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School-Based Health Services and Adolescents' Academic Performance The Role of School Provision of Preventive and Physical Health Services in Educational Outcomes

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ABSTRACT

Research indicates a reciprocal relationship between health and education, and that unhealthy students are poorly positioned to learn. One way that schools intervene in the relationship between student background and educational outcomes is by providing services that prevent health problems or help students cope with existing health concerns. Providing health services on campus is theorized to promote educational goals by increasing access to services, improving health, and thus enhancing opportunities to learn. However, empirical tests of this relationship are rare, and generally use small samples with a single service or full-scale clinic. This paper uses data from Add Health, which identifies numerous services provided by schools across the U.S. Multilevel models test how provision 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 Health Services and Adolescents' Academic Performance
The Role of School Provision of Preventive and Physical Health Services in Educational Outcomes*

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Biography: Jane Rochmes is a postdoctoral fellow in the Center for Education Policy Analysis at Stanford University. Her research focuses on how school context shapes the experiences and outcomes of students, and the ways in which schooling perpetuates or ameliorates racial and socioeconomic inequality broadly and academic disparities within schools. Other research projects include an examination of teachers' beliefs that family background and home environment are barriers to effective teaching; a study of teacher labor market dynamics in a large, urban district; and research on the influence of for-profit colleges on degree receipt and labor market outcomes.

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Abstract

Research indicates a reciprocal relationship between health and education, and that unhealthy students are poorly positioned to learn. One way that schools intervene in the relationship between student background and educational outcomes is by providing services that prevent health problems or help students cope with existing health concerns. Providing health services on campus is theorized to promote educational goals by increasing access to services, improving health, and thus enhancing opportunities to learn. However, empirical tests of this relationship are rare, and generally use small samples with a single service or full-scale clinic. This paper uses data from Add Health, which identifies numerous services provided by schools across the U.S. Multilevel models test how provision 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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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 broadly (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 an ideal and unique location to target young people's health, by providing healthcare services on campus. Due to the negative effect of poor health on education, school-based provision of healthcare may also promote schools' academic mission. Moreover, health disparities are a source of educational stratification, implying that reducing health inequality could help to lessen 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 multiple 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 or specific populations of schools and students. These are important instances to study for many reasons, but they are likely not generalizable to what we would see in a more 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 influence student outcomes. Third, these studies have typically ignored 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, and to improve access to healthcare (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. 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 different health-related services that schools across the United States provide. Using these measures, 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] My analysis has three goals. First, I examine how the provision of these services at school predicts students' academic performance in both the short- and long-term, analyzing multiple measures of educational outcomes to assess the consistency of the results and controlling for a rich set of school contextual variables. Second, I test whether the relationship between service provision and academic outcomes is explained by increased opportunities to learn. Third, I test whether school provision of preventive/physical health services is more strongly related to academic performance for subpopulations of students facing educational disparities and potential unmet health needs—specifically, subgroups defined by race, family income, and health insurance status.

An important concern in observational survey research of this kind 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 a rich set of measures reflecting schools' level of advantage and academic environment in the multilevel models that test the main relationships in this study helps to mitigate these concerns. However, the potential for selection on unobservable traits remains. Although examining unobservable traits is impossible, 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 other indicators of school quality, including measures of the student body's socioeconomic composition and academic experience. The main analyses consistently show a positive relationship between provision of services and academic performance: Offering preventive or physical health services at school predicts a higher GPA, a higher chance of passing all courses,

and a higher chance of graduating from high school. 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). Experiencing excellent rather than poor childhood health predicts completing an additional half a year of education (Haas 2006). Poor health during adolescence leads to substantially lower chances of completing high school on time (Haas and Fosse 2008; Jackson 2009) and (among high school graduates) attending a two- or four-year college (Jackson 2009). 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). 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

