How Does Access to Health Care Affect Teen Fertility and High School Dropout Rates? Evidence from School-based Health Centers*

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October 2015

Abstract

Children from low-income families face persistent barriers to accessing high-quality health care services. Providing primary care services through schools is a potentially powerful way to target health care services to this population that can affect important life outcomes. This paper examines the provision of primary care health services to students from low-income families that are delivered through school-based health centers (SBHCs). Using the timing of center entry combined with changes in service levels from year to year at these centers, we estimate how the primary care services provided by SBHCs affect teen fertility and high school dropout rates. Our results indicate that school-based health centers have a large, negative effect on teen birth rates: adding services equivalent to the average SBHC reduces the birth rate for girls 15 and under by 30% and reduces the 16-19 year old birth rate by 11-15%. The effects are largest among centers that offer access to hormone-based contraception. However, primary care health services do not reduce high school dropout rates by very much despite the sizable reductions in teen birth rates.

KEYWORDS: School-based Health Centers, High School Dropout, Heath Care, Teen Childbearing

*We would like to thank the National Alliance on School-based Health Care for allowing us access to their data and for their assistance in using the data. We thank Will White, Nicolas Ziebarth, Samuel Kleiner, Janet Currie, Phil Levine and Anjali Adukia for helpful discussions, as well as seminar participants at the CESifo conference on economics of education, the NBER Summer Institute Children's Working Group, the New York Federal Reserve Bank Economics of Education Seminar, University of Chicago, Michigan State University, Bocconi University, University of Wisconsin, University of Oklahoma, and the Association for Education Finance and Policy Annual Meeting. We also gratefully acknowledge funding from the Department of Policy Analysis and Management at Cornell University for this project.

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1 Introduction

Access to affordable health care for low-income Americans has become a preeminent policy issue in the U.S. The massive expansions of Medicaid and the State Children's Health Insurance Program that occurred over the past several decades have caused the gap in health insurance coverage between children from low-income and high-income families to all but disappear. Yet, health care access for children depends both on the affordability of care and on convenient availability of effective health care. Despite the elimination of the health insurance coverage gap, low-income families still face considerably higher costs of accessing high-quality health care services that drive disparities in the quality of care across the socioeconomic distribution (Smedley, Stith and Nelson 2003; Andrulis 1998). This quality gap can be attributed in part to supply-side factors, such as medical practices choosing not to accept Medicaid insurance and the reluctance of many doctors to locate their practices in low-income urban or rural areas. The gap also may be due to demand-side factors, such as low-income adults lacking information on appropriate health care providers or finding it difficult to take time away from hourly-paid jobs in order to accompany their children to these providers.

Medicaid eligibility leads to better health (Currie and Gruber, 1996a; Finkelstein et al., 2012; Kaestner, Joyce and Racine 2001; Currie, Decker and Lin 2008), more stable household finances (Gross and Notowidigdo, 2011) and higher educational attainment and earnings (Cohodes et al. forthcoming; Brown, Kowalski and Lurie 2014). However, inadequate access to primary care facilities and doctors among low-income families may preclude them from realizing these benefits of health insurance, which can render the roughly $86 billion the U.S. spends on Medicaid for children less effective. Given the large and persistent disparities across the socioeconomic distribution in academic achievement, health care access, and health status,[1] understanding how primary care health care services affect important life outcomes among youth is of high policy relevance.

In this paper, we explore whether expanding teenagers's access to health care influences their fertility rates and their educational attainment. We estimate the effects of providing primary care health services to teens through school-based health centers (SBHCs), which are health

[1] For example, see Currie, Decker and Lin (2008), Adler and Rehkopf (2008), Case, Lubotsky and Paxson (2002), Cunha et al. (2006), Conti, Heckman and Urzua (2010), and Todd and Wolpin (2007).

clinics located in a school or on school grounds. While they vary in size and scope, virtually all SBHCs provide basic preventative health services to students, and many of them also provide reproductive health services and contraception. SBHCs target underserved communities by predominatly locating in schools in low-income urban and rural areas. They therefore can dramatically reduce the costs of obtaining health care services for children from low-income families. Particularly for reproductive health among teenagers, these SBHCs may be extremely effective at increasing health care utilization because they reduce any reliance on parents to bring teenage students to the doctor. Currently, there are over 2,000 SBHCs in the US, and their prevalence has increased markedly over the past 25 years (see Figure 1). Although these centers are an increasingly important way through which low income youth receive primary care health services, little is known about how they affect student health and education.

Our analysis makes two contributions to the literature. First, we present new evidence on the effect of primary health care services delivered through schools on teen birth rates. Whether a teenager gives birth is a critical health outcome that can have long-run consequences for the individual. Teen fertility rates in the U.S. are very high relative to similarly-industrialized nations but also have declined substantially in the last 25 years (Kearney and Levine 2012).[2] Currently, there is very little understanding of what policies are effective in reducing teen births as well as what underlies the recent downward trend in teen fertility. Providing health care services to teens, and in particular easy-to-access contraception through health centers in schools, may be an effective policy tool with which to lower teen birth rates. This paper is the first in the literature to estimate the causal effect of such primary care services on teen fertility.[3]

Second, our paper is the first to examine how primary health care services affect the educational attainment of children from low-income families. Providing access to primary health care services could increase educational attainment through any effect on child health as well as on family finances. A sizable amount of work has demonstrated that poor health or adverse health

[2]Kearney and Levine (2014) find evidence that the MTV show *16 and Pregnant* explains about one third of the decline in teen births that occurred between 2009 and 2010. Due to the timing of when this show began, they are unable to examine the causes surrounding the large drop in teen fertility between 1990 and 2009, which is the period on which our study focuses.

[3]Much prior research has examined the effect of the diffusion of the birth control pill in the 1960s and 1970s on fertility decisions and life outcomes of somewhat older women (Goldin and Katz 2002; Bailey 2006, 2010; Ananat and Hungerman 2012). This literature does not analyze the effect of access to contraception among teens on fertility nor does it examine the efficacy of providing contraceptive services through schools, which is what we focus on in this analysis.

events among children are associated with worse long-run outcomes (e.g., Currie et al. 2010; Case, Fertig and Paxson 2005; Case, Lubotsky and Paxson 2002). Studies have found positive effects from specific types of child health interventions, such as hookworm eradication (Bleakley 2007), malaria eradication (Bleakley 2010) and school-based deworming drug interventions (Miguel and Kremer 2004). Several papers have also explored the 'fetal origins' hypothesis and have found evidence that pre-natal health care and health outcomes affect subsequent academic performance and success (e.g., Almond and Currie 2011; Figlio et al. 2014). Yet, we are unaware of prior research that credibly estimates the causal effect of comprehensive health services for school-age children on their educational attainment.

A major hurdle in estimating the effect of health care services on fertility and education that has impeded prior research is that access to such services is not exogenously assigned: unobserved factors correlated with the quality of health care service availability are likely to be correlated with underlying fertility and education outcomes. We overcome this problem by exploiting the opening and yearly service level changes of school-based health centers in different school districts in the U.S. We obtained data from surveys of SBHCs conducted by the National Alliance on School-Based Health Care in 1998, 2001, 2004, 2007 and 2011. Centers are followed longitudinally, and in addition to being able to link them to the districts they serve, we have information on when each center opened, its size in terms of students served, hours open, staffing hours, and the specific health services it provides to students. We focus on centers that serve high school students, and overall we observe 2,586 centers during our analysis period.

To identify the effect of SBHCs on teen fertility rates and high school dropout rates, we combine the NASBHC survey data with county-level information on births as well as district-level information on high school dropout rates. We measure treatment by whether there is *any* SBHC open in the county or school district as well as by treatment intensity using the primary care staff hours per week and total medical staff hours per week offered by SBHCs. Together, these measures provide a comprehensive depiction of the medical services offered to students. Our main identification strategy is essentially a difference-in-differences approach that exploits changes over time in student access to primary care services due either to center openings or to yearly service level variation. The main identification concerns with our approach are that center entry is endogenously related to pre-treatment trends in the county or school district and that service level variation is correlated with fixed trends in birth rates or educational outcomes. Using the panel structure of our data, we present extensive evidence that center entry is not endogenous with respect to pre-treatment trends in our outcomes of interest. This finding is consistent with our argument that there is substantial idiosyncratic variation in the timing of SBHC openings that is driven by the lengthy bureaucratic process required to open a center. To address concerns related to endogenous yearly service level variation, we exploit the exogeneity of the initial opening of a center with respect to potential birth and dropout rates. We employ two instrumental variables strategies that isolate the variation in primary health care services driven only by the first center opening in an area. The timing of center entry varies significantly across counties and school districts, allowing us to control for state-by-year fixed effects that provide further confidence in the validity of our approach.

Our analysis begins with an examination of the effect of school-based health centers on teen births. We use U.S. vital statistics data for which the smallest level of geographic identification is the county. Our baseline estimates show that center entry in a county reduces the birth rate of girls aged 15 and under by 0.052 per 1,000, which is a 6.6% reduction relative to the baseline birth rate. The reduction in births per 1,000 15-17 year olds is 1.76, or 3.8%. Just using the existence of a center in a county ignores potentially important service differences across centers. Our preferred estimates examine the effect of adding additional primary care or total medical staff hours at an SBHC, and we scale the treatment effects to give the impact of adding services equivalent to an average-sized SBHC because this is a policy parameter that is straightforward to interpret. These results reveal that service changes equivalent to opening an average-sized center lead to a 10% reduction in births per 1,000 girls aged 15 and under and a 5% decline in births per 1,000 women aged 16-19. The IV results are considerably larger: an average-sized center reduces under-16 birth rates by about 30% and 16-19 year old birth rates by 11-15%. The IV estimates are larger because we find there are short-run increases in birth rates after initial entry for centers with higher service levels that we argue reflect the targeting of services to the centers that need them most. This biases the OLS estimates towards zero, and hence the IV results more accurately reflect the causal effect of SBHC services on teen fertility.[4]

[4]As we discuss in Section 4, the IV estimates also help reduce attenuation bias from measurement error that is driven by center

Using the information on the types of services provided by SBHCs, we examine how the birth effects we document vary by the type of contraceptive options offered by the local centers. We split centers into four mutually exclusive and exhaustive groups: those prescribing hormone-based contraceptives (such as the birth control pill) on-site, those that provide referrals to patients for hormone-based contraceptives and provide condoms on-site, those that provide referrals to patients for hormone-based contraceptives but do not provide condoms on-site, and those that provide no contraceptive services or referrals. We find evidence that the largest fertility effects come from centers that prescribe hormone-based contraceptives on-site. Providing teenage girls with access to hormone-based contraceptives that does not require as much parental involvement can significantly reduce birth rates.

Despite the effectiveness of SBHCs in reducing teen pregnancies, we find no evidence that they substantially reduce high school dropout rates. We measure high school dropout rates using reported high school diplomas awarded at the district level and U.S. Census and American Community Survey (ACS) data. Our estimates are universally small in magnitude, vary in sign across specifications, and are only rarely statistically significantly different from zero. For example, we can rule out at the 5% level that increasing primary care service hours equivalent to an average-sized SBHC would reduce high school dropout rates by more than 0.08 percent (i.e., less than a tenth of a percent).

Our most economically significant finding is that school-based health centers produce large declines in teen childbearing. There is much policy interest in reducing teen birth rates in the U.S. due to their high levels and the potentially high private and social costs associated with teen births (Kearney and Levine, 2012). At least for this outcome, these centers are quite effective at altering teen health. That they do not translate into changes in high school dropout rates underscores the importance of more research examining the role of health care services among school-age children on educational attainment.

non-responses to the survey.

2 School-based Health Centers

School-based health centers (SBHCs) are health clinics that are located inside specific schools or elsewhere on the school's property.[5] They are funded by some combination of state and federal government funds as well as by private foundations.[6] While they have been in existence since the 1930s, there has been a large increase in their prevalence since the 1990s. Figure 1 shows the distribution of opening years for SBHCs in our data (see Section 3 for a description of these data). Over 85% of these clinics opened after 1989, with over 41% opening after 1997. This expansion has occurred unevenly across states: Figure 2 shows the number of SBHCs in our data in each state. They are located in all but five small states, and the largest concentrations are in the Northeast, Midwest, Southwest and West. However, there also is a large number of centers in Louisiana, Texas and Florida, which highlights the large geographic coverage of school-based health care in the US. Together, Figures 1 and 2 show that in the past two decades, an increasing proportion of students from low-income families across the United States have been exposed to a health center that is attached to their school.

SBHCs provide services for two main types of students: urban students in school districts serving low-income populations and rural students. As of school year 2010-2011, 54% of the centers were located in urban schools, with 28% located in rural schools and 18% in more suburban areas. Sixty-three percent of the students exposed to a school-based health center are of either African American or Hispanic descent. The focus of SBHCs is on providing primary care services for student populations. The majority of centers are attached to high schools, but many centers also provide services for students outside of the school to which they are attached: only 38% of centers report that use is restricted to students in the school. About a quarter of the SBHCs allow for families of the student to use the services, and 25% also allow use by school personnel. Almost 35% of the centers also report that they serve students from other schools. In some cases, the services provided are free to students. However, most

[5] These are distinguished from community health centers that began opening in the mid-1960s to provided care to low-income communities as part of President Johnson's war on poverty. Bailey and Goodman-Bacon (2015) exploit the timing of the opening of these centers and show they had a significant effect on mortality rates of people over 50 years old. Relative to these centers, school-based health centers are focused on a much younger population with different health needs, and their prevalence is much more recent than general community health care centers. However, both types of centers are focused on bettering the provision of health care services to low-income communities.

[6] School districts themselves typically do not provide direct financial support to these centers, other than providing space for them on school grounds. As such, these centers are unlikely to substantially crowd out other school programs or resources. We explore this issue formally in Section 5.3.

centers operate more like traditional clinics and charge patients for services rendered. Due to the location of SBHCs, most students exposed by these centers are Medicaid-eligible, though, so these fees are unlikely to pose a large constraint to access. This feature of SBHCs highlights the fact that the treatment we examine is mostly due to health care *provision*, not due to health insurance access *per se*.

