across racial groups and by family income. I do not find a differential relationship for students without health insurance, but students with public health insurance may benefit more. One potential explanation for this finding is that although students with public insurance and students without any insurance may both face access barriers due to low income, students with no insurance may be weakly tied to healthcare providers in the first place, whereas students with public insurance may have more experience seeking out healthcare. Thus, students with public insurance may seek out school-based services more than students with private insurance because they need services more, while also being better able to capitalize on the presence of services than students with no insurance (because of greater experience having their health needs met). Another possibility is that school health interventions can more easily provide services to students with public health insurance because government agencies can coordinate reimbursement. Particularly with health care coverage more universal and school health services receiving additional funding, both as a result of the Affordable Care Act (see Rothstein 2012; Shah 2011), future research could investigate how school services reach populations with different types of insurance coverage, and how this translates into educational outcomes.

The lack of many significant differential effects across student subgroups does not mean that school-based health service provision cannot play a role in reducing health and educational disparities. Rather, if the academic benefit is uniform across groups, to reduce inequality health service interventions would need to be targeted to the schools and students that need them most.

With accountability pressures on schools and the primary focus within government on in-school reforms, if targeted appropriately, school-based health services might aid this goal. The Affordable Care Act's inclusion of funds for school health clinics is evidence of an endorsement of this approach. And numerous well-known scholars and policymakers (including former Secretary of Education Arne Duncan) have called for health services to play a more central role in educational reform efforts, frequently emphasizing preventive care and services to address physical health needs (see, for example, the Broader, Bolder Approach to Education Reform website at www.boldapproach.org; see also Rothstein 2004).

More generally, the results of this paper suggest a reconsideration of the typical dichotomy between in-school and out-of-school factors in research on educational contexts. The Coleman Report and substantial research since indicates that family background and factors related to students' out-of-school time (e.g. the "summer setback" [Downey, von Hippel, and Broh 2004]) account for more variation in students' academic outcomes than school factors. Yet school health services play an interstitial role between the characteristics of the family and community that strongly influence academic outcomes and the characteristics of the school instructional environment that are typically targeted for school-based reforms. This is not to say that schools can intervene in every sphere of student life or that they should be expected to improve health in addition to educational outcomes. Rather, researchers interested in school effects and contextual effects more broadly should also pay attention to the non-organizational and non-instructional domains of schools that also touch the lives of young people. School health services are an example of something that schools are already doing and of the types of things that can be done in schools that may improve students' educational outcomes. Moreover, insofar as student health is tied up in the set of characteristics comprising "family background"—indeed,

health is highly related to race, socioeconomics status, and other demographic characteristics—providing health services offers schools a way to mitigate the relationship between student background and academic outcomes. In this way, despite limited evidence in this study that school health services have differential effects, they nevertheless have implications for inequality. Many scholars and advocates argue that we cannot solve issues of educational inequality without addressing precipitating factors like poor health. This study speaks to how health policy can be leveraged as educational policy, with implications for improving outcomes broadly or targeting interventions to reduce inequality.

**Notes**

[1] Needham et al. (2004) partially address these limitations by using national data and additional school measures, but their paper has multiple objectives, with examining service provision using a single service and a limited set of school contextual variables being just one part.

[2] Reback (2010) uses cross-state differences in school-based mental health counseling to show a positive relationship between service provision and students' test score gains. Carrell and Hoekstra (2014) use within-school variation in number of counselors to show that increased access to counseling improves academic achievement, at least for boys. More research attention could be paid to how school-based services to address reproductive health or substance abuse predict academic outcomes. Although Add Health provides measures of these types of services, I do not focus on them in this study because they are different in character from routine health services and presumably are aimed at students engaged in specific types of risky behaviors.

[3] Properly weighting both school and student data is essential in adjusting for Add Health's complex survey sampling design. For details, see Chantala 2006.

[4] I exclude from the sample two schools that are indicated as special education schools as well as the single boarding school, as such schools present both unusual educational environments and in the latter case, a highly unusual need for campus-based services.

[5] The specific other health services measured in Add Health are emotional counseling, drug and alcohol awareness and abuse programs, rape counseling, physical violence programs, family planning counseling and services, STD treatment, and prenatal/postpartum healthcare.