The importance of health in educational outcomes has lead schools to 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 student health guidelines to which schools must attend—such as requiring certain immunizations before enrollment, following certain procedures for medication administration, or requiring specific

health screenings be provided (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 (Brener et al. 2007). Although SBHCs are relatively uncommon (a 2006 study reports that SBHCs only exist in 6.4 percent of schools; see Brener et al. 2007), they are the most researched model for providing healthcare in schools. Thus, any investigation into the effects of school-based health provision encounters studies of SBHCs, which are typically comprehensive clinics providing a range of physical and mental health services (Dryfoos 1995; Gustafson 2005; Silberberg and Cantor 2008). Studies examining SBHCs provide evidence that 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). More than a decade ago, a comprehensive review of research on the link between SBHCs and academic performance found only seven empirical studies, many of which examined multifaceted social and familial service interventions rather than specific health service provision (Geierstanger et al. 2004). These studies generally show positive or null impacts of service presence and/or actual use (Geierstanger et al. 2004). Among those examining health services specifically, 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 also studied attendance and drop out rates for SBHC students, but did not compare these rates to other groups. 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. Although interest in how school-based healthcare influences academics has remained high since the Geierstanger et al. (2004) review, few researchers have heeded their call for more empirical research. One recent study, however, 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). This study defined "medical" vs. "mental health" visits based on the type of practitioner a student saw, rather than by the specific type of service received. Other research examining the type of staffing shows that having a full-time nurse reduces dismissals for health reasons, and in school districts where school nurses are more available, children appear to exhibit higher levels of well-being, lower absenteeism, and higher graduation rates from high school (Maughan 2003).

Beyond the small number of studies, existing work on SBHCs and nursing is limited in a number of 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 specific populations. For example, McCord et al. (1993) examine the impact of registration at one North Carolina SBHC on academic outcomes at "an alternative high school for students who were not able to succeed in traditional educational programs" (p. 91)—an exceptionally high-risk population. Kisker and Brown (1996) examine multiple clinics, but all within the Robert Wood Johnson Foundation SBHC model, established specifically to serve urban high school students with "substantial unmet health needs" (p. 336). Findings from these specific contexts are quite useful in identifying potential effects of services for students who need them most. But they are likely not generalizable, as both the health and educational disadvantages experienced by these populations are atypical for the broader population of adolescents, and the implemented services and specific

school environments are certainly atypical relative to the broader population of schools. Walker et al. (2010) study the Seattle district, considering a more general population of schools and students, but it remains unclear how the Seattle SBHC model and Seattle schools might differ from school-based healthcare provision and high school contexts more broadly.

Existing work is also quite limited in its ability to support causal inferences, and concern is warranted as to the extent of bias in current estimates. Many studies acknowledge that the conditions that would support strong causal inferences (random assignment of services to schools or of students to receive services) do not exist. However, even within plausible analytical designs, most studies fail to consider how schools with services might differ from those without them and other potential issues of selection bias. Studies of school provision of health services seldom consider the broader educational context that surrounds school-based services. Schools are complex environments, and 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. For example, Kisker and Brown (1996) did not examine any other school features beyond SBHC characteristics, and their comparison group for student outcomes was constructed through a survey of a national sample of urban youths without SBHC access that does not appear to have included questions about any other characteristics of the comparison groups' academic environments. Although 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, they too did 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; Coleman, Hoffer, and Kilgore 1982; Condron and Roscigno 2003; Crosnoe 2009; Lee and Burkam 2003; Owens 2010; Rice 2010). Many features are considered important because of how they influence either the instructional capacity of schools and teachers or the academic and social environment that students experience. 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. Yet existing research has generally not considered anything about students' school context besides the presence of services.

One previous paper has addressed a few of these limitations (in addition to bringing a sociological perspective to this typically practitioner-oriented field). In a small part of a study with multiple objectives, Needham, Crosnoe, and Muller (2004) use nationally representative data (also Add Health) in an attempt to understand how aspects of school climate—including health service provision, school size, and student-teacher relationships—condition the relationship between student health and academic problems. Their work includes testing an interaction effect between student health and whether the school offers non-athletic physical exams on site to determine whether the relationship between student health and course failure depends on school context. Needham et al. 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 this is because student health was influenced by school-based physicals; measured in the same survey wave, health status would be measured during the school year that students had access to physicals at school.) Their paper takes a useful step toward a more generalizable analysis of the role of school health services in academic achievement. However, the current study seeks to account for health service provision and school context in a more comprehensive way. It is not clear that non-athletic physicals would be the most or only important service in improving academic outcomes (either in theory or among those measured in Add Health). In this study, I take multiple preventive and physical health services into consideration. Also, school size and student-teacher bonding are the only school characteristics Needham et al. (2004) measure, but it is possible that other school-level factors confound the relationship between students' health and academic outcomes. For example, if students with better health are advantaged in other ways, they may be more likely to attend better schools—such as those with more resources or better teachers—which may also relate to better educational outcomes. I control for several such school characteristics as potential confounders of the relationship between service provision and academic performance. 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). Studies on the comprehensive SBHC model demonstrate that students attending middle and high schools with SBHCs are more likely to make health maintenance/primary care 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 for screening for health risks) than students with only HMO healthcare access (Kaplan et al. 1998). In addition to specific services, students who receive healthcare at school may gain information that helps them maintain better health in the future. Even students who do not visit school health services might acquire knowledge from peers or staff familiar with the services, reaping spillover effects from an environment of better health (Kisker and Brown 1996; McNall et al. 2010