All centers provide primary care services, but the exact services provided by SBHCs vary across centers. The distribution of primary care services is shown in Figure 3, Panel A. About 85% of centers provide some form of reproductive health service as well. Figure 3, Panel B, shows the distribution of reproductive health services other than contraception provided by SBHCs in 2007-2008. Mostly, these services include testing for sexually transmitted infections, preventive care such as gynecological exams, PAP tests and prenatal care, as well as both abstinence and birth control counseling. Almost 40% of centers also are allowed to either prescribe or dispense contraceptives of some form directly, but many of the remainder refer students to other providers for contraception. Table 1 shows detailed information about the types of contraceptive services SBHCs offer. Over 37% either can dispense or prescribe the birth control pill, and another 30% can refer patients to other doctors for a prescription. Condoms are dispensed at over 30% of centers, and emergency contraception or plan B also is available either directly or through referral at the majority of SBHCs. Table 1 highlights that a large proportion of SBHCs provide significant contraceptive services but that there is considerable heterogeneity across centers in the types of contraceptives to which they give student access and the method by which students can access contraceptives. Because of the location of these centers, they may provide particularly important access to contraceptive services for female students who do not need to be taken to them by parents or guardians.[7]

In addition to primary care and reproductive health services, many school-based health centers have mental health and dental services. Eighty-four percent of centers provide oral health education, and 57% have dental screenings. Only about 20% conduct dental examinations, but the majority are able to refer students to dentists if they require dental services. Over 70% of health centers also have mental health providers on staff, with the remainder typically providing

[7] Currently, 26 states allow all minors over 12 to consent to birth control without their parents' approval. Another 20 states allow minors to consent under certain circumstances, such as being deemed "mature" or having a health issue. The remaining four states have no statutes regarding minor access to birth control.

referrals through the primary care doctors for students who need mental health services.

Our main methodological approach is to exploit the differences across areas in the timing of SBHC entry. Thus, it is important to understand the process by which centers are opened that underlies the variation we use. While the specific requirements vary by state, typically it takes several steps to open a school-based health center: 1) conduct a needs assessment to determine lack of access to health care among students, 2) build a partnership between the school and a local health organization (e.g., the department of public health, a local hospital, or a community health center), 3) generate a funding plan, 4) find appropriate space in the school, 5) obtain approval from the state/local government, 6) develop a staffing plan that includes mechanisms for coordinating services across agencies, and 7) modify the space in the school so that it meets code for health clinics and has proper equipment. The impetus to open a center in a specific location can come from local public health officials, school administrators, or community leaders. States typically require that an application for a new center is sent directly from the health organization that would operate the center, along with appropriate sign-off from the school district that would host the center. There are clearly substantial bureaucratic and organizational hurdles associated with opening a center, and in practice it takes several years from initial conception to a center opening. This makes it difficult to target openings based on short-run trends or shocks in health or educational outcomes. The large number of administrative hurdles and the need to mobilize numerous community groups likely generate considerable random variation in the specific year in which a center opens. As we show below, our data are consistent with the contention that center entry is not being targeted based on short-run trends in our outcomes of interest.

Overall, SBHCs give students access to primary care doctors and nurses as well as more specialized medical services depending on the center. Since most centers can refer patients to more specialized doctors, the increased access to primary care services that SBHCs represent is likely to increase health care options substantially for students who are served by these centers. The focus of this paper is on evaluating whether this increased access to health care affects teen birth rates and high school dropout rates. The main mechanisms through which these centers could impact student educational attainment are twofold. First, access to health care services could lead directly to better student health outcomes. To the extent that health enters positively in the production function for educational achievement, these health increases could drive better educational outcomes. A potential concern with this mechanism is that teens may be quite healthy. If high school students do not require much access to health care, then SBHCs will have little impact on them, at least in the short-run.

Despite the fact that high school corresponds with a relatively healthy part of the lifecycle, there is evidence that a substantial fraction of teens have health problems that would benefit from medical interventions. Figure 4 shows tabulations from the 2011 Youth Risk Behavior Surveillance System (YRBSS), which is a nationally-representative health survey conducted by the CDC that focuses on students in high school. As the figure demonstrates, the incidence of mental health issues and the prevalence of sexual activity amongst high school students is high. For example, almost 30% of students report feeling sad or hopeless, over 15% report considering suicide, and about 7% have attempted suicide. Almost 60% of these students have had sex, and many have done so without a condom or without any birth control. Furthermore, a non-trivial proportion of the sample reports being a victim of physical violence, and incidence rates of asthma and obesity are also high. Figure 4 shows racial/ethnic differences in these health outcomes as well, with black and Hispanic students reporting outcomes consistent with lower health levels and more risky behaviors. As discussed above, most health centers offer reproductive services that include birth control as well as pregnancy and STI testing. In addition, most offer mental health services. The tabulations in Figure 4 are suggestive that such services would be of value to many high school students.

There is further evidence of unmet health care needs among lower-SES high school students. In a review of the public health literature, Flores (2010) reports that the preponderance of work points to large disparities in adolescent health outcomes and health care access across the socioeconomic spectrum. Harris et al. (2006) show that about 25% of black and Hispanic adolescents report needing medical attention but not receiving it, as compared to about 18% for whites. About 7-10% of these adolescents also report being in poor health. Hence, there is ample evidence that teens in the U.S. have health outcomes and unmet health care needs that could lead SBHCs to have a substantial positive impact on their health and on their subsequent educational attainment.

Second, access to affordable primary health care can reduce the household's exposure to financial risk from an adverse health event (Gross and Notowidigdo, 2011; Leininger, Levy and Schanzenbach, 2009; Finkelstein et al. 2012). Receipt of primary care services may make students healthier and allow them to address health problems before they worsen and cost more to treat. This effect of primary care service provision thus could better the financial position of households, which can lead to higher student academic attainment.[8]

Despite the rise in SBHC prevalence in the US over the past several decades, there is no nationally-representative study of these centers using methods that can plausibly identify their causal effects on health and education. Several prior analyses have examined the relationship between SBHCs and student health and educational achievement, and they typically show a positive relationship between SBHCs and these outcomes (Kerns et al. 2011; Walker et al., 2010; Geierstanger et al., 2004; Kisker and Brown, 1996). However, these studies have several serious shortcomings that we seek to address in this paper. First, all previous analyses have focused on identifying the effect of one SBHC or of several in a particular city or school district. No study of which we are aware has estimated SBHC impacts on health and academic outcomes for the entire United States. Results from the current literature thus are hard to generalize to larger state or national populations. Second, the previous work in this area largely has been cross-sectional in nature, either comparing outcomes across students who do and do not use the SBHC within a school or comparing student outcomes across schools with and without a health center. It is unlikely the set of control variables in the data sets used are sufficient to control for selection across schools or into SBHC use within a school. Thus, using cross-sectional methods in this context makes it very difficult to identify the causal effect of SBHCs on student educational attainment.

One recent study of SBHCs in New York City uses a similar methodology to ours and finds evidence that SBHCs located in elementary and middle schools increase student test scores in those schools (Reback and Cox 2014). Their findings suggest that the health benefits from SBHCs could increase educational attainment, particularly if positive effects on middle school students do not fade during high school. Our work complements this analysis by examining

[8] See Michelmore (2013) and Dahl and Lochner (2012) for evidence on the effect of family income on student academic attainment.

the impacts of SBHCs serving high school students, by examining health outcomes, by directly estimating effects on educational attainment, and by providing estimates for the entire US.

3 Data

The data for this analysis come from four sources: 1) National Alliance on School-based Health Care National Census of School-based Health Centers, 2) Live birth data from the U.S. Centers for Disease Control and Prevention National Vital Statistics System, 3) National Center for Education Statistics (NCES) data on high school diplomas awarded and enrollment, and 4) U.S. Census and American Community Survey data on school district dropout rates. Below, we discuss each of these data sources in turn.

3.1 NASBHC Census of School-based Health Centers

Beginning in 1998, the National Alliance on School-based Health Care began surveying school-based health centers about their locations, staffing levels, services provided, usage and the timing of when they first opened. They repeated their survey in 2001, 2004, 2007 and 2011. The survey is designed to be a census in the sense that all centers known to NASBHC are contacted, but there is considerable non-response. In the 1998 survey, 70% of centers contacted responded, and the response rates were 85%, 78%, 64% and 77% in 2001, 2004, 2007 and 2011 surveys, respectively.[9] Across all surveys, we observe 2,586 centers serving high school students in 566 school districts throughout the United States. This number of centers is larger than the total number of centers that exists in any one year, which is due to center closures over time.

Each NASBHC survey contains detailed information on center location (e.g., zip code), services, utilization, days and hours open, what populations the center serves, and staffing hours for both primary care and total medical staff. Primary care staff includes physicians and nurse practitioners only. Total medical staff hours include mental health, dental care, nurse and physicians assistant hours in addition to primary care. Thus, for survey respondents, we have comprehensive information on the level and types of services the center provides for students.

[9]Much of this non-response is actually due to center closures. Although NASBHC attempts to purge their roles of closed centers, which centers close is difficult to observe. Thus, the response rates among currently active centers is likely to be significantly higher than what is reported here.

In order to obtain a panel of SBHCs, we link centers over time across the different surveys. The center identification codes NASBHC uses changed over time, so that a unique id does not exist for each center. Instead, we match centers over time by linking them to the school districts in which they are located. Matching centers to school districts is complicated by the way centers report the schools that they serve. Since the survey question is open-ended, many centers give responses such as "all schools in district" or "only our schools" without naming the district or individual schools. Instead of relying directly on school names for the match, we use the geographic information about the center that was provided in the 1998, 2007 and 2011 waves. Centers in these waves were matched to school districts based either on their zip code or on their city and state. A school district was considered a match if it was the only district that shared this geographic information. Centers that could not be linked to school districts in this way, either because the geographic information applied to more than one district or the survey was missing information, were hand-matched to districts by using the NCES online school search tool. Centers were then matched to each other over time using the name of the center, the school in which the center is located, the schools the center serves, and the opening year. A center was matched across time if the name of the center and state were the same or the school location, name, and state were the same. Due to changes in reported names or school location, many centers had to be hand-matched across waves. It is important to highlight that the aggregation to the school district level means that errors made in matching specific centers to each other over time will not affect our results as long as we correctly link centers to school districts. Given the data limitations in the NASBHC data, using school-district level aggregations likely leads to less measurement error than if we had attempted to match each center to a specific school.

One of the drawbacks of our data is that we observe service and staffing levels only for the years in which the surveys were completed. However, for all but 51 centers (or 1.9% of the total centers observed), the opening date is contained in the survey.[10] These center opening dates allow us to use outcome data from before 1998. As Figure 1 demonstrates, 58% of the centers in our data were opened prior to 1998, so the use of these earlier data increases the amount of treatment variation considerably. For observations prior to 1998, we assume each SBHC has the

[10]We drop these 51 centers from our analysis, since we have no way of knowing when they first opened.

service level equal to the first time we observe the center in the data. We linearly interpolate center service levels between surveys as well. Furthermore, we assume a center closed when we no longer observe it in our data.[11]

3.2 Vital Statistics Birth Data

Data on all live births in the US come from the birth certificate files of the Centers for Disease Control and Prevention National Vital Statistics Data.[12] For each birth, we observe the race and ethnicity of the mother as well as her age. For mothers who live in counties with more than 100,000 residents, we also observe the county of birth. Recall from Section 2 that SBHCs are concentrated in urban and rural areas. The fact that geographic identifiers only are available for large counties means that our birth analysis is most relevant for the urban school-based health centers. The birth and SBHC data are merged based on the county of the SBHC. To the extent that school districts split county lines, we assign each center to the county in which it is located.

The vital statistics data give us information on all live births in 793 counties in the US from 1990 through 2012. Beginning the analysis in 1990 captures 86% of the SBHC opening variation in our data; we are loathe to extend the analysis sample back farther given that the first year we observe SBHC characteristics is in 1998. We construct birth rates per 1,000 women in each county for two age groups: ≤15 and 16-19. Mean birth rates by age group are shown in Table 2. Because of the timing differences between conception and birth, we link all births to the prior school year's school-based health center treatment measure.

3.3 Common Core of Data High School Diploma Data

Since 1998, the National Center of Education Statistics has collected information on the number of high school diplomas awarded in each school district. These data are reported as part of the Common Core of Data (CCD).[13] We use these reports, combined with grade-specific

[11] The way we identify center closings likely confounds closure and survey non-response for centers that respond to the survey in an earlier year but not subsequently. However, this method will bias our estimates towards zero to the extent that some centers we code as closing are still providing services to students. Furthermore, our instrumental variables strategy should account for any measurement error induced by center closures and non-response, as the instruments we use are unlikely to be related to closure or non-response.

[12] These data are available at http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm.

[13] The CCD diploma data are available at http://nces.ed.gov/ccd/drpagency.asp.

enrollments, to construct a measure of high school dropout rates. Specifically, we estimate the dropout rate for a given grade as $1 - \frac{Diplomas_t}{Enrollment_{t-g}}$, where g$\in [0, 1, 2]$. For example, when g=2, this formula yields the 10^{th} grade dropout rate. In particular, it is the proportion of 10^{th} graders in the district from two years ago that do not receive a high school diploma this year. Similarly, we calculate the 11^{th} and 12^{th} grade dropout rate using once-lagged enrollment of 11^{th} graders and year t enrollment of 12^{th} graders. We calculate these rates for each school district in the US, from 1998-2010.

Heckman and LaFontaine (2010) and Mishel and Roy (2006) provide detailed discussions of the problems arising from using the CCD diploma data to calculate graduation rates.[14] The biggest problem with these data is associated with the use of 9^{th} grade enrollments, as there is a substantial amount of grade retention in 9^{th} grade. This grade retention is more prevalent for low-SES students as well, and it leads one to understate graduation rates, especially for minority students. Heckman and LaFontaine (2010) show that when one uses 8^{th} grade enrollments instead, this bias is reduced considerably. We instead ignore 9^{th} grade enrollment and focus on enrollment in higher grades that are less problematic. To the extent that SBHCs affect the likelihood of being held back in 9^{th} grade, we thus will miss some of the ways in which these centers influence students' paths through high school. However, our estimate should not be seriously affected by the retention rate problems that come with using 9^{th} grade enrollment data.

The CCD diploma data cannot distinguish between actual dropout rate changes and changes in the timing of degree receipt and student transferring behavior. Thus, this dropout rate will predominantly measure "on time" high school graduation for those in each grade cohort net of transfer. If there is a net loss of the 10^{th}-12^{th} grade cohorts due to transferring out of the school district, however, this measure will show an increase in dropout rates. For transferring to create a bias in our estimates, it would have to be correlated with SBHC entry/exit and service changes. While possible, we do not believe such effects would be large. The complications induced by these data are balanced by the fact that they are yearly, allowing us to exploit more within-district variation in SBHC services. Table 2 presents descriptive statistics of dropout rates calculated using these data.