[6] Of concern, these measures of the school's academic environment could be endogenous to school-level services—a product of health service provision themselves. Results reported here are robust to excluding these variables from the model.

[7] Multiple imputation by chained equations fills in missing values based on plausible values determined by the distribution of the variable itself and the covariates in the equation. Typically only one to three schools were missing on any individual school characteristic, but two variables required that 22.0 and 26.8 percent of the school sample be imputed. Fewer than 30 students were missing values on student-reported variables, but parent-reported variables have missing rates of 12.6 to 23.9 percent of the sample. Covariates in the imputation model included all of the study variables as well as some ancillary measures from Add Health. All outcome models were estimated on each of 10 complete datasets (the limit in HLM), and results were combined to account for variance in imputed values across the datasets.

[8] As noted previously, measures of academic quality could be endogenous. The results described below, as well as results of the main multilevel models in the next section, are robust to excluding average daily attendance rate, percent of students testing below grade level, and percent of students in a college preparatory program from the model.

**References**

Allison, Mandy A., Lori A. Crane, Brenda L. Beaty, Arthur J. Davidson, Paul Menlinkovich, & Allison Kempe. 2007. "School-Based Health Centers: Improving Access and Quality of Care for Low-Income Adolescents." *Pediatrics* 120(4): e887-e894.

Brener, Nancy D., Lani Wheeler, Linda C. Wolfe, Mary Vernon-Smiley, & Linda Caldart-Olson. 2007. "Health Services: Results From the School Health Policies and Programs Study 2006." *Journal of School Health* 77(8): 464-485.

Brindis, Claire D., Jonathan Klein, John Schlitt, John Santelli, Linda Juszczak, & Robert J. Nystrom. 2003. "School-Based Health Centers: Accessibility and Accountability." *Journal of Adolescent Health* 32(Supplemental): 98-107.

Carbonaro, William & Elizabeth Covay. 2010. "School Sector and Student Achievement in the Era of Standards Based Reforms." *Sociology of Education* 83(2): 160-182.

Carrell, Scott E. & Mark Hoekstra. 2014. "Are school counselors an effective education input?" *Economic Letters* 125: 66-69.

Chantala, Kim. 2006. *Guidelines for Analyzing Add Health Data*. Carolina Population Center, University of North Carolina at Chapel Hill. Updated October 1, 2006. Available online at http://www.cpc.unc.edu/projects/addhealth/data/using/guides.

Coleman, James S., Ernest Q. Campbell, Carol J. Hobson, James McPartland, Alexander M. Mood, Frederic D. Weinfeld, and Robert L. York. 1966. *Equality of Educational Opportunity*. Washington DC: U.S. Government Printing Office.

Condron, Dennis J. & Vincent J. Roscigno. 2003. "Disparities within: Unequal Spending and Achievement in an Urban School District." *Sociology of Education* 76(1): 18-36.

Crosnoe, Robert. 2006. "Health and the Education of Children from Racial/Ethnic Minority and

Immigrant Families." *Journal of Health and Social Behavior* 47(1): 77-93.

Crosnoe, Robert. 2009. "Low-Income Students and the Socioeconomic Composition of Public High Schools." *American Sociological Review* 74(5): 709-730.

Currie, Janet. 2005. "Health Disparities and Gaps in School Readiness." *The Future of Children* 15(1): 117-138.

Dilley, Julia. 2009. *Research Review: School-Based Health Interventions and Academic Achievement*. Healthy Students, Successful Students Partnership Committee. Washington State Board of Health, Washington State Office of Superintendent of Public Instruction, Washington State Department of Health.

Downey, Douglas B., Paul T. von Hippel, & Beckett A. Broh. 2004. "Are School the Great Equalizer? Cognitive Inequality during the Summer Months and the School Year." *American Sociological Review* 69(5): 613-635.

Dryfoos, Joy G. 1995. "Full Service Schools: Revolution or Fad?" *Journal of Research on Adolescence* 5(2) 147-172.

Federico, Steven G., Lisa Abrams, Rachel M. Everhart, Paul Melinkovich, & Simon J. Hambidge. 2010. "Addressing Adolescent Immunization Disparities: A Retrospective Analysis of School-Based Health Center Immunization Delivery." *American Journal of Public Health* 100(9): 1630-1634.