We might expect that if health services are located on school premises, it is easier for an adolescent to get treatment for pain that is distracting in class, easier to receive an early diagnosis and prevent health-related absences, or easier to get immunizations or tests that might otherwise require visiting the doctor during school hours or time that could be spent on homework. By improving students' well-being, health services may augment students' ability to function well at school, learn better, and therefore be better situated to achieve academically. The deleterious effect of poor health on educational outcomes seems to operate at least partially through the relationship between health and 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).

School-based provision of health services could also play a role in reducing educational inequality. 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 affect both health and education especially for the neediest children (Rothstein 2004). Numerous health conditions disproportionately impact children of color and from low-income backgrounds, such as hearing and vision impairments, asthma, obesity, diabetes, anemia, increased exposure to environmental hazards, and overall poorer physical health (Crosnoe 2006; Currie 2005; Dilley 2009; Rothstein 2004). Crosnoe (2006) shows that poorer health among children of color compared to their white peers contributes to racial gaps in achievement and achievement growth. And Rothstein (2004) documents how the cumulative disadvantage of multiple chronic health problems contributes to the socioeconomic achievement gap. 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. A study of eight schools in Ohio and Kentucky found SBHCs disproportionately benefited the health of students from low-income families and without private health insurance (Wade et al. 2008). On the other hand, Jackson (2009) finds that whites experience worse educational outcomes as a result of poor health than do black and Hispanic adolescents, with similar (though not significant) patterns where health problems impact students with better-educated and wealthier parents most adversely as well. Her findings are consistent with the interpretation that "those closer to the top of the hierarchy have further to fall than those who begin lower" (Jackson 2009, p. 675). This finding raises the possibility that the most socially advantaged groups, rather than the most disadvantaged, would derive the most

benefit from health enhancements, such as the increased accessibility of school-based provision. 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 of service provision. It also examines a broad range of preventive and physical health services instead of mental health services or more ambiguous interventions such as clinic or nurse presence. It studies how service provision predicts overall academic performance, but also examines differential effects for subgroups of students, and the extent to which the relationship is mediated by one plausible mechanism. Finally, while prior research typically lacks controls for other school-level characteristics, this study includes a rich 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 as well as the Adolescent Health and Academic Achievement Study (AHAA). Add Health is a longitudinal study including extensive student, parent, and school administrator surveys. 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 context and all students present (over 90,000 students) completed in-school surveys. Approximately 18,000 of these students participated in longer in-home interviews, which provide in-depth information that is nationally representative of adolescents who were in 7th through 12th grade during 1994 to 1995. These adolescents were followed, and 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. (For more detailed information on Add Health, its design, and AHAA see Harris 2011).

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 long in-home surveys administered to students and their parents provide detailed information about adolescents' backgrounds and educational experiences. Moreover, the official records from students' transcripts allow for a nuanced analysis of students' educational outcomes that are not self-reported.

My analyses include schools that completed a school administrator questionnaire, valid school administrator weights,[3] and 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. Because Add Health only measured school service provision in Wave 1 and AHAA only collected high school transcripts, students' grade level at Wave 1 affects what data are available from AHAA for my two short-term and one long-term outcomes. I create two analytic samples depending on the timing of the dependent variable.