[14] See also the comprehensive review of U.S. high school graduation rates in Murnane (2013).

3.4 US Census and ACS Data

Due to some of the potential problems with the CCD diploma data, we supplement our graduation analysis with 1990 and 2000 Census data as well as with the 2005-2011 American Community Survey. Using these data, we calculate for each school district the proportion of 14-17 year olds living in the school district who are not enrolled in school and who do not have a high school degree. This is the 14-17 year old dropout rate. The 18-19 dropout rate is calculated similarly using those aged 18-19. It is important to highlight that high school degrees in the Census/ACS include GEDs. Thus, we are unable to determine in our data whether SBHCs are shifting students from a GED to a traditional high school diploma. The evidence on the relatively lower returns to a GED than a high school diploma suggest such a change would be of value (Heckman and LaFontaine 2006), but our data do not allow us to measure these outcomes separately. However, to the extent that the Census/ACS and CCD graduation rate estimates yield similar results, it suggests that our inability to separate GED and traditional high school diplomas is not a driver of our estimates. Descriptive statistics of the dropout rates in the Census and ACS are shown in Table 2.

Because the ACS data are for a period of 3 years, we use the average SBHC service level over those 3 years for each school district when we analyze these data. In addition to providing a check on the NCES-based dropout rates, the Census/ACS data allow us to calculate dropout rates separately by gender.

4 Empirical Methodology

Our methodological approach to overcoming the inherent endogeneity between health care access, health and educational attainment is to use the variation in student exposure to health care services that is driven by school-based health center openings and the scope of the services provided. Our baseline model is a straightforward difference-in-differences design that uses variation only from the initial center entry in an area. Thus, we compare changes in birth or graduation outcomes in areas that receive their first center relative to areas that do not receive their first center in that year. Due to data limitations, our birth rate analysis and completion rate analysis occur at different levels of aggregation. In the birth data, the county is the most disaggregated level of geography available, so this part of the analysis is done at the county level.[15] In particular, we estimate models of the following form:

$$Y_{cst} = \beta_0 + \beta_1 SBHC_{ct} + \gamma_c + \delta_{st} + \epsilon_{cst}, \quad (1)$$

where Y_{cst} is the birth rate per thousand women in county c in year t,[16] γ is a set of county fixed effects, and δ is a set of state-by-year fixed effects that control for any state-level unobserved shocks in each year as well as state-year level policies (such as Medicaid). The variable $SBHC$ is an indicator variable equal to 1 if there is a school-based health center in the county and is zero otherwise. Thus, the variable of interest in equation (1) is β_1, which shows the effect on the birth rate of a SBHC entering the county.

For the birth rate analysis, equation (1) is estimated at the county-year level. It is important to highlight that the county fixed effects control for any fixed differences across counties in birth rates that are correlated with SBHC treatment. The identifying variation for β_1 comes only from differences in the timing of the first center opening across counties. Identification of β_1 thus rests on several assumptions that are common in difference-in-differences analyses. The first is that the decision to open a center is uncorrelated with trends in teen birth rates. Put differently, counties in which a SBHC will open in the near future should have the same outcome trends as those that will not experience an initial opening in the near future. Of particular concern is whether centers are put into schools where the teen birth rate is declining. If so, equation (1) will not be able to distinguish treatment effects from differential secular relative trends. We do not believe, however, that this concern is very relevant in this context. It is far more likely that SBHCs are targeted toward schools that have declining health outcomes. As discussed in Section 2, the timing of when centers open is likely to be related to lack of health care access among students, the desire and ability of a principal or administrator to partner with a local health care provider, space in the school, and demand among the community for expanding health care access for low-income kids. Many of these factors may be related to underlying trends in health or educational attainment, but the sign of any resulting bias would

[15] One benefit of using aggregated data is that our estimates account for both the direct effect of SBHCs on teen pregnancy and the indirect effects coming through peer influences that Yakusheva and Fletcher (2015) show are important.

[16] We also have estimated models that use the log of the birth rate. These estimates are very similar to those shown below and available from the authors upon request.

be towards zero.[17] However, the multiple steps and administrative hurdles necessary to open a center make it very likely that there is exogenous variation in the specific year in which a center opens. We test directly for whether center entry is related to pre-SBHC birth rate trends with the following "event study" specification:

$$Y_{cst} = \phi + \sum_{\tau=-5}^{10} \alpha_\tau I(t - t_0 = \tau)_{ct} + \gamma_c + \delta_{st} + \epsilon_{cst}. \qquad (2)$$

In equation (2), $I(t - t_0 = \tau)$ is an indicator variable equal to 1 if the observation is τ years away from the first SBHC opening in the county and is equal to zero otherwise. These variables are zero for counties that have no health centers in the time period of our analysis. This event study model allows us to both test for pre-treatment trends by examining $\alpha_{-5} - \alpha_{-1}$ and to test for time-varying treatment effects (given by $\alpha_0 - \alpha_{10}$) that might be missed in equation (1). We examine an event window from relative year -5 to 10 as outside that window we have fewer observations with which to identify each relative time parameter. All observations with relative times to treatment outside this window are dropped from this part of the analysis. However, we include all "never-treated" counties, which constitute the implicit control group in this model.

Another identification concern with difference-in-differences analyses is that secular shocks or unobserved policies that correlate with the timing of the treatment can bias the results. Such shocks are unlikely to be a factor in this analysis, however. Since the timing of the treatment varies across counties, it is doubtful secular shocks exist that are highly correlated with the timing of SBHC entry. That is takes several years for centers to open from when they are initially conceived also makes it unlikely that they are systematically correlated with county-level shocks. As well, the use of state-by-year fixed effects helps control for any state-level policies or shocks that could be correlated with the timing of treatment.

The coefficient β_1 in equation (1) yields the average effect of center entry. This treatment specification omits a large amount of heterogeneity across centers, though, in the amount and type of services offered. From a policy perspective, we are interested more in the services offered through the centers than the centers *per se*. We therefore estimate versions of equation (1) that replace $SBHC_{ct}$ with $Service\ Hours_{ct}$, which are measures of the amount of services provided

[17] We also note that if the timing of center openings were related to unobserved trends, our birth rate and dropout rate estimates should be biased in the same direction. That we find no effect on high school dropout rates but a large negative effect on teen fertility rates argues against such selection.

by each center relative to the underlying size of the student population. Specifically, we focus on two different service measures: Primary Care Staff Hours per week and Total Medical Staff Hours per week. These services are set to zero prior to an SBHC opening. The Total Medical Staff Hours differ from Primary Care Hours due to hours from mental health staff, dental staff, physician's assistants and nurses. In the Online Appendix Table A-1, we also show estimates that use Days per Week and Hours per Week as the service measures. As Primary Care Staff and Total Medical Staff Hours are the most comprehensive measures of the medical services provided by school-based health centers, they are our preferred treatment variables. Means of these treatment measures are shown in Table 2.

Throughout the analysis, the SBHC service variables are constructed by first summing the total amount of each service measure for each county or school district and year. For example, we calculate the total number of medical staff service hours in the county and year across all centers in the county. We then divide by the total high-school-aged population in the county.[18] This provides a measure of the hours of SBHC medical services per high-school-aged student in the county. Finally, we re-scale the measure to be representative of a typical center by multiplying by 1000, which is the approximate average size of a high school in our sample. The method is identical for our school district level regressions, where we sum over districts rather than counties. Using the primary care or medical staff hours as our treatment measures, β_1 is interpreted as the effect on the birth rate of SBHCs increasing their service levels by an additional hour. When multiplied by the average SBHC service level, this estimate shows the effect of a service increase equivalent to one more average-sized center opening. We focus on this parameter for policy purposes.

Variation in primary care and medical staff hours comes from two different sources: 1) openings/closings of SBHCs with different service levels and 2) changes in service levels among open centers from year to year. Because the sources of variation are more varied for these service measures, the identifying assumptions for these models are somewhat stronger than when only an indicator variable treatment measure is used. In addition to the identification assumptions discussed above, we now require that decisions about the initial amount of services each center should offer are uncorrelated with pre-treatment trends in teen birth rates. That is, trends

[18] Our high-school-aged population count includes individuals between the ages of 14 and 19.

in the outcome variables from before a center opens should not predict the future intensity of treatment. We are most concerned about whether relatively more service-intensive clinics are put into schools where the teen birth rate is declining. This would introduce a negative bias in β_1. Furthermore, it now needs to be the case that year-to-year service variation after initial center entry is exogenous. If service levels rise in areas that are experiencing more rapid declines in teen birth rates for other reasons, our estimates will be biased away from zero.

We address these core identification concerns in several ways. First, we estimate event study models that test for selection on trends as a function of initial service level variation:

$$\begin{aligned} Y_{cst} &= \phi + \sum_{\tau=-5}^{-1} \alpha_\tau \textit{Service Hours}_{ct_0} I(t - t_0 = \tau) + \sum_{\tau=0}^{10} \alpha_\tau \textit{Service Hours}_{ct} I(t - t_0 = \tau) \\ &\quad + \gamma_c + \delta_{st} + \epsilon_{cst}. \end{aligned} \tag{3}$$

In the pre-period, the *Service Hours* variable is set to the first observed service level in that county. That is, we set it equal to the service level observed when τ=0, denoted t_0. In the post-period, the *Service Hours* variable is allowed to vary over time, similar to how it is specified in equation (1). Equation (3) therefore allows us to test whether future service levels are related to differential trends in outcomes prior to first center entry as well as for time-varying treatment effects of school-based health center service levels. However, it does not allow us to test whether post-entry variation in service levels is exogenous.

Second, in order to account for the potential endogeneity of year-to-year service level variation, we employ two instrumental variables strategies. We first instrument Primary Care Staff Hours and Total Medical Staff Hours with an indicator for whether there is a center in the county and with a quadratic trend in the time since first center entry. This quadratic time trend is set to zero prior to the first center entering a county. As long as center entry is uncorrelated with pre-entry trends in birth rates, this instrument is valid. Thus, equation (2) is a direct test of the validity of this IV approach. The second instrument we use accounts for the differences in the service levels of the initial center that enters a county ($\textit{Service Hours}_{ct_0}$): the instruments are comprised of $\textit{Service Hours}_{ct_0}$ and $\textit{Service Hours}_{ct_0}$ interacted with the quadratic time trend.[19] Equation (3) therefore provides evidence on the validity of this instrument. Critically, because

[19] Note that $\textit{Service Hours}_{ct_0}$ is fixed over time within a county after time t_0.

neither instrument contains variation in service levels after the initial center is opened, they will account for any endogeneity in equation (1) in year-to-year service levels.

Our analysis of high school dropout rates takes a very similar form as our birth rate models. The main difference between the two is that, for high school dropout rates, we observe outcomes at the school district level, rather than at the county level. We estimate the following models:

$$Y_{dst} = \beta_0 + \beta_1 SBHC_{dt} + \gamma_d + \delta_{st} + \epsilon_{dst} \tag{4}$$

$$Y_{dst} = \phi + \sum_{\tau=-5}^{10} \alpha_\tau I(t - t_0 = \tau)_{dt} + \gamma_d + \delta_{st} + \epsilon_{dst} \tag{5}$$

$$Y_{dst} = \phi + \sum_{\tau=-5}^{-1} \alpha_\tau \mathit{Service\ Hours}_{dt_0} I(t - t_0 = \tau) + \sum_{\tau=0}^{10} \alpha_\tau \mathit{Service\ Hours}_{dt} I(t - t_0 = \tau) + \gamma_d + \delta_{st} + \epsilon_{dst}. \tag{6}$$

In equations (4)-(6), we now include district, rather than county, fixed effects. The assumptions underlying the identification of the treatment parameters in equations (4)-(6) are essentially identical to those for equations (1)-(3), except instead of there being no differential county-level relative trends, here there must be no differential district-level trends. Equations (5) and (6) allow us to test for such trends as well as for time-varying treatment effects. We also estimate instrumental variables models akin to those at the county level to account for any endogeneity associated with yearly variation in SBHC service levels in our dropout analysis.

A final potential methodological issue is the presence of measurement error in our service hours treatment measures. One source of measurement error is the fact that, while the NASBHC National Census is designed to cover all health centers, there is not complete coverage in every year. The use of multiple years of data combined with information on the date of opening of the centers should mitigate this problem. But, it is possible there are health centers we do not observe in our data and some we code as closing when they still exist. To the extent that some districts and counties are more heavily treated than our data show, this should attenuate our estimates. As well, our instrumental variables should account for this source of measurement error because the instruments are unlikely to be correlated with center closure or with survey non-response.

A second source of measurement error is that prior to 1998, the first year of NASBHC data, we cannot observe changes in the level of services provided. For all centers opened before 1998, we use the first observed service levels (typically from the 1998 survey). This could produce further measurement error in the *Service Hours* variables. Finally, aggregation to the county and school district levels could produce measurement error from the fact that many students in each county and district are ostensibly untreated. The fact that 62% of centers are open to community members outside of the specific school in which they are located suggests that some aggregation would be appropriate even if it were not necessitated by the data. Furthermore, SBHCs are concentrated amongst the lowest-SES schools in counties and districts, which also are schools in which teen pregnancy and dropout rates are most prevalent.[20] This argument supports our contention that the aggregated data can provide informative estimates of the relationship between school-based health centers, teen childbearing, and educational attainment.

5 Results

5.1 Birth Results

Table 3 presents the baseline estimates of the effect of school-based health centers on teen birth rates. Each cell in the table is from a separate regression, and all standard errors are clustered at the county level. In the first two columns, we show OLS estimates of β_1 from equation (1). The first set of estimates in the top row of the table uses an indicator for the presence of any center in a county as the treatment measure. We find a negative and statistically significant effect of center entry on both 15 and under and 16-19 year old fertility rates. In particular, when the first SBHC enters a county, the birth rate among those under 16 declines by 0.052 per 1000 and the birth rate of 16-19 year olds declines by 1.76. These represent 6.6 and 3.8 percent declines relative to the baseline fertility rate means, respectively.

The remaining rows in columns (i) and (ii) show estimates using Primary Care Staff Hours and Medical Staff Hours as the treatment measures. Across the two treatment variables, the table shows a consistent negative relationship between SBHC service levels and teen birth rates.