Fothergill, Kate & Elisa Ballard. 1998. "The School-Linked Health Center: A Promising Model of Community-Based Care for Adolescents." *Journal of Adolescent Health* 23(1): 29-38.

Geierstanger, Sara P. & Gorette Amaral. 2005. "School-Based Health Centers and Academic Performance: What is the Intersection?" April 2004 Meeting Proceedings. White Paper. Washington, DC: National Assembly on School-Based Health Care.

Geierstanger, Sara Peterson, Gorette Amaral, Mona Mansour, & Susan Russell Walters. 2004. "School-Based Health Centers and Academic Performance: Research, Challenges, and Recommendations." *Journal of School Health* 74(9): 347-352.

Gustafson, Elaine M. 2005. "History and Overview of School-Based Health Centers in the US." *Nursing Clinics of North America* 40: 595-606.

Haas, Steven A. 2006. "Health Selection and the Process of Social Stratification: The Effect of Childhood Health on Socioeconomic Attainment." *Journal of Health and Social Behavior* 47(December): 339-354.

Haas, Steven A. & Fosse, Nathan E. 2008. "Health and the Education Attainment of Adolescents: Evidence from the NLSY97." *Journal of Health and Social Behavior* 49(2): 178-192.

Jackson, Margot I. 2009. "Understanding Links Between Adolescent Health and Educational Attainment." *Demography* 46(4): 671-694.

Juszczak, Linda, Paul Melinkovich, & David Kaplan. 2003. "Use of Health and Mental Health Services by Adolescents Across Multiple Delivery Sites." *Journal of Adolescent Health* 32(Supplemental): 108-118.

Kaplan, David W., B. Ned Calonge, Bruce P. Guernsey, & Maureen B. Hanrahan. 1998. "Managed Care and School-Based Health Centers: Use of Health Services." *Archives of Pediatrics and Adolescent Medicine* 152(January): 25-33.

Kisker, Ellen E. & Randall S. Brown. 1996. "Do School-Based Health Centers Improve Adolescents' Access to Health Care, Health Status, and Risk-Taking Behavior?" *Journal of Adolescent Health* 18(5): 335-343.

Ladd, Helen F. 2012. "Education and Poverty: Confronting the Evidence." *Journal of Policy*

*Analysis and Management* 31(2): 203-227.

Lear, Julia G. 2002. “Schools and Adolescent Health: Strengthening Services and Improving Outcomes.” *Journal of Adolescent Health* 31(6S): 310-320.

Lee, Valerie E. & David T. Burkam. 2003. “Dropping Out of High School: The Role of School Organization and Structure.” *American Educational Research Journal* 40(2): 353-393.

Maughan, Erin. 2003. “The Impact of School Nursing on School Performance: A Research Synthesis.” *The Journal of School Nursing* 19(3): 163-171.

McCord, Marcella T., Jonathan D. Klein, Jane M. Foy, & Kate Fothergill. 1993. “School-Based Clinic Use and School Performance.” *Journal of Adolescent Health* 14(2): 91-98.

McNall, Miles A., Lauren F. Lichty, & Brian Mavis. 2010. “The Impact of School-Based Health Centers on the Health Outcomes of Middle School and High School Students.” *American Journal of Public Health* 100(9): 1604-1610.

Needham, Belinda L., Robert Crosnoe, & Chandra Muller. 2004. “Academic Failure in Secondary School: The Inter-Related Role of Health Problems and Educational Context.” *Social Problems* 51(4): 569-586.

Owens, Ann. 2010. “Neighborhoods and Schools as Competing and Reinforcing Contexts for Educational Attainment.” *Sociology of Education* 83(4): 287-311.

Reback, Randall. 2010. “Schools’ Mental Health Services and Young Children’s Emotions, Behavior, and Learning.” *Journal of Policy Analysis and Management* 29(4): 698-725.

Rice, Jennifer King. 2010. “The Impact of Teacher Experience: Examining the Evidence and Policy Implications.” Brief 11. National Center for Analysis of Longitudinal Data in Education Research (CALDER). August 2010.

Ross, Catherine E. & Chia-Ling Wu. 1995. “The Links Between Education and Health.”

*American Sociological Review* 60(5): 719-745.