Wave 1 High Schoolers Sample. The first analytic sample of students, which I call the "High Schoolers" sample, only includes adolescents who were in high school (grades 9 – 12) during Wave 1. The two outcomes analyzed for this sample (GPA and passing all courses) are based on grades at the end of that school year. These outcomes draw on transcript data concurrent with the year in which schools reported the health services they provide, and since

AHAA only includes high school (not middle school) transcripts, these outcomes can only be analyzed for Wave 1 high schoolers. The High Schoolers sample consists of 7,951 students in 86 schools. This sample averages 92 students per school, with a range from 1 to 950 students. In these analyses, the sample can be interpreted as having had access to school-based services at a time point proximate to their educational outcomes.

Wave 1 All Grades Sample. The second analytic sample includes the 7th and 8th 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. Students in all grades at Wave 1 had passed the age of "timely" high school graduation by the time AHAA collected transcript data at Wave 3, 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. The "All Grades" sample consists of 11,170 students in 127 schools, with an average of 88 students per school, and a range from 17 to 967 students. In analyses of high school graduation, the sample can be interpreted as having had access to school-based services at some point in their adolescence prior to high school 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," "provided by district, at another school," "referred to other providers," or "neither provided or referred." If a school responded that the service was "provided on school premises" it is counted as offering the service. Based on these 16 variables, I identified services representing routine preventive or physical health services, as these are the types of services that would most likely address common health concerns, aid general health maintenance, and influence students' overall

physical well-being. These services include treatment for minor illnesses and injuries, athletic physicals, non-athletic physicals, nutrition or weight loss programs, immunizations, and diagnostic screenings. 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 equal to 1 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). Moreover, a school's broader attention to preventive and physical health needs may be more consequential than whether a specific type of service is provided. 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. I discuss these alternative specifications in more detail following the presentation of the main results.

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 the most commonly provided service, 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 nevertheless provided by a modest number of schools.

[Table 1 about here]

Academic Performance and Attainment. The two dependent variables for the "High

Schoolers" sample 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) a dummy variable measuring whether 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). Using these two measures allows me to capture how service provision relates to educational performance across a broad range of academic achievement, as well as how it relates to the extreme end of academic outcomes (course failure). My third dependent variable, analyzed using the "All Grades" sample, is the student's transcript-recorded exit status as a dummy variable indicating high school graduation (1 = graduated with a standard or honors diploma). This measure allows me to capture a longer-term and consequential marker of educational success. Each of these student-level dependent variables comes from administrative transcript data and is coded to reflect a positive educational outcome.

School-Level Control Variables

An important advantage of using Add Health data for this study is that I can account for numerous characteristics of school context in addition to health service provision. Table 2 displays descriptive statistics for all school characteristics in both analytic samples of schools. These include basic school features of size, type, urbanicity, and region, as well as several variables that indicate social advantage or disadvantage at the school level based on compositional characteristics of the school student body, including racial composition, students with at least one college-educated parent, and students eligible for free or reduced-price lunch.[6] Additionally, I capture schools' academic quality by including measures of teacher experience, average daily attendance rate (a proxy for funding),[7] percent of students testing below grade level, and percent of students in an "academic or college preparatory" instructional program. A concern is that these latter three measures of the school's academic environment could be

endogenous to school-level services—a product of health service provision themselves. I ran models excluding these variables as well (available from the author), and results do not change, so I include them as indicators of school academic environment. Lastly, I also measure two state-specific policies regarding school health service provision at the school level: whether the state funds school-based health centers and whether the state requires schools to offer school health nurse services.[8]

[Table 2 about here]

Student-Level Control Variables

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 students in both analytic samples are displayed in Table 3.

[Table 3 about here]

Methods

To answer my research questions I use two-level models in HLM, nesting students within schools. HLM corrects for clustering (which violates assumptions about the independence of observations because students in the same school are likely to be more similar than students in different schools), and allows data to be weighted at both levels to adjust for Add Health's complex survey sampling design, making the results nationally representative. The analyses to address research question 1 test how school provision of preventive/physical health services relates to student GPA, course failure, and high school graduation. Indexing individuals with *i*

and schools with *j*, I estimate one of the following student level models depending on the outcome variable (using the linear model to predict GPA and the logistic model to predict course failure and high school graduation):

(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 β_1 is a vector of coefficients. Then a school-level equation predicts the random intercept β_{0j} as a function of *S*, the 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 γ_{02} is a vector of coefficients and $\gamma_{01}$is the primary coefficient of interest.