[20] We also note that it would be exceedingly difficult to match schools to specific centers. The school codes for centers are not consistently present in the data, and many centers have administrative offices that occasionally answer the surveys. In some years the administrative offices answer the surveys and in some years the centers themselves do. Aggregating to service levels at higher geographic levels sidesteps this problem.

The interpretation of these coefficients is the effect on the birth rate if the center increases primary or medical staff hours by one in a high school. Thus, increasing primary care service levels by one hour decreases the birth rate among girls under 16 by 0.015, and increasing total physician hours by one decreases the birth rate by 0.007. These estimates both are negative, sizable in magnitude, and statistically different from zero at the 5% or 10% level. A useful way to interpret these estimates is to calculate their implications for the effect of opening an average-sized center. To calculate such an effect, we multiply the estimates by the average amount of services each center supplies (shown in Table 2) and then divide by the average age-specific birth rate. The implied percent effect of a center that supplies the average amount of service hours is shown below each standard error. The estimates are very similar across service measures, suggesting adding an average-sized center in a county would reduce under-16 birth rates by between 9.6 and 10.1 percent. Among 16-19 year olds, the estimates are smaller but also are highly consistent across measures, at 4.5 to 4.8 percent. The magnitude of these estimates is similar to the 6.8% decline in birth rates among 18-19 year olds following Medicaid family planning waiver expansions reported in Kearney and Levine (2009). While relatively smaller than the estimates for those 15 and under, they represent more births averted due to the substantially higher underlying birth rate of those 16-19 relative to those who are under 16.

As discussed above, a central concern with the type of difference-in-differences analysis we employ is that centers may be targeted at areas based on fixed relative trends. Furthermore, there may be time-varying treatment effects that provide a more detailed picture of how SBHCs influence teen births than allowed by equation (1). Panel A of Figure 5 shows the estimates of α from equation (2) and Panels B and C show estimates of α from equation (3) for birth among teens 15 and under. Panels A-C in Figure 6 show the associated estimates using 16-19 year old birth rates as the dependent variable. In both figures, we have excluded relative year -1 such that all estimates are relative to this year. The points in the figures are the point estimates of α, while the lines extending from each point show bounds of the 95% confidence intervals that we calculated using standard errors that are clustered at the county level. Three patterns emerge from Figures 5 and 6. First, in all three panels, there is no evidence of pre-treatment trends in birth rates as a function of future treatment. While the estimates in Panels B and C are somewhat noisy in the pre-treatment period, the Panel A estimates clearly show no evidence of pre-treatment trends in either figure. These results indicate that the entry of the first SBHC in a county is unrelated to teen fertility trends. In Panels B and C they suggest that the service level of the first center to enter in a county is unrelated to prior trends in birth rates. The lack of pre-treatment trends in Figures 5 and 6 strongly support our use of first center entry and the service level of the first center to enter in a county as instruments for the yearly service levels offered by SBHCs.

The second evident pattern in Figures 5 and 6 is that there is a short-run increase in teen births among centers that initially offer more services after entry (Panels B and C). The same positive effect in the years directly after entry is not evident in Panel A, which is one reason why the IV estimates may be larger than the OLS estimates using yearly service measure variation. This is somewhat of an odd result, as it is unlikely SBHCs that offer more medical services would increase teen birth rates in the first years after entry. More likely is that these results reflect targeting of services to areas that are experiencing an increase in teen births. That the estimates in Panel A do not exhibit this increase suggests that the decision to open a center is unrelated to these trends but that the service levels of opening centers are affected by local teen birth rates.[21] Put differently, when birth rates increase in an area that is opening a center, that center likely receives more resources that allow it to have higher service levels. The bias from such targeting is positive, leading our estimates to be closer to zero. These results underscore the importance of the our IV approach that Panel A suggests should account for this bias.

Third, in all panels of Figures 5 and 6, the long-run effects of SBHCs are much larger than the short-run effect. These time-varying treatment effects reflect the fact that centers may take time to ingrain themselves in the community and that repeated exposure for all four years of high school may have larger effects than exposure for a smaller number of years.[22] If anything, the OLS estimates in Table 3 likely understate the long-run effect of SBHCs on teen fertility.

Because of the potential endogeneity of yearly service level variation, we instrument Primary Care Staff Hours and Medical Staff Hours with first center entry in a county and quadratic time

[21]These findings are consistent with the fact that it takes several years to open a center. As a result, one cannot target centers to places experiencing short-run increases in teen birth rates but can target more services towards existing centers when birth rates increase secularly.

[22]The larger longer-run effects also may reflect additional center openings in a county. The OLS models that use service hours include variation in services from any centers that open after the first one in an area, but our IV estimates are designed to only include variation from first center entry.

trends in the time since first entry interacted with center entry (i.e., these time trends are zero prior to first entry). The results from these IV models are shown in columns (iii) and (iv) of Table 3. The estimates are considerably larger in absolute value than the OLS estimates and are statistically significantly different from zero at the 5% level. Furthermore, the instruments are strong, with first-stage F-statistics above 40.[23] One reason why the IV estimates are so much larger than the OLS estimates is because they are less influenced by the short-run increase in birth rates as a function of center hours post-entry. Another reason is that the IV models can account for measurement error in the service level measures driven by center non-response. Converting these point estimates to the implied effect of adding a SBHC with the average level of services indicates that an average-sized SBCH reduces birth rates among girls 15 and under by 27-29 percent and 16-19 year old birth rates by 14%. In columns (v) and (vi), we use a similar set of instruments that interacts each instrumental variable with the service level of the initial entering center in a county in the initial year. The results are, on the whole, very similar to those in columns (iii) and (iv) and demonstrate that these results are robust to accounting for initial service level heterogeneity across centers.

The IV estimates indicate that there is a large negative effect of SBHCs on teen fertility. One way to frame the size of these effects is to calculate the extent to which SBHC services can explain the recent decline in birth rates. Kearney and Levine (2012) show that teen birth rates have declined significantly since the early 1990s. However, in their review of the evidence, they highlight that little is understood about why these rates have declined. School-based health centers have large effects on teen birth rates, and their rise potentially can contribute to this aggregate pattern. Martin et al. (2013) show that teen birth rates have declined by 1 per 1,000 for girls 15 and under and by 30.5 for teens 16-19 between 1991 and 2011. The changes in SBHC services between 1991 and 2011, combined with the estimates in Column (iii) of Table 3, can explain between 3.5-3.8% of this decline. Thus, the rise of SBHCs can explain a modest but non-trivial amount of the aggregate decline in teen birth rates in the US. Given that SBHCs are located in a minority of school districts, our point estimates suggest that expanding such centers would lower the birth rate even further.

SBHCs differ in the types of contraceptive services they offer. About 65% of centers offer

[23] First-stage coefficients are shown in Online Appendix Table A-5.

some type of birth control, either directly or through referral (see Table 1). In Table 4, we show estimates of equation (1) that allow the effect of Primary Care Staff Hours and Medical Staff Hours to differ by the type of contraceptive services offered by the clinic. We split centers into four groups that together encompass the entire range of birth control offerings in US SBHCs: centers that prescribe hormone-based contraceptives on-site,[24] centers that refer patients for hormone-based birth control but do not offer condoms on-site, centers that refer patients for hormone-based birth control and offer condoms on-site, and centers that do not offer any contraceptive services. Each column in Table 4 comes from a separate regression. The results in Table 4 are consistent with SBHC services most affecting teen birth rates in centers that can prescribe hormone-based birth control. Although the estimates in Table 4 are somewhat imprecise, if we instead pool the bottom three categories together, we find centers that prescribe hormone-based contraceptives have a statistically significantly larger effect on teen births than other centers.[25] Thus, providing simple access to hormone-based contraception for female teenagers that does not require them to go through their parents can have large impacts on fertility rates.

In Table 4, the estimates among centers that simply refer for hormone-based contraceptives are much smaller in absolute value, and it matters little whether those centers distribute condoms. Importantly, our results are not driven primarily by condom distribution, which is consistent with theoretical and empirical research arguing that distributing condoms may not reduce (and might increase) teen birth rates (Buckles and Hungerman 2014; Arcidiacono, Khwaja and Ouyang 2012). We also note that we find negative effects of SBHCs on teen birth rates among centers that offer no access to contraception. As shown in Figure 3, many of the centers that do not offer contraception do offer other family planning services, such as pregnancy tests, tests for sexually transmitted infections, abstinence counseling, and general health advice that would come with a primary care visit. While often statistically significantly different from zero, these estimates are smaller in absolute value than the estimates for service hours at centers that offer hormone-based contraceptives. This finding highlights that it is not

[24]Hormone-based contraceptives include birth control pills, Depo-Provera, implants, inter-uterine devices (IUDs), the patch, and the NuvaRing. We code centers as offering hormone-based contraceptives if they report offering birth control pills or report offering more than one other form of hormone-based contraception.

[25]The p-values for a one-sided test that the effect of Primary Care Hours among centers prescribing hormone-based contraceptives on-site is larger than the effect of Primary Care Hours in other centers are 0.055 for 15 and under and 0.027 for 16 to 19 year olds.

simply contraceptive access that drives our birth rate results but the sum total of primary care health care services offered to teens through these centers.[26]

School-based health centers may have a larger effect on African American and Hispanic students than on white students because these centers are targeted at low-income populations. Furthermore, African American and Hispanic teen birth rates are much higher than those of whites, which makes these groups particularly important to study. In Table 5, we show OLS and IV estimates of the effect of SBHCs on teen fertility rates by race/ethnicity. As in Table 3, we also calculate percent effects of opening an average-sized center in order to compare more easily across specifications. Among teens 15 and under, the estimates mostly are not statistically significantly different from zero. Qualitatively, however, SBHCs have the largest impact on Hispanic birth rates among girls in this age group. For teens aged 16-19, the estimates among both whites and blacks are large and are statistically significant at the 5% or 10% level in all columns. Focusing on the IV estimates, opening a center with the average level of services would decrease African American teen birth rates by 14-19%, with an effect among whites between 7 and 15%. Estimates for Hispanic women aged 16-19 are much smaller and are not significantly different from zero at conventional levels. Taken together, the results in Table 5 suggest that SBHCs have the largest effects on the birth rates of younger Hispanic teens but older African American and white teens. However, the estimates are consistent with a negative effect among all racial/ethnic groups and ages.

5.2 High School Dropout Results

The results presented above suggest that school-based clinics promote better health outcomes among the teens exposed to them, at least in terms of birth rates. A question of high importance is whether the changes in teen health caused by these centers, in terms of pregnancy as well as other health outcomes, affect educational attainment. For students in the low-income areas targeted by SBHCs, high school completion is a very important measure of educational

[26]In addition, centers might reduce rates of sexually transmitted diseases. We estimated state-level models of how SBHC services affect STD rates among teens using data from the U.S. Center for Disease Control, which are shown in Online Appendix Table A-4. Unlike birth data, data by age group for STDs are available at the state level and not the county level (county level data are not disaggregated by age). We regressed rates of three STDS - gonorrhea, chlamydia, and syphilis – among 15-19 year olds on the number of hours of primary care and total medical staff services provided by school-based health centers in that state, in models controlling for state fixed effects and year effects. Although most of the estimates are not statistically different from zero, they all point to sizable declines in STD rates among teens when SBHC services in the state rise. While the need to aggregate to the state level leaves us with too little power to draw definitive conclusions, these results are suggestive of positive sexual health benefits of SBHCs in addition to lower teen birth rates.

attainment, and it thus is the focus of our analysis. In Table 6, we present the first evidence in the literature of the effect of providing primary care services to low-income school-age children on high school dropout rates. Due to serial correlation of errors within districts over time, all estimates are accompanied by standard errors that are clustered at the school district level throughout the dropout rate analysis.

The estimates in Table 6 are in percent terms, such that a coefficient of 1 would mean that a 1 hour increase in SBHC services would increase dropout rates by 1 percent (rather than by 100% if the dependent variable was in percentage terms). Across all models and treatment measures, there is no evidence that SBHCs or SBHC services affect high school dropout rates. Half of the estimates are positive, and only two of the negative estimates are statistically significant at the 10% level. Furthermore, the estimates are precise: the 95% confidence intervals show we can rule out declines in dropout rates from an average-sized center of more than -0.17% for 10^{th} grade, -0.08% for 11^{th} grade, and -0.26% for 12^{th} grade using the estimates in columns (vii)-(ix).[27]

Figure 7 shows the event study estimates from equation (6) for 10^{th}, 11^{th} and 12^{th} grade dropout rates using Medical Staff Hours as the treatment measure. Estimates of equations (5) and (6) using center indicators and Primary Care Staff Hours are shown in Online Appendix Figures A-1 through A-3. These figures show that the null finding in Table 6 does not mask important heterogeneity in long-run effects or selection on pre-treatment trends. Recall that our dropout rate sample begins in 1998, and as a result we have much fewer observations pre-dating center openings. Thus, the standard error bounds in the pre-treatment period are relatively large. Still, there is little evidence of differential trends prior to center entry, and there is no evidence of a dropout effect post-entry either in the short or long run.

A drawback of using the diploma data, especially if teen childbearing is a primary explanation for any dropout rate decline, is that they do not allow us to distinguish between males and females. It is likely female dropout rates are much more sensitive to births than are male dropout rates. We therefore turn to US Census and American Community Survey data that

[27]Similar to Table 4, we have estimated dropout models that examine heterogeneous SBHC effects by birth control services offered. These are shown in Online Appendix Table A-2 and do not point to any dropout rate effects in centers that offer access to certain types of contraception. We also have examined effects of service hours among centers that offer mental health services. We find no evidence of a dropout rate effect among centers that offer such services. These results are available from the authors upon request.

allow us to calculate age-specific dropout rates by gender. These data also have the benefit that they capture GEDs as well as traditional high school diplomas. A drawback of these data, though, is that we only observe each school district a maximum of 4 times: in 1990, 2000, 2005-2007 and 2008-2011.[28] But, combined with the diploma results this analysis will provide a more complete picture of the effect of SBHCs on high school completion.

Dropout rate estimates using Census/ACS data are shown in Table 7. We present estimate for both 14-17 year olds and 18-19 year olds. The estimates from equation (1) for the whole sample are similar to those in Table 6 in showing no effect of SBHCs on high school dropout rates. The one exception is for women aged 18-19. When we use Primary Care and Medical Staff Hours as the treatment measure, there is a small, negative effect of an average-sized SBHC on the dropout rate. However, the effects are less than a quarter of a percent and are not robust to using a center indicator as the treatment measure. Thus, we view these estimates as being merely suggestive of a small impact of SBHCs on female high school dropout rates.