Rothstein, Richard. 2004. *Class and Schools: Using Social, Economic, and Educational Reform to Close the Black-White Achievement Gap*. Washington, DC: Economic Policy Institute.

Rothstein, Richard. 2012. "He's looked at life from both sides now—or has he? Arne Duncan claims the high ground, but school clinics still face needless obstacles." Economic Policy Institute Commentary. February 26, 2012. Available online at: http://www.epi.org/publication/education-arne-duncan-school-health-clinics/

Shah, Nirvi. 2011. "School-Based Health Centers to Share $95 Million in Grants." *Education Week* 30(37): 6. August 10, 2011.

Silberberg, Mina & Joel C. Cantor. 2008. "Making the Case for School-Based Health: Where Do We Stand?" *Journal of Health Politics, Policy, and Law* 33(1): 3-37.

Symons, Cynthia Wolford, Bethann Cinelli, Tammy C. James, & Patti Groff. 1997. "Bridging Study Health Risks and Academic Achievement Through Comprehensive School Health Programs." *Journal of School Health* 67(6): 220-227.

Wade, Terrance J., Mona E. Mansour, Kristin Line, Tracy Huentelman, & Kathryn Keller. 2008. "Improvements in Health-Related Quality of Life Among School-Based Health Center Users in Elementary and Middle School." *Ambulatory Pediatrics* 8(4): 241-249.

Walker, Sarah Cusworth. Suzanne E.U. Kerns, Aaron R. Lyon, Eric J. Bruns, & T.J. Cosgrove. 2010. "Impact of School-Based Health Center Use on Academic Outcomes." *Journal of Adolescent Health* 46: 251-257.

Table 1. Descriptive Statistics for School Variables

| | **High Schoolers Sample** (n = 86) | | **All Grades Sample** (n = 127) | |
|---|---|---|---|---|
| *Panel A: Counts and Weighted % of Schools Providing Preventive/Physical Health Services* | | | | |
| | Sample Count | Weighted % | Sample Count | Weighted % |
| **Any Preventive/Physical Health Services** | **67** | **71.5** | **97** | **77.5** |
| Treatment for Minor Illnesses and Injury | 53 | 57.2 | 74 | 49.6 |
| Athletic Physical | 39 | 40.8 | 51 | 43.7 |
| Non-athletic Physical | 16 | 18.4 | 20 | 24.3 |
| Nutrition/Weight Loss Program | 13 | 11.4 | 18 | 8.8 |
| Immunizations | 9 | 11.4 | 11 | 7.1 |
| Diagnostic Screenings | 7 | 8.2 | 11 | 5.8 |
| **None of these services** | **19** | **28.5** | **30** | **22.5** |
| *Panel B: Descriptive Statistics for School Control Variables* | | | | |
| | Weighted % or Mean | Standard Deviation | Weighted % or Mean | Standard Deviation |
| School Size | | | | |
| Small (1 – 400) | 39.4 | | 57.7 | |
| Medium (410 – 1000) | 41.1 | | 31.8 | |
| Large (1001+) | 19.5 | | 10.6 | |
| School Type | | | | |
| Public | 81.0 | | 82.5 | |
| Private | 19.1 | | 17.5 | |
| Urbanicity | | | | |
| Urban | 23.2 | | 22.2 | |
| Suburban | 44.7 | | 58.6 | |
| Rural | 32.0 | | 19.2 | |
| Region | | | | |
| West | 16.0 | | 12.9 | |
| Midwest | 29.2 | | 40.0 | |
| South | 40.5 | | 33.1 | |
| Northeast | 14.4 | | 14.1 | |
| Average Daily Attendance Rate | 92.6 | 4.8 | 93.9 | 4.1 |
| % of students testing one or more grades below grade level | 18.2 | 15.2 | 16.8 | 13.9 |
| % of students in a college preparatory program | 53.7 | 31.3 | 32.2 | 36.3 |
| % of teachers at school new this year | 11.2 | 13.7 | 9.0 | 11.4 |
| % of teachers at school 5+ years | 58.5 | 25.5 | 64.3 | 28.3 |
| % of students eligible for free or reduced-price lunch | 28.6 | 21.1 | 28.0 | 20.0 |
| % of student body that is black | 19.1 | 27.4 | 16.8 | 27.1 |
| % of student body that is Hispanic | 11.3 | 15.3 | 11.9 | 14.1 |
| % of student body that is Asian | 4.0 | 6.8 | 3.2 | 5.6 |
| % of student body with at least one college-educated parent | 46.8 | 18.2 | 47.4 | 18.5 |
| State policy requiring schools to offer health nurse services | 43.7 | | 36.4 | |
| State policy funding school-based health centers (SBHCs) | 68.2 | | 61.2 | |

Note: Percentages that do not add to 100% are the result of rounding error.