I first estimate Model 1, which controls only for student characteristics. This model approximates previous studies by only considering health service provision at the school level, providing a baseline for understanding whether accounting for other school features alters the central relationship of interest. Model 2 adds all of the school characteristics listed in Table 2. For each educational outcome, Model 2 answers the central question of this study by providing evidence for how provision of preventive/physical health services relates to academic performance when numerous potential confounding factors are taken into account. Model 3 then answers research question 2 by providing a partial test of whether opportunities to learn are a mechanism through which school-based service provision benefits academic performance. Model 3 adds a dummy variable representing whether the student had any absences for health reasons in the previous month to *X* (the vector of student controls) in Student Equations 1 and 2, and I examine how this changes the coefficient for service provision.

To understand whether service provision provides the most educational benefit to

subpopulations of students facing educational disparities and potential unmet health needs (research question 3), I run another set of analyses that 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 β_{0j} is identical to the School Equation 1 above, but the interaction analyses add a separate equation for the student-level coefficient(s) on *M*:

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

In the interaction models, the school intercept and the relationship between the student covariate and academic performance are both modeled as a function of school health service provision.

Missing Data

All schools provided complete data on health service provision. I fill in missing data on control variables using multiple imputation by chained equations.[9] Because my student-level dependent variables come from administrative data, missing values are not equivalent to non-response in the typical survey sense. The very small number of respondents missing outcome variables were dropped based on AHAA's missing data indicators, typically because their course-taking was not included on their transcript or their exit status was unknown.

Results

Addressing Selection

An important limitation in observational survey research of this kind is the worry that omitted factors are related to both student outcomes and the presence of health services on school campus. 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. This potential difference between schools with and without services is one reason to control for measures of school quality and advantage. As described above, my main analyses include a rich set of controls. However, the available measures are finite and the potential for 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 the 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 truly sufficient to capture the most relevant dimensions of quality/advantage and whether there is common support to compare schools with and without services. In order to assess this possibility, I precede my main models with an investigation of how various school characteristics relate to the provision of preventive and physical 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[10] and student body composition.

Across bivariate and multivariate models with both school samples, the only school characteristic that is significantly related to 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 significantly 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 caution against this conclusion. For instance, the percent of new teachers also shows a positive relationship with the presence of services. The percent of students in an academic or 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, when controlling for other school characteristics, schools with a higher percent of students eligible for free or reduced-price lunch are more likely to offer services.

Because the samples contain only 86 and 127 schools, findings that are marginally significant by conventional standards ($p < 0.10$) may be indicative of noteworthy substantive relationships. By this standard, we see that 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 marginally significantly 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 provision.

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 allowed for non-linearity in the coefficients on percent of the student body testing below grade level, percent of the student body in academic or 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 by including squared terms. In no case were these alternatives significant or even substantively large, nor did they ever alter the pattern of results for the other predictors (results of these alternative specifications available from the author). 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 who 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 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 most likely 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 level of 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. First, Model 1 estimates the relationship between provision of preventive/physical health services and academic outcomes when only student characteristics are controlled. Then, Model 2 examines how the relationship changes when both student and school characteristics are controlled, most directly answering Research Question 1. Finally, I add to Model 2 an indicator representing whether the student had any absences for health reasons in the previous month as a partial test that school-based health service provision relates to academic performance by increasing students' opportunities to learn, addressing Research Question 2.

GPA in 1994 to 1995. Table 4 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 we see that absences are a significant predictor of lower GPA, and controlling for this reduces the coefficient on health service provision 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 4 about here]

No course failure in 1994 to 1995. The results from models predicting whether or not students passed all courses in the 1994 to 1995 school year—a marker of educational

performance capturing more of an extreme than GPA—follow a similar pattern to the results for GPA. Key coefficients are displayed in Table 5. 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 suggesting that absences are a partial mediator for the role of school health service provision in academic performance.

[Table 5 about here]

High School Graduation. Table 6 shows key coefficients for the last outcome tested, high school graduation, which is 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.

[Table 6 about here]

Overall, the results of the analyses summarized in Tables 4-6 provide evidence that

students perform better in schools that offer preventive and physical health services. The findings are small to moderate in size, but relatively consistent across measures. They also show that health-related absences explain a small portion of the relationship between service provision and academic outcomes, suggesting that there are likely to be other more powerful mediators.