Our findings relate to a large literature examining the causal effect of teen childbearing on educational outcomes. While there is a robust positive correlation in most data sets between teen pregnancy and the likelihood of dropping out of high school, obtaining credible causal evidence of this link has proven difficult. The difficulty in establishing causality in this context is that it is very hard to generate variation in teen pregnancy rates that is driven by factors that do not affect schooling decisions as well. The literature on this subject, while large, is quite mixed. Ribar (1994) uses age at menarche, OB-GYN availability and state abortion rates as instruments and finds no effect of teen childbearing on high school completion. Hotz, McElroy and Sanders (2005) use natural experiments driven by miscarriages to generate plausibly exogenous variation in teen births. They find a small negative effect of teen childbearing on high school completion. Fletcher and Wolfe (2009) and Ashcraft, Fernandez-Val and Lang (2013), however, argue that miscarriages are not exogenous events; they report modest negative effects of adjusted teen birth effects on high school completion. More closely related to this study, Klepinger, Lundberg and Plotnick (1999) use state-level variation in family planning and abortion services/policies as instruments for teen childbearing. They report that a teen giving birth reduces her educational attainment by 2.5 years. Finally, there are several studies that use sibling fixed effects as

[28] The limited number of observations per district preclude us from estimating IV models with these data.

well as matching estimators to identify the effect of teen childbearing. While the sibling fixed effects analyses come to very mixed conclusions (Ribar, 1999; Holmlund, 2005; Geronimus and Korenman, 1992), the results from the matching literature point more consistently to a negative effect of teen fertility on educational outcomes (Levine and Painter, 2003; Sanders, Smith and Zhang, 2008). Our estimates, however, suggest that the teen birth rate declines as well as the other health benefits teens receive as a result of these centers to not substantially affect their likelihood of completing high school.

5.3 Robustness Checks

In this section, we present a series of robustness checks that examine the sensitivity of our results and conclusions to several of the identifying assumptions that are outlined in Section 4. First, recall that the dropout estimates include all school districts in the US, while the birth rate estimates include only large counties. In Online Appendix Table A-3, we estimate dropout rate models using the CCD diploma data in which we use only those counties included in the birth rate analysis. These estimates are directly comparable to those in Table 6. The results are extremely similar to baseline and show no effect of SBHC services on high school completion. Thus, the difference between the birth and dropout findings is not due to the differences in the samples used.[29]

Throughout, we have imposed a linear functional form assumption between SBHC service levels and outcomes. In particular, this functional form assumes there are no "level shifts" in outcomes that are associated with center entry. If simply having a center has an impact on dropout rates or teen birth rates aside from the number of hours of services provided, equation (1) will be misspecified when we use service levels as the treatment measures. In Table 8, we show results in which we control for both service levels and an indicator for whether the county (Panel A) or school district (Panel B) has a SBHC in the given year. This specification basically combines our different treatment measures to examine whether the effects load on the center indicator versus the amount of services. Thus, we are allowing center entry to affect both the intercept and slope, rather than just the slope as in the baseline analysis. In Panel A,

[29] In results available upon request, we also have estimated dropout rate models aggregated to the county-year level rather than the district-year level. The estimates are very similar to those shown in Table 6.

the coefficients on the service hours are very similar to those in columns (i) and (ii) in Table 3. Additionally, the Center Indicator estimates all are negative but are significant at the 10% level only in one case. While the standard errors grow somewhat with the more demanding specification, allowing for a level shift does not change the results and conclusions.

In Panel B, we estimate this model for high school dropout rates. The coefficients on service levels change little from Table 6 and the center indicators are positive but not statistically significant at conventional levels. As in Panel A, allowing for a level shift when centers open in an area does not affect the results.

Finally, in Table 9, we examine whether SBHC service variation is correlated with school expenditures and enrollment using data from the 1998-2011 Common Core of Data. These centers are not financed by the school, and aside from the space that they are allocated do not use school resources. Still, it is possible that SBHCs use other school resources in a manner that might influence our dropout rate estimates, or SBHC entry could be correlated with unobserved trends in school resources. In Table 9, we see that there is no relationship between SBHC services and per-student expenditures: the coefficients are small, precisely estimates and are not statistically different from zero at even the 10% level. These results suggest that expenditure changes correlated with SBHC entry or service level variation are not driving the results and conclusions of our analysis.

6 Conclusion

Disparities in health care access, health and educational attainment are large in the United States, and policies to help close these gaps have received much policy attention. In this paper, we study school-based health centers that provide primary health care services to students and families living in under-served communities. Despite the rapid growth of SBHCs in the US over the past two decades, the effect of these centers on health and educational attainment has not been studied previously in a manner that allows one to overcome the endogeneity problems related to center placement and use decisions. Using detailed data from repeated surveys of SBHCs conducted by the National Alliance on School-based Health Care, we construct district- and county-level measures of SBHC services over time and employ difference-in-differences and instrumental variables techniques to identify the causal effect of these center services on teen fertility rates and on high school dropout rates.

We present two broad findings from our empirical analysis. First, we show the SBHCs have large, negative effects on fertility rates among teenage girls. Adding a center with the average amount of SBHC services leads to a decrease in the under 16 year old birth rate of about 30% relative to the baseline fertility rate. For 16-19 year olds, SBHCs reduce the birth rate by 11-15%. These effects are even larger among the centers that prescribe hormone-based contraception to students. Overall, our calculations suggest that the growing number of SBHCs explains some of the decline in teen birth rates in the US during recent decades. Second, despite the large effect of SBHCs on teen fertility, we find no substantial effect on high school dropout rates.

There are several implications of our results that are important for public policy. One central message of our findings is that SBHCs are a useful tool to reduce teen birth rates in the US, which are amongst the highest in the industrialized world (Kearney and Levine 2012). Another important implication of our results is that the provision of low-cost and convenient primary care services through schools has at most a small effect on students' decisions to drop out of high school. This is not to suggest that providing such services does not improve these students' lives, but it does suggest that any positive health benefits of this care do not immediately yield greater educational investment. High school health interventions may come too late to influence high school completion; it is possible that expanding health care services to these children when they were younger would have produced greater effects on high school completion rates. Our work highlights the importance of further study of the linkages between health care access, health outcomes and educational investment decisions to determine whether there are aspects of health care provision that could support educational investment among students from low-income backgrounds.

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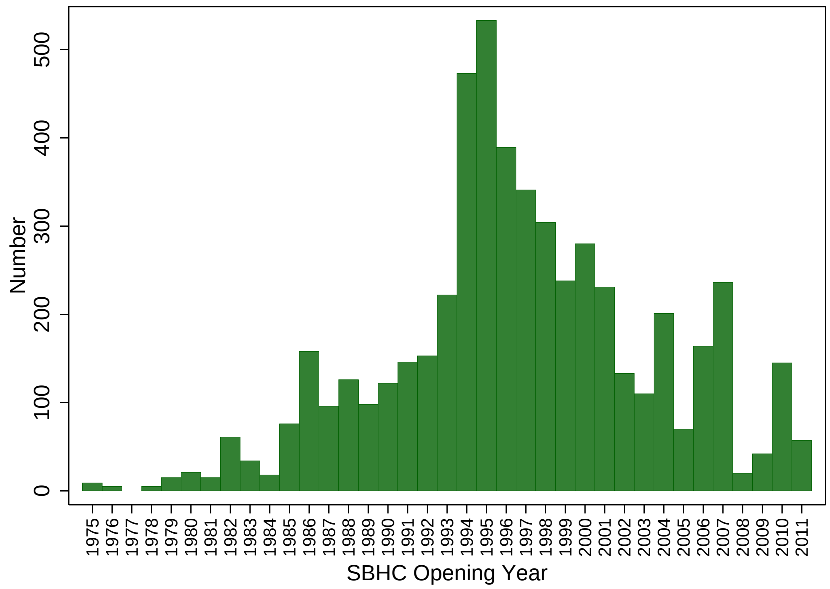
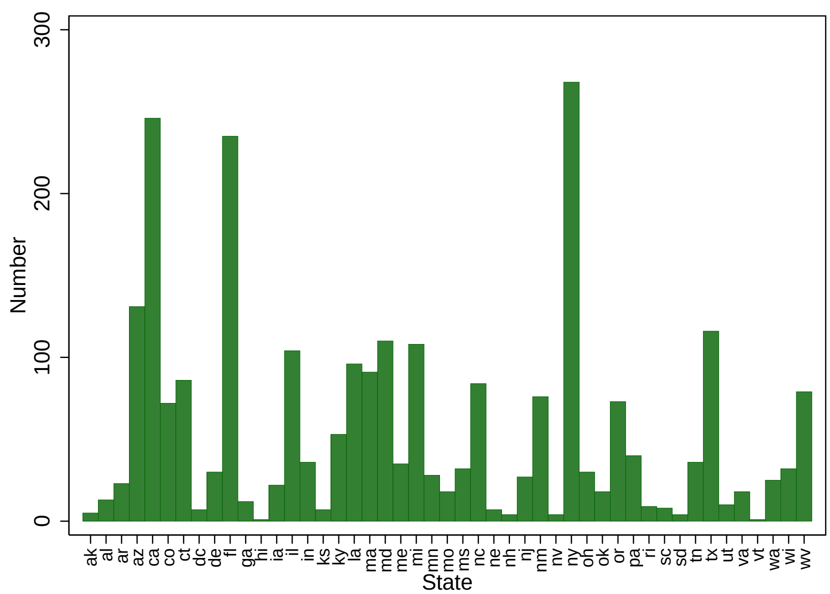
Figure 1: Distribution of SBHC Opening Years



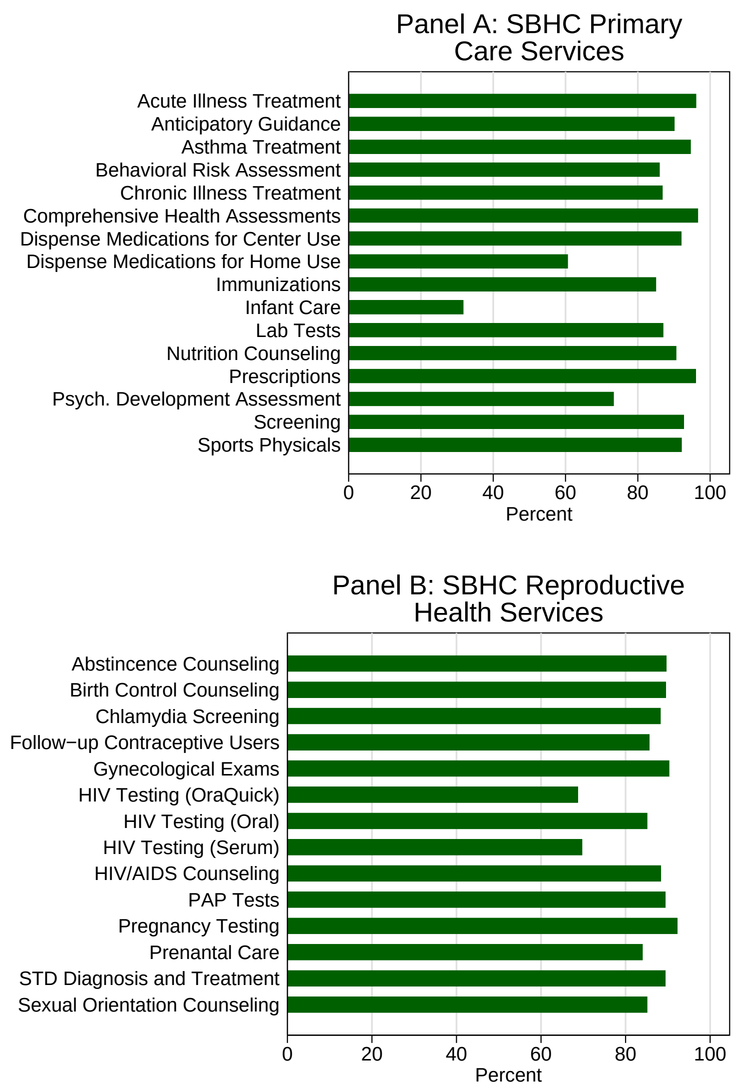
Source: NASBHC School-based Health Center Census, 1998-2011.

Figure 2: Distribution of SBHCs Across States



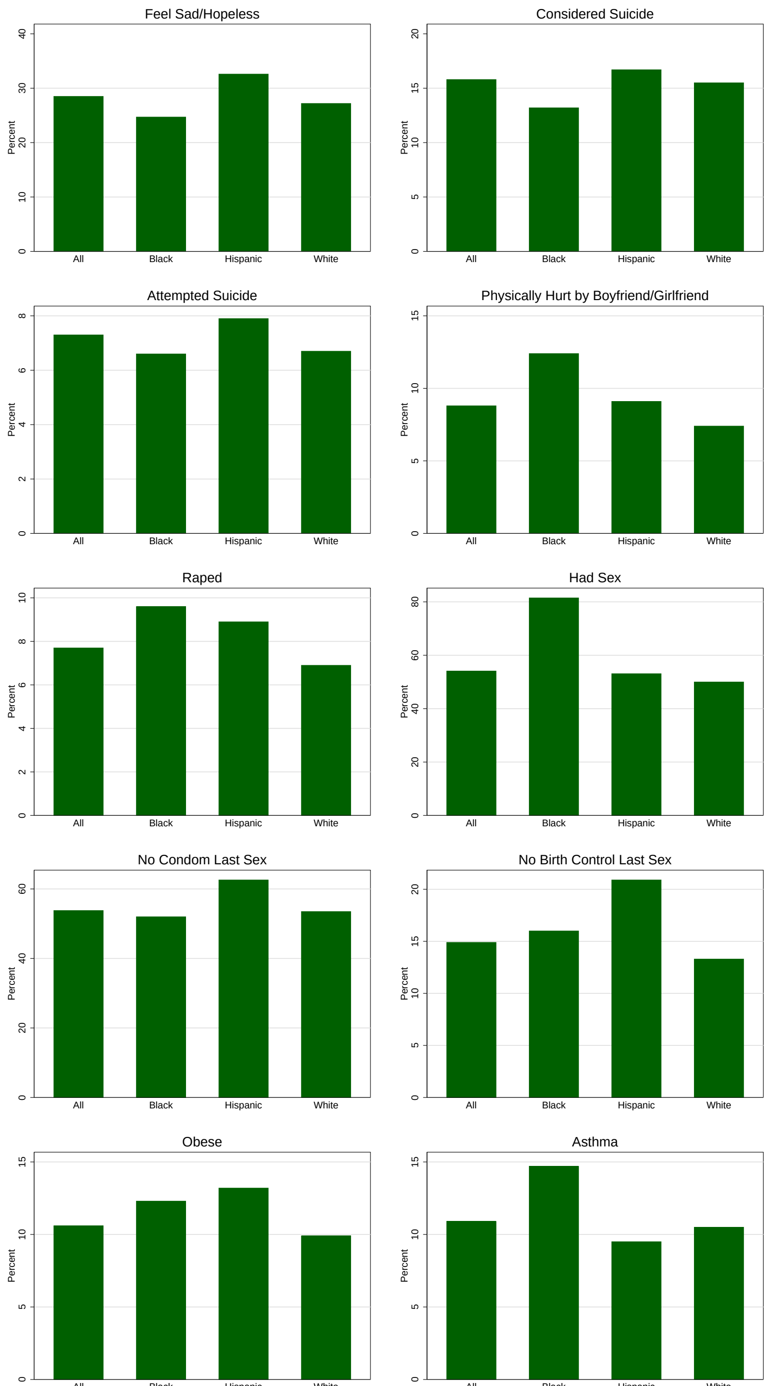
Source: NASBHC School-based Health Center Census, 1998-2011. The five states without SBHCs (ID, MT, ND, SD, WY) are omitted from the figure.