Table 2. Descriptive Statistics for Student Variables

| | **High Schoolers Sample** (n = 7,951) | | **All Grades Sample** (n = 11,170) | |
|---|---|---|---|---|
| | Weighted % or Mean | Standard Deviation | Weighted % or Mean | Standard Deviation |
| *Demographic Characteristics* | | | | |
| Female | 49.2 | | 48.9 | |
| Race/Ethnicity | | | | |
| White | 64.8 | | 65.4 | |
| Black | 16.5 | | 16.3 | |
| Hispanic | 11.5 | | 11.3 | |
| Asian | 4.3 | | 4.0 | |
| Native American | 1.9 | | 2.0 | |
| Other Race | 0.9 | | 1.0 | |
| Immigrant to U.S. | 8.8 | | 7.6 | |
| Language spoken at home | | | | |
| English | 92.0 | | 92.8 | |
| Spanish | 5.3 | | 4.8 | |
| Other (non-English) | 2.6 | | 2.4 | |
| Single-parent Family | 25.2 | | 26.3 | |
| Family Income (in $1,000s and logged) | 3.57 | 0.85 | 3.51 | 0.85 |
| Parent's Education | | | | |
| Less than high school | 9.7 | | 9.7 | |
| High school or equivalent | 26.1 | | 26.7 | |
| Some post-secondary | 31.0 | | 31.8 | |
| College degree or higher | 33.3 | | 31.5 | |
| *Educational Characteristics* | | | | |
| Grade Level | | | | |
| 7th | – | | 17.5 | |
| 8th | – | | 16.6 | |
| 9th | 25.2 | | 17.3 | |
| 10th | 25.2 | | 16.3 | |
| 11th | 23.8 | | 15.5 | |
| 12th | 25.8 | | 16.9 | |
| Special education (past 12 months) | 8.0 | | 9.0 | |
| Parent helped on a school project (past 4 weeks) | 16.4 | | 19.5 | |
| Any health-related absences in past month | 32.6 | | 33.1 | |
| *Insurance Status* | | | | |
| Public Health Insurance (Medicare or Medicaid) | 7.3 | | 8.6 | |
| No Health Insurance | 11.9 | | 11.6 | |
| *Academic Outcomes* | | | | |
| Mean GPA in 1994-1995 | 2.55 | 0.93 | – | |
| No courses failed in 1994-1995 | 69.3% | | – | |
| Graduated from high school | – | | 87.9 | |

Note: Percentages that do not add to 100% are the result of rounding error.

Table 3. Coefficients for Key Variables from Multilevel Regression Models of School Provision of Physical Health Services Predicting All Academic Performance Outcome Measures

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| | Model with Student Controls | Model with Student and School Controls | Model with Indicator for Any Health Absences |
| *Panel A: Linear Models Predicting **GPA in the 1994-1995 School Year*** | | | |
| Any physical/preventive health services offered | 0.117 | 0.132* | 0.111* |
| | (0.070) | (0.050) | (0.051) |
| Student demographic & educational controls | ✓ | ✓ | ✓ |
| School organizational, compositional, & policy controls | | ✓ | ✓ |
| Any school absence due to health or emotional problem in past month | | | -0.213*** |
| | | | (0.044) |
| Observations | | | |
| Schools | 86 | 86 | 86 |
| Students | 7,951 | 7,951 | 7,951 |
| *Panel B: Logistic Models Predicting **No Course Failure in the 1994-1995 School Year*** | | | |
| Any physical/preventive health services offered | 0.395 | 0.536** | 0.497* |
| | (0.257) | (0.185) | (0.187) |
| Student demographic & educational controls | ✓ | ✓ | ✓ |
| School organizational, compositional, & policy controls | | ✓ | ✓ |
| Any school absence due to health or emotional problem in past month | | | -0.390*** |
| | | | (0.101) |
| Observations | | | |
| Schools | 86 | 86 | 86 |
| Students | 7,951 | 7,951 | 7,951 |
| *Panel C: Linear Models Predicting **High School Graduation*** | | | |
| Any physical/preventive health services offered | 0.621* | 0.395 | 0.386 |
| | (0.302) | (0.226) | (0.223) |
| Student demographic & educational controls | ✓ | ✓ | ✓ |
| School organizational, compositional, & policy controls | | ✓ | ✓ |
| Any school absence due to health or emotional problem in past month | | | -0.501*** |
| | | | (0.118) |
| Observations | | | |
| Schools | 127 | 127 | 127 |
| Students | 11,170 | 11,170 | 11,170 |