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 7 displays key coefficients for Models 4, 5, and 6, which build on Model 2 above by adding cross-level interactions between preventive health service presence and student characteristics in predicting each educational outcome. Panel A shows results for interactions by student race.[11] For each outcome the main coefficient on health service provision is similar in magnitude and significance to Model 2, the comparable model without interactions, and all of the interaction coefficients are small and not significant, indicating a constant relationship across racial groups. In Panel B, displaying results for interactions between health service provision and family income, we again see no significant interactions; however, there are two notable things in these results. First, across outcomes the main effect of health services is substantially larger in Models 4, 5, and 6 than in the previous Model 2 (0.237 vs. 0.132 for GPA; 0.782 vs. 0.536 for no course failure; 0.776 vs. 0.395 for high school graduation). Second, across outcomes the interactions are negative. These results provide limited suggestive evidence 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 more noisy and do not attain levels of significance comparable to Model 2, thus it is possible that no difference by family income exists.

[Table 7 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 7, 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 ($e^{0.516+0.575}$). Although not significant, the coefficients for the public health insurance interactions in Model 4 for GPA and Model 6 for high school graduation both suggest a near doubling of the effect of health service provision. Although the interaction for no health insurance is negative across models, none of these coefficients are significant, suggesting that the role of health services is similar for students who have private insurance (the reference group) versus none.

Alternative Specifications

Given that Add Health measures 16 different health services schools provide, these data could be usefully employed to study the role of individual services offered. The focus in the present study is on a broader sense of schools' attention to students' physical health needs, but researchers interested in specific service offerings might find Add Health data fruitful. An alternative approach to measuring physical health provision broadly is to measure the number of services offered, 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 than the main models presented here (results available by request). I chose the approach of 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 preventive and physical health services relates to academic outcomes in two ways. A model adding controls for whether the school offers other types of services (mental health, reproductive health, and drub abuse services) in addition to physical health services, as well as a model controlling for an indicator of providing a large number of services (six to eleven services—the upper tail of the school services distribution in Add Health) 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 risk factors emanating from health issues 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). Moreover, existing studies typically examine a specific single service or the presence of a clinic or nurse, rather than a range of services. 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. I drew on six different services to create my measure.

This study is also distinctive for its modeling of the types of schools that provide health services and for accounting for potentially confounding school characteristics when assessing the relationships between health service provision and academic outcomes. Accounting for a rich set of school context measures shows that school provision of preventive and physical health services is significantly related to higher GPA and higher odds of passing all courses. My multilevel models employ three different dependent variables to assess the consistency of the results when different types of educational outcomes are considered. Across the three outcomes the results show 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

between the measurement of service provision and high school graduation for students who were in different grades at Wave 1. Future research might examine whether consistent provision of health services throughout schooling shows a clearer relationship with measures of attainment. Despite the lack of significance in models predicting high school graduation and controlling for school context, the estimates are consistent with the pattern that school provision of preventive and physical health services is related to better educational outcomes.

We must be cautious in interpreting these relationships as causal effects, of course, 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 to investigate potential selection 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 an important limitation to interpreting my results as representing a causal relationship. However, I have included a rich 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. And if students select into schools with services, those effects should at least be partially captured by student characteristics I control in my multilevel models, such as family background and parental involvement. 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 these analyses and 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 creating a school environment of 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 the 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* as compared to *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 SBHC users vs. nonusers 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 markedly 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. That school-average results in this study are positive and that health-related absences are a partial mediator provides evidence that school-based health services do bolster schools' educational objectives by augmenting health and increasing opportunities to learn, and suggests that we might find even larger effects for schools with higher quality services and for students who access services if these were measured.

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 as health care coverage becomes more universal and school health services receive additional funding, both as a result of the Affordable Care Act (see Rothstein 2012; Shah 2011; Weiss 2012), future research could investigate how school services reach populations of students with different types of health 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, since any academic benefit may be uniform across groups, to reduce inequality health service interventions would need to be targeted to the schools and students that need them most. With strong accountability pressures on schools to reduce gaps by student background 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 appropriation of funds for school health clinics is evidence of an endorsement of this approach. And numerous well-known scholars and policymakers (including Secretary of Education Arne Duncan, when he was Superintendent of Chicago Public Schools) 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 education. 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, the implication is that 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 for student subgroups, they nevertheless have implications for educational 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] Recent research has considered the role of school-based mental health services in students' academic outcomes. 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. Add Health provides measures of these types of services as well; because these services are different in character from preventive/physical health services and presumably are aimed at students engaged in specific types of risky behaviors rather than students more broadly, I do not focus on them in this study.