Figure 3: Primary Care and Non-Contraceptive Reproductive Health Services Provided by SB-HCs



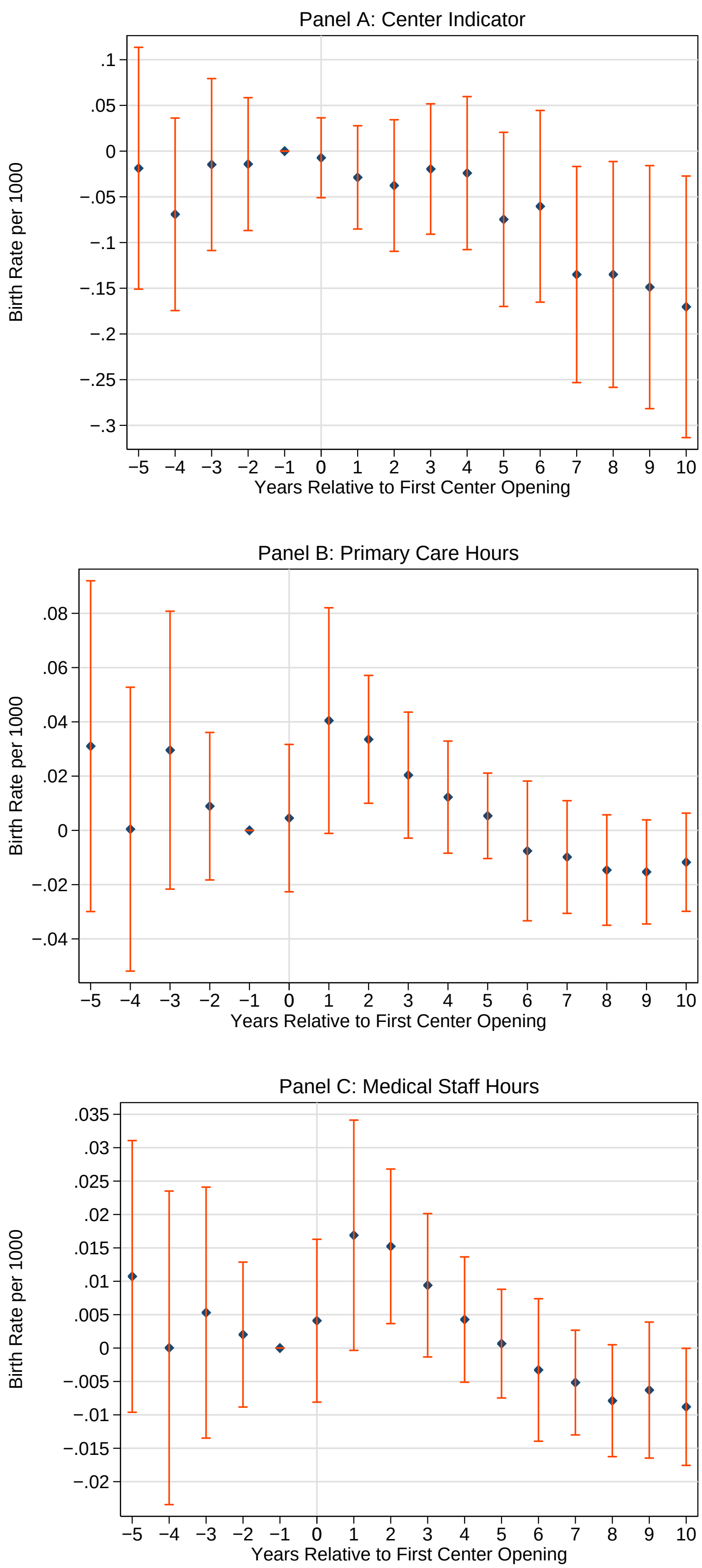
Source: These figures are reproduced from the 2007-2008 School-based Health Centers National Census annual report, available at http://www.sbh4all.org/atf/cf/%7Bcd9949f2-2761-42fb-bc7a-cee165c701d9%7D/NASBHC%202007-08%20CENSUS%20REPORT%20FINAL.PDF. The reproductive care service tabulations show the percent providing each service on-site and the percent providing referrals for each service.

Figure 4: Health Outcomes Among High-School-Aged Students, 2011 YRBSS



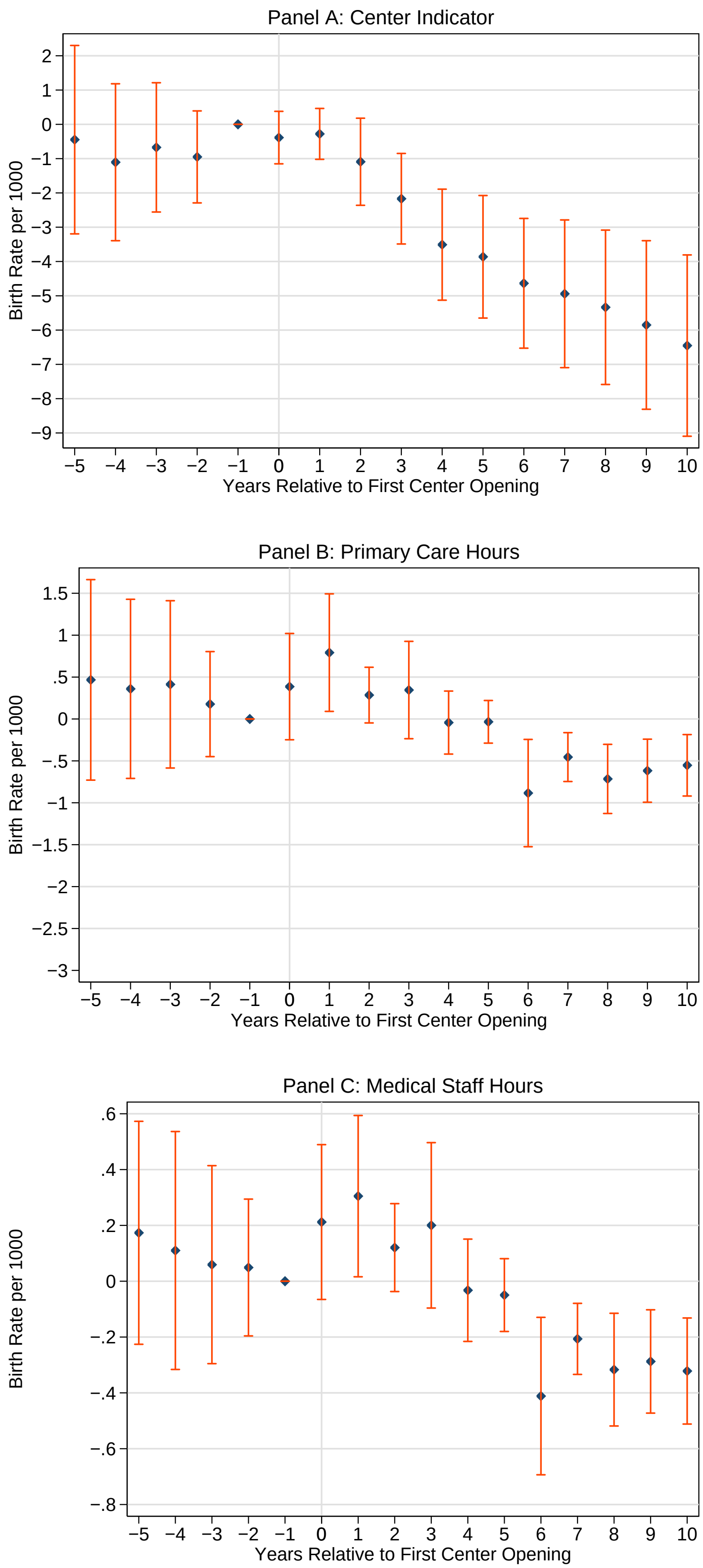
Source: 2011 Youth Risk Behavior Surveillance System (YRBSS).

Figure 5: Event Study Estimates of the Effect of SBHC Entry and SBHC Services on Under-16 Birth Rates (per 1000 women)



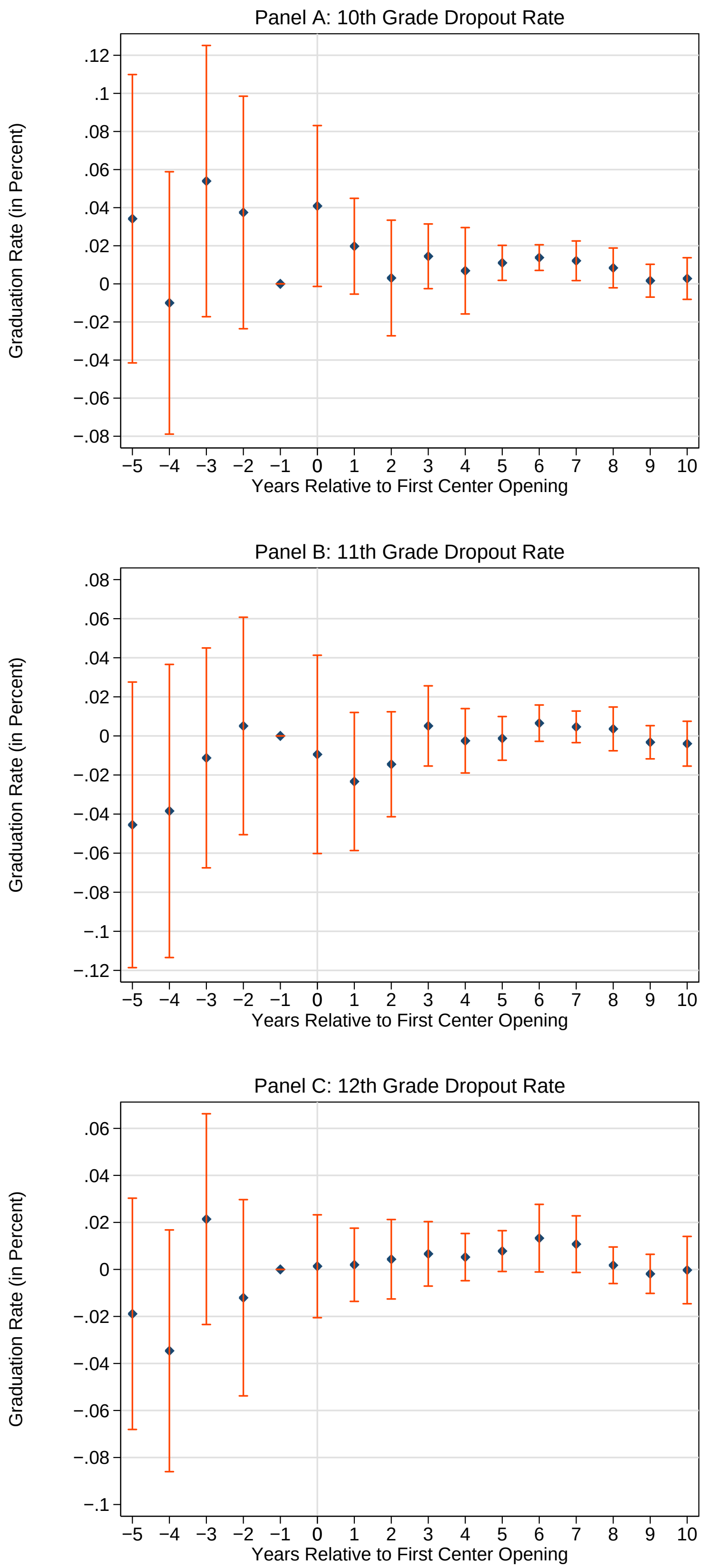
Authors' estimates of equations (2) and (3) as described in the text. Each point shows the coefficient estimate on the service measure or center indicator interacted with the relative time to the first center opening in the county. Relative time is lagged one year to adjust for gestation time. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 and counties that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the county level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure 6: Event Study Estimates of the Effect of SBHC Entry and SBHC Services on 16-19 Birth Rates (per 1000 women)



Authors' estimates of equations (2) and (3) as described in the text. Each point shows the coefficient estimate on the service measure or center indicator interacted with the relative time to the first center opening in the county. Relative time is lagged one year to adjust for gestation time. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 and counties that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the county level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure 7: Event Study Estimates of the Effect of Total SBHC Medical Staff Hours on High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equations (5) and (6) as described in the text. Each point shows the coefficient estimate on the total medical staff hours service measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 and school districts that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Table 1: Percent of Health Centers Providing Different Contraceptive Services

Contraception Type	Prescribed & Dispensed On Site	Prescribed On Site	Referrals Only	No Provision
Condoms	31.7	N/R	N/R	68.3
Birth Control Pills	22.1	15.5	29.9	32.5
Birth Control Shot (Depo-Provera)	25.7	7.7	32.1	34.6
Implant	4.9	6.6	47.1	41.5
IUD	4.3	6.6	49.6	39.5
Patch	14.6	12.5	34.9	38.0
Ring (NuvaRing)	16.5	12.2	33.5	37.9
Emergency Contraception	20.0	11.0	30.2	38.8
Any Hormone Contraception	26.9	9.2	28.2	35.7
Any Contraception	31.7	6.6	26.4	35.3

Source: 2011 National Alliance on School-based Health Care census data. Hormone contraception includes all listed methods except condoms and emergency contraception. "N/R"=not relevant for that category.