Note: Models weighted by school administrator and transcript sample weights. Standard errors in parentheses. Student controls include student sex, race, immigration status, home language, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental school help (see Table 3). School controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in a college prep program, percent of teachers new and at that school for 5+ years, percent of students eligible for free or reduced-price lunch, racial composition, percent of student body with a college-educated parent, state policy requiring school nurse services, and state policy funding SBHCs (see Table 2).
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Coefficients for Key Variables from Multilevel Regression Models of School Provision of Physical Health Services Interacted with Student Race, Family Income, and Student Health Insurance Status, Predicting All Outcome Measures

| | Model 4 | Model 5 | Model 6 |
|---|---|---|---|
| | Outcome: GPA in 1994-1995 | Outcome: No Course Failure in 1994-1995 | Outcome: High School Graduation |
| *Panel A: Models Interacting Health Services with Student Race* | | | |
| Any physical/preventive health services offered | 0.123* | 0.578** | 0.378 |
| | (0.053) | (0.193) | (0.246) |
| Student Race | | | |
| (Ref: White/Native American/Other) | | | |
| Hispanic | -0.041 | -0.302 | -0.511 |
| | (0.142) | (0.327) | (0.422) |
| Health Services*Hispanic | -0.051 | 0.118 | -0.144 |
| | (0.163) | (0.393) | (0.520) |
| Black | -0.147 | -0.172 | -0.042 |
| | (0.080) | (0.235) | (0.306) |
| Health Services*Black | 0.027 | -0.156 | 0.151 |
| | (0.099) | (0.289) | (0.360) |
| Asian | -0.006 | 0.413 | 0.064 |
| | (0.107) | (0.523) | (1.042) |
| Health Services*Asian | 0.240 | -0.074 | -0.300 |
| | (0.156) | (0.521) | (1.062) |
| *Panel B: Models Interacting Health Services with Family Income* | | | |
| Any physical/preventive health services offered | 0.237 | 0.782 | 0.776 |
| | (0.166) | (0.397) | (0.475) |
| Family income (ln) | 0.123** | 0.162 | 0.363** |
| | (0.034) | (0.087) | (0.113) |
| Health Services*Family income | -0.030 | -0.072 | -0.120 |
| | (0.043) | (0.097) | (0.127) |
| *Panel C: Models Interacting Health Services with Student Health Insurance Status* | | | |
| Any physical/preventive health services offered | 0.137* | 0.516** | 0.342 |
| | (0.052) | (0.188) | (0.239) |
| Student Insurance Status | | | |
| (Ref: Any other kind of health insurance) | | | |
| Public Insurance | -0.120 | -0.536* | -0.557** |
| | (0.107) | (0.219) | (0.194) |
| Health Services*Public Insurance | 0.144 | 0.575* | 0.292 |
| | (0.131) | (0.262) | (0.257) |
| No Insurance | 0.005 | -0.104 | -0.557** |
| | (0.110) | (0.254) | (0.190) |
| Health Services*No Insurance | -0.137 | -0.225 | -0.021 |
| | (0.124) | (0.299) | (0.249) |
| Observations | | | |
| Schools | 86 | 86 | 127 |
| Students | 7,951 | 7,951 | 11,170 |

Note: Models weighted by school administrator and transcript sample weights. Standard errors in parentheses. Student controls include student sex, race, immigration status, home language, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental school help (see Table 3). School controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in a college prep program, percent of teachers new and at that school for 5+ years, percent of students eligible for free or reduced-price lunch, racial composition, percent of student body with a college-educated parent, state policy requiring school nurse services, and state policy funding SBHCs (see Table 2).
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