[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] I create these measures by aggregating data collected with Add Health's in-school questionnaire, administered to nearly all students at participating schools. Other potential measures of aggregate student body characteristics, such as those referencing parents' occupations or family structure, are highly correlated with racial composition and with parental education, and thus have been tested but are not included in the models presented here. Three schools completed the school administrator questionnaire and had students participating in the in-home portion—criteria for inclusion in my sample—but did not have students participate in the in-school portion. For just these schools, I use in-home data to create aggregated student characteristics. I flag these schools in the analysis to ensure this does not unduly affect the results. My measure of percent of free or reduced-price lunch eligible students comes from data that AHAA appended based on the 1993 Common Core of Data collected by the National Center for Education Statistics.

[7] Add Health originally measured average daily attendance using an ordinal variable with values representing 75 to 79%, 80 to 84%, 85 to 89%, 90 to 94%, and 95% or more. I converted this to a linear measure with values at the midpoints of each category—so my measure of ADA takes on values of 77, 82, 87, 92, and 97. Because of this unusual coding, I also control for ADA squared.

[8] These measures are part of additional Census-based contextual data collected by Add Health.

[9] 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. Following multiple imputation for missing data, 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 ten datasets.

[10] 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 an academic or college preparatory program from the model.

[11] Sample sizes for Native American and other race groups are not large enough to estimate separate interaction effects for these groups, so they are included with whites in the reference group.

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Table 1: Counts and Weighted % of Schools Providing Preventive/Physical Health Services

	High Schoolers Sample n = 86		All Grades Sample n = 127	
	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**

Table 2. Descriptive Statistics for School Variables

	High Schoolers Sample (n = 86)		**All Grades Sample** (n = 127)	
	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 an academic or 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 3. 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				
7^{th}	–		17.5	
8^{th}	–		16.6	
9^{th}	25.2		17.3	
10^{th}	25.2		16.3	
11^{th}	23.8		15.5	
12^{th}	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 4. Coefficients for Key Variables from Multilevel Linear Regression Models of School Provision of Physical Health Services Predicting GPA in the 1994-1995 School Year

	Model 1	Model 2	Model 3
	Model with Student Controls	Model with Student and School Controls	Model with Indicator for Any Health Absences
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

Note: Models weighted by school administrator and transcript sample weights. Standard errors in parentheses. Student demographic and educational controls include student sex, race, immigration status, language spoken at home, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental help on a school project (see Table 3). School organizational, compositional, and policy controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in an academic or 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). Full model results including coefficients for control variables are available from the author.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. Coefficients for Key Variables from Multilevel Logistic Regression Models of School Provision of Physical Health Services Predicting No Course Failure in the 1994-1995 School Year

	Model 1	Model 2	Model 3
	Model with Student Controls	Model with Student and School Controls	Model with Indicator for Any Health Absences
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

Note: Models weighted by school administrator and transcript sample weights. Standard errors in parentheses. Student demographic and educational controls include student sex, race, immigration status, language spoken at home, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental help on a school project (see Table 3). School organizational, compositional, and policy controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in an academic or 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). Full model results including coefficients for control variables are available from the author.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Coefficients for Key Variables from Multilevel Logistic Regression Models of School Provision of Physical Health Services Predicting High School Graduation

	Model 1	Model 2	Model 3
	Model with Student Controls	Model with Student and School Controls	Model with Indicator for Any Health Absences
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 demographic and educational controls include student sex, race, immigration status, language spoken at home, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental help on a school project (see Table 3). School organizational, compositional, and policy controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in an academic or 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). Full model results including coefficients for control variables are available from the author.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7. 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 demographic and educational controls include student sex, race, immigration status, language spoken at home, family structure, family income, parental education, grade level, receipt of special education services, and receipt of parental help on a school project (see Table 3). School organizational, compositional, and policy controls include size, type, urbanicity, region, average daily attendance rate, percent of students testing below grade level, percent of students in an academic or 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).

Full model results including coefficients for control variables are available from the author.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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 n = 86		All Schools Sample n = 127	
	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.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$