Table 2: Descriptive Statistics of Analysis Variables

Variable	Mean	SD
<u>Treatment Measures</u>		
Center Indicator	0.175	0.380
Primary Care Staff Hours per Week	0.876	4.970
Primary Care Staff Hours per Week (in districts with any center)	5.025	10.997
Primary Care Hours with Hormones Prescribed On Site	2.101	7.606
Primary Care Hours with Hormones Referred, No Condoms	2.090	7.219
Primary Care Hours with Hormones Referred & Condoms Dispensed	0.135	1.384
Primary Care Hours with No Birth Control Services	0.691	3.327
Medical Staff Hours per Week	4.058	13.321
Medical Staff Hours per Week (in districts with any center)	11.377	23.139
Medical Staff Hours with Hormones Prescribed On Site	4.959	16.600
Medical Staff Hours with Hormones Referred, No Condoms	4.299	14.665
Medical Staff Hours with Hormones Referred & Condoms Dispensed	0.461	3.939
Medical Staff Hours with No Birth Control Services	1.644	7.333
<u>Outcome Measures</u>		
Birth Rate per 1,000 Women $\leq$15	0.789	0.919
Birth Rate per 1,000 Women 16-19	46.267	23.178
10^{th} Grade Dropout Rate (%)	22.39	12.18
11^{th} Grade Dropout Rate (%)	15.43	9.79
12^{th} Grade Dropout Rate (%)	9.28	8.75
14-17 Dropout Rate (%)	10.08	20.59
Female 14-17 Dropout Rate (%)	9.98	20.73
Male 14-17 Dropout Rate (%)	10.16	20.66
18-19 Dropout Rate (%)	15.50	8.20
Female 18-19 Dropout Rate (%)	14.81	7.34
Male 18-19 Dropout Rate (%)	15.82	7.34

Sources: School-based health center service data come from the 1998-2011 National Alliance on School-based Health Care census data. Birth rates are calculated from US vital statistics data from 1990-2012. The 10^{th} through 12^{th} grade dropout rates are calculated from National Center for Education Statistics Common Core of Data on school enrollments and high school diplomas awarded from 1998-2011. The male and female dropout rates come from the 1990 and 2000 US Census as well as the 2005-2011 American Community Survey. Means of treatment variables use the diploma data sample. All service hours are per 1,000 high school aged student in the school district. The "in districts with any center" tabulations showing mean service hours per 1,000 high school aged students among schools districts with any center. Birth control service level means include only those schools districts with any center. All tabulations are school district level means, except for the birth variables which are county level means.

Table 3: The Effect of SBHC Services on Birth Rates (per 1000 women), by Age

	OLS		2SLS		2SLS	
IV:			Center Indicator		Initial Hours	
Age:	≤ 15	16-19	≤ 15	16-19	≤ 15	16-19
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Treatment Measure						
Center Indicator	-0.052*	-1.762**				
	(0.029)	(0.547)				
% Effect of Average Center	-6.6%	-3.8%				
Primary Care Staff Hours	-0.015*	-0.415**	-0.043**	-1.274**	-0.053	-1.397**
	(0.008)	(0.155)	(0.018)	(0.329)	(0.042)	(0.539)
% Effect of Average Center	-9.6%	-4.5%	-27.4%	-13.8%	-33.8%	-15.2%
Medical Staff Hours	-0.007**	-0.196**	-0.020**	-0.555**	-0.007	-0.442**
	(0.003)	(0.075)	(0.007)	(0.142)	(0.011)	(0.203)
% Effect of Average Center	-10.1%	-4.8%	-28.8%	-13.6%	-10.1%	-10.9%
First-stage F-Stat (Primary Care)			48.19		105.33	
First-stage F-Stat (Medical Staff)			45.22		40.77	

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. In columns (iii) and (iv), Primary Care Staff Hours and Medical Staff Hours are instrumented with an indicator for whether there is a center in the county in the previous year as well as a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). In columns (v) and (vi), the instruments are the number of primary or medical staff hours per student in the first year the first center opened in the county as well as an interaction between this hours measure and a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Percent effects for the Center Indicator results are calculated by dividing the coefficient by the mean birth rate for that age group. The percent effects for the staff hours estimates show the percent effect relative to the mean for a center with the average number of primary care or medical staff hours. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 4: The Effect of SBHC Services on Birth Rates (per 1000 women), by Age and Birth Control Services

Service Measure:	Primary Care Staff Hours		Medical Staff Hours	
Age:	≤ 15	16-19	≤ 15	16-19
	(i)	(ii)	(iii)	(iv)
Birth Control Services				
Hormones Prescribed On Site	-0.046*	-0.955**	-0.018*	-0.371**
	(0.025)	(0.315)	(0.010)	(0.140)
Hormones Referred, No Condoms	-0.009	-0.552	-0.007	-0.363*
	(0.012)	(0.346)	(0.007)	(0.223)
Hormones Referred & Condoms Dispensed	-0.034	-0.518	-0.004	-0.145*
	(0.025)	(0.333)	(0.006)	(0.086)
No Birth Control Services	-0.031	-0.630*	-0.010**	-0.195**
	(0.023)	(0.349)	(0.005)	(0.096)

Notes: Authors' estimates of equation (1) as described in the text. Each column comes from a separate regression. The birth control service measures include the number of service hours of each type in centers with the given birth control policy. The birth control policy groups are exhaustive and mutually exclusive. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 5: The Effect of SBHC Services on Birth Rates (per 1000 women), by Race/Ethnicity

Panel A: Births per 1,000 Women Age ≤15									
		OLS			2SLS			2SLS	
IV:					Center Indicator			Initial Hours	
Race/Ethnicity:	White (i)	Black (ii)	Hispanic (iii)	White (iv)	Black (v)	Hispanic (vi)	White (vii)	Black (viii)	Hispanic (ix)
Treatment Measure									
Center Indicator	-0.010	-0.046	-0.074						
	(0.021)	(0.076)	(0.058)						
% Effect of Average Center	-2.3%	-3.3%	-8.7%						
Primary Care Staff Hours	-0.007	-0.012	-0.023	-0.006	-0.007	-0.051	-0.033	-0.050	-0.090
	(0.005)	(0.014)	(0.017)	(0.011)	(0.045)	(0.033)	(0.036)	(0.089)	(0.125)
% Effect of Average Center	-8.0%	-4.3%	-13.5%	-6.9%	-2.5%	-30.0%	-37.9%	-18.0%	-53.0%
Medical Staff Hours	-0.003	-0.011*	-0.014*	-0.004	-0.011	-0.025*	-0.011	-0.009	-0.066**
	(0.002)	(0.006)	(0.007)	(0.005)	(0.019)	(0.014)	(0.009)	(0.027)	(0.029)
% Effect of Average Center	-7.8%	-9.0%	-18.7%	-10.4%	-9.0%	-33.3%	-28.6%	-7.3%	-88.0%
First-stage F-Stat (Primary Care)					48.19			105.33	
First-stage F-Stat (Medical Staff)					45.22			40.77	

Panel B: Births per 1,000 Women Age 16-19									
		OLS			2SLS			2SLS	
IV:					Center Indicator			Initial Hours	
Race/Ethnicity:	White (i)	Black (ii)	Hispanic (iii)	White (iv)	Black (v)	Hispanic (vi)	White (vii)	Black (viii)	Hispanic (ix)
Treatment Measure									
Center Indicator	-0.875*	-3.117**	-0.160						
	(0.506)	(1.125)	(1.434)						
% Effect of Average Center	-2.1%	-4.5%	-0.2%						
Primary Care Staff Hours	-0.320**	-0.532**	-0.169	-0.585**	-2.326**	-0.297	-1.235**	-2.617**	-0.683
	(0.143)	(0.227)	(0.258)	(0.282)	(0.673)	(0.834)	(0.539)	(0.692)	(0.934)
% Effect of Average Center	-3.9%	-3.8%	-1.2%	-7.0%	-16.8%	-2.1%	-14.9%	-18.9%	-4.7%
Medical Staff Hours	-0.142*	-0.292**	-0.096	-0.258**	-1.052**	-0.186	-0.413**	-0.847**	-0.179
	(0.080)	(0.104)	(0.126)	(0.115)	(0.295)	(0.342)	(0.188)	(0.227)	(0.432)
% Effect of Average Center	-3.9%	-4.8%	-1.5%	-7.0%	-17.2%	-2.9%	-11.3%	-13.9%	-2.8%
First-stage F-Stat (Primary Care)					48.85			42.63	
First-stage F-Stat (Medical Staff)					45.84			26.85	

Notes: Authors' estimates of equation (1). Each cell comes from a separate regression. In columns (iv)-(vi), Primary Care Staff Hours and Medical Staff Hours are instrumented with an indicator for whether there is a center in the county in the previous year as well as a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). In columns (vii) and (ix), the instruments are the number of primary or medical staff hours per student in the first year the first center opened in the county as well as an interaction between this hours measure and a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Percent effects for the Center Indicator results are calculated by dividing the coefficient by the mean birth rate for the age and racial/ethnic group. The percent effects for the staff hours estimates show the percent effect relative to the mean for a center with the average number of primary care or medical staff hours. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 6: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data

	OLS			2SLS			2SLS		
IV:				Center Indicator			Initial Hours		
Grade:	10^{th}	11^{th}	12^{th}	10^{th}	11^{th}	12^{th}	10^{th}	11^{th}	12^{th}
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Treatment Measure									
Center Indicator	0.485	0.149	0.563						
	(0.506)	(0.486)	(0.398)						
Primary Care Staff Hours	-0.003	-0.032	-0.009	0.080	0.014	0.151*	-0.010	0.002	-0.013
	(0.012)	(0.022)	(0.013)	(0.105)	(0.096)	(0.088)	(0.012)	(0.009)	(0.012)
% Effect of Average Center	-0.02%	-0.16%	-0.05%	0.40%	0.07%	0.76%	-0.05%	-0.01%	-0.07%
Medical Staff Hours	-0.003	-0.013**	-0.005	0.042	0.009	0.063	-0.001	0.008	-0.007
	(0.005)	(0.007)	(0.006)	(0.051)	(0.046)	(0.039)	(0.007)	(0.007)	(0.008)
% Effect of Average Center	-0.02%	-0.07%	-0.03%	0.21%	0.05%	0.32%	-0.01%	0.04%	-0.04%
First-stage F-Stat (Primary Care)					33.22			284.42	
First-stage F-Stat (Medical Staff)					39.57			235.08	

Notes: Authors' estimates of equation (4) using NCES CCD high school diploma data from 1998-2010. Each cell comes from a separate regression. In columns (iv)-(vi), Primary Care Staff Hours and Medical Staff Hours are instrumented with an indicator for whether there is a center in the school district in the previous year as well as a quadratic in the number of years since a center was first opened in the school district (set equal to zero in the years prior to a center first opening). In columns (vii)-(ix), the instruments are the number of primary or medical staff hours per student in the first year the first center opened in the school district as well as an interaction between this hours measure and a quadratic in the number of years since a center was first opened in the school district (set equal to zero in the years prior to a center first opening). The 10^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The percent effects for the staff hours estimates show the percent effect for a center with the average number of primary care or medical staff hours. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: The Effect of SBHC Services on High School Dropout Rates (in percent) – Census Data

	14-17 Year Olds			18-19 Year Olds		
	All	Female	Male	All	Female	Male
Treatment Measure	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Center Indicator	-0.107	-0.066	-0.143	0.751	0.429	0.985*
	(0.156)	(0.183)	(0.160)	(0.530)	(0.618)	(0.588)
Primary Care Staff Hours	-0.003	-0.002	-0.003	-0.017	-0.047**	0.011
	(0.004)	(0.005)	(0.005)	(0.016)	(0.022)	(0.021)
% Effect of Average Center	-0.02%	-0.01%	-0.02%	-0.09%	-0.24%	0.06%
Medical Staff Hours	-0.001	-0.0002	-0.002	-0.006	-0.021*	0.005
	(0.002)	(0.003)	(0.003)	(0.008)	(0.012)	(0.010)
% Effect of Average Center	-0.01%	-0.001%	-0.01%	-0.03%	-0.11%	0.03%

Notes: Authors' estimates of equation (4) using 1990 and 2000 Census data as well as 2005-2011 ACS data. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district that does not report attending school and that does not have a high school degree. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The percent effects for the staff hours estimates show the percent effect for a center with the average number of primary care or medical staff hours. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 8: The Effect of SBHC Services on Teen Birth and HS Dropout Rates, Allowing for Level Shifts

Panel A: Births per 1,000 Women

Treatment Measure	≤15 (i)	16-19 (ii)
Primary Care Staff Hours	-0.012	-0.324*
	(0.009)	(0.167)
Center Indicator	-0.027	-1.079*
	(0.032)	(0.622)
Medical Staff Hours	-0.006*	-0.153*
	(0.004)	(0.086)
Center Indicator	-0.024	-1.027
	(0.032)	(0.659)

Panel B: High School Dropout Rate

Treatment Measure	10^{th} Grade (i)	11^{th} Grade (ii)	12^{th} Grade (iii)
Primary Care Staff Hours	-0.008	-0.035	-0.017
	(0.013)	(0.024)	(0.014)
Center Indicator	0.520	0.316	0.657
	(0.527)	(0.528)	(0.420)
Medical Staff Hours	-0.006	-0.015**	-0.010
	(0.006)	(0.008)	(0.006)
Center Indicator	0.542	0.304	0.675
	(0.527)	(0.521)	(0.420)

Notes: Authors' estimation as described in the text. *Center Indicator* is an indicator variable equal to 1 if any school-based health center exists in the county (Panel A) or school district (Panel B). All estimates in Panel A include county and state-by-year fixed effects and all estimates in Panel B include school district and state-by-year fixed effects. Regressions are weighted by the high school aged population in the county (Panel A) or school district (Panel B). The 10^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. Standard errors clustered at the county (Panel A) or school district (Panel B) level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 9: The Relationship Between SBHC Services and Per-Student Expenditures