## Appendix A: Results for Initial Investigation into Possible Selection

Table A1. Coefficients from Bivariate and Multivariate Predictions of Preventive/Physical Health Service Presence Within Add Health Schools

| | High Schools Sample | | All Schools Sample | |
|---|---|---|---|---|
| | Model A | Model B | Model A | Model B |
| | Bivariate Regressions | Multivariate Regression | Bivariate Regressions | Multivariate Regression |
| School Size (ref: small) | | | | |
| Medium (401-1000 students) | 0.007 | 1.125 | -0.463 | 0.232 |
| | (0.641) | (1.202) | (0.562) | (0.893) |
| Large (1001+ students) | 0.733 | 1.268 | 0.144 | 0.945 |
| | (0.633) | (1.763) | (0.580) | (1.351) |
| Public school (ref: private) | 0.005 | -1.054 | -0.510 | -1.405 |
| | (1.004) | (2.439) | (0.982) | (1.881) |
| Location (ref: Suburban) | | | | |
| Urban | 0.252 | 0.967 | 0.417 | 0.496 |
| | (0.879) | (1.322) | (0.771) | (0.904) |
| Rural | 0.758 | 0.103 | -0.179 | -0.456 |
| | (0.717) | (1.389) | (0.694) | (0.844) |
| Region (ref: South) | | | | |
| West | 1.322 | 2.912 | 0.941 | 2.096$^{+}$ |
| | (0.983) | (1.923) | (0.761) | (1.157) |
| Midwest | -0.791 | 1.158 | -0.042 | 0.810 |
| | (0.734) | (1.442) | (0.717) | (0.890) |
| Northeast | 1.916$^{+}$ | 3.463 | 2.278$^{+}$ | 3.607$^{+}$ |
| | (1.164) | (2.555) | (1.177) | (1.880) |
| Average daily attendance (ADA) | -0.027 | 0.062 | 0.044 | -2.952 |
| | (0.060) | (4.734) | (0.054) | (3.864) |
| ADA squared | -0.000 | -0.001 | 0.000 | 0.017 |
| | (0.000) | (0.026) | (0.000) | (0.021) |
| % of teachers new this year | 0.004 | 0.007 | -0.001 | 0.010 |
| | (0.026) | (0.034) | (0.025) | (0.037) |
| % of teachers at school 5 yrs + | 0.028$^{*}$ | 0.042$^{*}$ | 0.022$^{*}$ | 0.024$^{*}$ |
| | (0.012) | (0.019) | (0.010) | (0.012) |
| % of students testing below grade level | -0.008 | -0.004 | -0.012 | 0.006 |
| | (0.021) | (0.028) | (0.018) | (0.023) |
| % of students in academic or college prep track | -0.005 | -0.003 | -0.009 | -0.009 |
| | (0.011) | (0.024) | (0.008) | (0.012) |
| % of students eligible for free/reduced-price lunch | -0.001 | 0.051 | -0.008 | 0.020 |
| | (0.017) | (0.049) | (0.013) | (0.036) |
| % of students who are African American | -0.016 | -0.020 | -0.012 | -0.004 |
| | (0.011) | (0.027) | (0.010) | (0.019) |
| % of students who are Latino | 0.017 | -0.005 | 0.023 | 0.010 |
| | (0.017) | (0.029) | (0.020) | (0.024) |
| % of students who are Asian | 0.015 | -0.005 | -0.011 | -0.047 |
| | (0.043) | (0.046) | (0.034) | (0.052) |
| % of students with college-educated parents | -0.008 | -0.012 | -0.007 | -0.016 |
| | (0.020) | (0.038) | (0.017) | (0.024) |
| Policy - State funds SBHCs | -0.331 | -0.340 | -0.170 | -0.006 |
| | (0.781) | (0.846) | (0.700) | (0.694) |
| Policy - State requires schools to offer school health nurse services | 0.412 | -0.174 | 0.190 | 0.177 |
| | (0.670) | (0.999) | (0.612) | (0.720) |
| Observations | 86 | 86 | 127 | 127 |

Note: Models weighted by school administrator weights. Standard errors in parentheses.
$^{+}$ $p < 0.10$, $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$