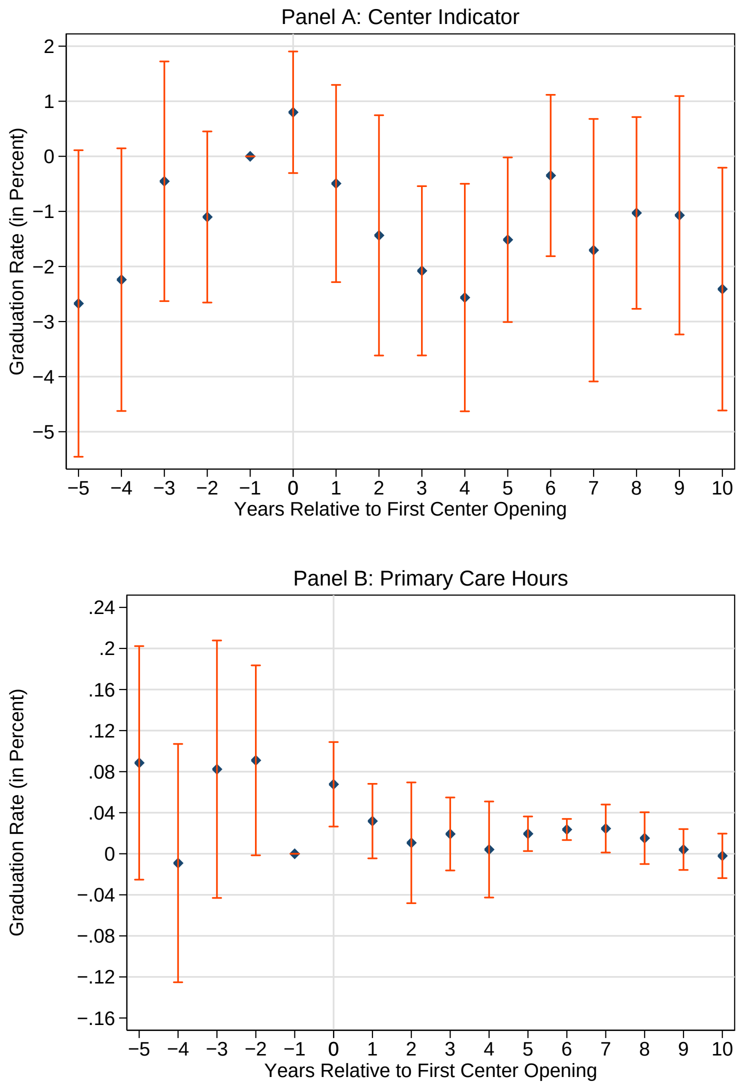
Treatment Measure	Log Per Student Expenditures
Center Indicator	-0.003 (0.006)
Primary Care Staff Hours	0.0005 (0.0003)
Medical Staff Hours	0.0002 (0.0001)

Notes: Authors' estimation as described in the text using data from the 1998-2011 Common Core of Data. All estimates include school district and state-by-year fixed effects. Regressions are weighted by the high school aged population in the school district. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Online Appendix

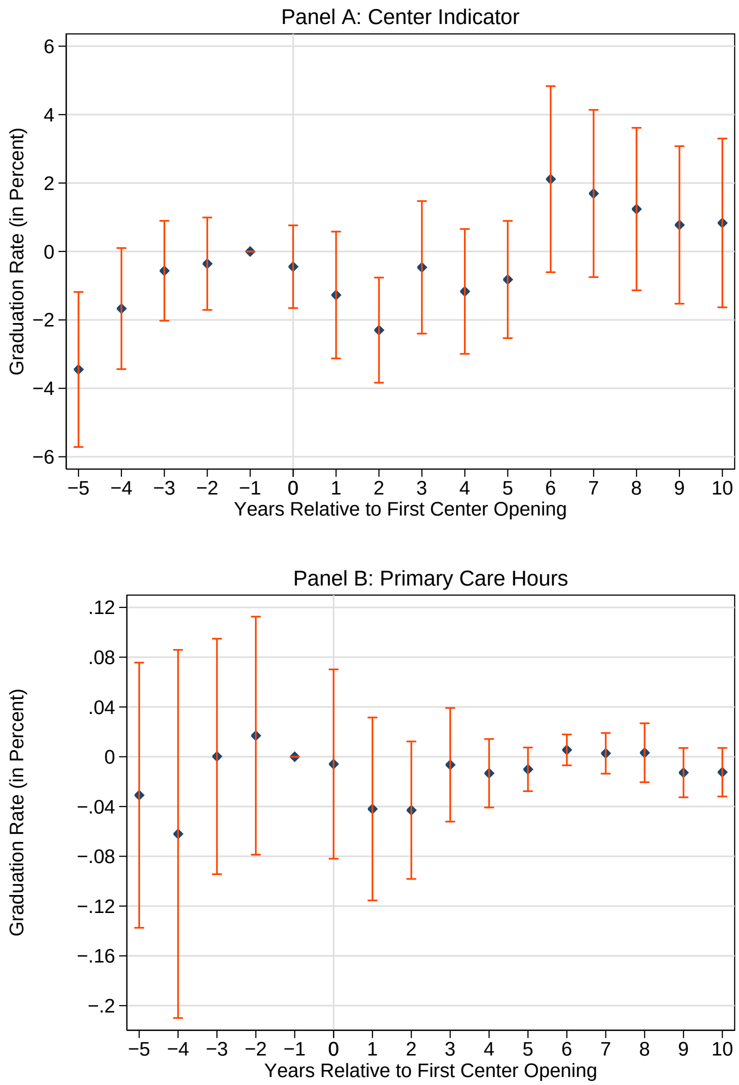
Not for Publication

Figure A-1: Event Study Estimates of the Effect of SBHC Entry and Primary Care Services on 10^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



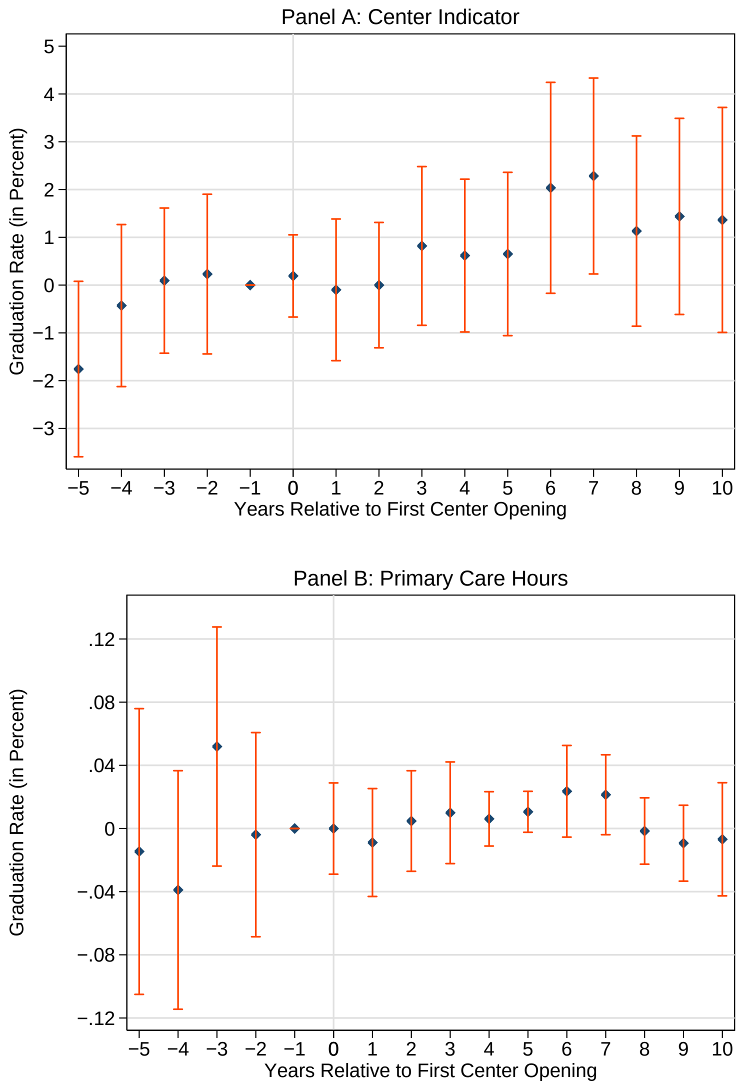
Authors' estimates of equations (5) and (6) as described in the text. Each point shows the coefficient estimate on the total medical staff hours service measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 and school districts that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure A-2: Event Study Estimates of the Effect of SBHC Entry and Primary Care Services on 11^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equations (5) and (6) as described in the text. Each point shows the coefficient estimate on the total medical staff hours service measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 and school districts that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure A-3: Event Study Estimates of the Effect of SBHC Entry and Primary Care Services on 12^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equations (5) and (6) as described in the text. Each point shows the coefficient estimate on the total medical staff hours service measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 and school districts that have no centers are included in the regressions. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Table A-1: The Effect of SBHC Services on Teen Birth and HS Dropout Rates Using Alternative Service Measures

Panel A: Births per 1,000 Women		
	≤15	16-19
Treatment Measure	(i)	(ii)
Days Open per Week	-0.087*	-2.199**
	(0.051)	(1.085)
Hours Open per Week	-0.031**	-0.796**
	(0.012)	(0.244)

Panel B: High School Dropout Rate			
	10^{th} Grade	11^{th} Grade	12^{th} Grade
Treatment Measure	(i)	(ii)	(iii)
Days Open per Week	-0.022	-0.220*	-0.138
	(0.086)	(0.130)	(0.103)
Hours Open per Week	0.0001	-0.033	-0.011
	(0.017)	(0.020)	(0.018)
Average Days per Week			
Average Hours per Week			

Notes: Authors' estimates of equations (1) and (4) as described in the text. Each cell comes from a separate regression. All estimates in Panel A include county and state-by-year fixed effects and all estimates in Panel B include school district and state-by-year fixed effects. The 10^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. Regressions are weighted by the high school aged population in the county (Panel A) or school district (Panel B). Standard errors clustered at the county (Panel A) or school district (Panel B) level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table A-2: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data, by Birth Control Services

	Primary Care Staff Hours			Medical Staff Hours		
Grade:	10^{th}	11^{th}	12^{th}	10^{th}	11^{th}	12^{th}
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Birth Control Services						
Hormones Prescribed On Site	-0.013	-0.010	0.003	-0.008	-0.006	-0.001
	(0.013)	(0.014)	(0.014)	(0.006)	(0.007)	(0.007)
Hormones Referred, No Condoms	0.004	-0.065	-0.021	-0.001	-0.027*	-0.009
	(0.020)	(0.024)	(0.028)	(0.009)	(0.016)	(0.010)
Hormones Referred & Condoms Dispensed	-0.010	0.034	-0.061	0.013	-0.035	-0.064
	(0.095)	(0.069)	(0.055)	(0.024)	(0.063)	(0.046)
No Birth Control Services	0.027	-0.034	-0.017	0.010	0.005	0.003
	(0.041)	(0.038)	(0.027)	(0.021)	(0.024)	(0.016)

Notes: Authors' estimates of equation (4) as described in the text. Each column comes from a separate regression. The birth control service measures include the number of service hours of each type in centers with the given birth control policy. The birth control policy groups are exhaustive and mutually exclusive. The 10^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table A-3: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data Using Large Counties

Grade:	10^{th} (i)	11^{th} (ii)	12^{th} (iii)
Treatment Measure			
Center Indicator	-0.005	0.152	-0.386
	(1.028)	(0.791)	(0.762)
Primary Care Staff Hours	0.020	0.021	0.002
	(0.018)	(0.014)	(0.011)
Medical Staff Hours	0.006	0.011	-0.004
	(0.008)	(0.007)	(0.006)

Notes: Authors' estimates of equation (4) using NCES CCD high school diploma data from 1998-2010. The sample is comprised of the large counties that constitute the birth rate analysis sample. Each cell comes from a separate regression. The 10^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table A-4: The Effect of SBHC Services Among Centers Providing Birth Control Services on STD Rates per 1000 15-19 Year Olds

Panel A: Baseline Estimates			
Treatment Measure	STDs (i)	Chlamydia (ii)	Gonorrhea (iii)
Primary Care Staff Hours	-0.187	-0.102	-0.102
	(0.135)	(0.111)	(0.046)
Medical Staff Hours	-0.048	-0.021	-0.080
	(0.044)	(0.039)	(0.067)

Panel B: Controlling for Chlamydia and Gonorrhea Rates Among 25-29 Year Olds			
Treatment Measure	STDs (i)	Chlamydia (ii)	Gonorrhea (iii)
Primary Care Staff Hours	-0.187	-0.105	-0.077**
	(0.179)	(0.147)	(0.034)
Medical Staff Hours	-0.047	-0.019	-0.026**
	(0.052)	(0.043)	(0.010)

Notes: Authors' estimates of a version of equation (1) aggregated to the state-year level. Each cell comes from a separate regression. All estimates include state and year fixed effects. STD data are for years 1998-2011 and include chlamydia, gonorrhea and syphilis in column (i). Standard errors clustered at the state level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table A-5: First-Stage Estimates from Instrumental Variables Models

	Birth Rates				Dropout Rates			
IV:	Center Indicator		Initial Hours		Center Indicator		Initial Hours	
Service Measure:	Primary Care	Medical Staff	Primary Care	Medical Staff	Primary Care	Medical Staff	Primary Care	Medical Staff
Center Indicator	1.701**	4.039**	4.024**	8.648**				
	(0.173)	(0.443)	(0.415)	(0.825)				
Time Since First Entry	0.029	-0.030	0.834**	1.644**				
	(0.024)	(0.075)	(0.175)	(0.340)				
$(\text{Time Since First Entry})^2$	-0.00005	0.006	-0.051**	-0.109**				
	(0.002)	(0.005)	(0.015)	(0.027)				
(Center Indicator)*	.	.	.	.	0.392**	0.417**	2.315**	2.347**
(Initial Hours)	.	.	.	.	(0.044)	(0.046)	(0.080)	(0.089)
(Time Since First Entry)*	.	.	.	.	0.017**	-0.012	-0.002	-0.025**
(Initial Hours)	.	.	.	.	(0.007)	(0.010)	(0.013)	(0.009)
(Time Since First Entry)*	.	.	.	.	-0.0001**	0.00002*	0.000	0.000
$(\text{Initial Hours})^2$	.	.	.	.	(0.00001)	(0.00001)	(0.00002)	(0.00002)

Notes: Authors' estimates of equations (1) and (4) as described in the text. All estimates include county/school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county/school district. Standard errors clustered at the county/school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.