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

Michael F. Lovenheim
Cornell University and NBER†

Randall Reback
Barnard College & ISERP, Columbia University

Leigh Wedenoja
Cornell University

November 2014

Abstract

The large amount of money spent on providing health care in the US to low-income Americans combined with persistent disparities in health and education across the socioeconomic distribution leads to the important question of how expanding health care access could help address these disparities. This paper examines the provision of primary care health services to low-income students that are delivered through school-based health centers (SBHCs). Using the timing of center entry and exit 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 16%-21% and reduces the 16-19 year old birth rate by 8%-10%. We also find that centers slightly reduce high school dropout rates, at least for female students. These estimates suggest that primary care health services do not reduce high school dropout rates by much, despite the sizable reductions in teen birth rates. This does not mean that SBHCs do not make students better off, as reducing teen fertility is desirable in its own right.

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

*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 and Janet Currie 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, 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.

†Corresponding author contact information: 102 Martha Van Rensselaer Hall, Ithaca, NY 14853; *email:* mfl55@cornell.edu.

1 Introduction

Access to affordable health care for low-income Americans has become a preeminent policy issue in the U.S., which is highlighted by the vigorous debate surrounding the passage and implementation of the 2010 Affordable Care Act (ACA). Combined with the ACA, the massive expansion of Medicaid that has occurred over the past several decades has caused the gap in health insurance coverage between children from low-income and high-income families to all but disappear. However, 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, there remain large disparities across the income distribution in the quality of care to which families have access (Smedley, Stith and Nelson 2003; Andrulis 1998). This quality gap can be attributed in part to the lack of medical practices that take Medicaid insurance and the reluctance of many doctors to locate their practices in low-income urban or rural areas. Inadequate access to primary care facilities and doctors among low-income families may preclude them from realizing any benefits of health insurance, which can render the roughly $86 billion the U.S. spends on Medicaid for children less effective. While a large literature exists that shows 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. 2014; Brown, Kowalski and Lurie 2014), there is virtually no empirical evidence on the extent to which expanding the quality of health care services to youth can impact their health and educational attainment. Given the large and persistent disparities across the socioeconomic distribution in academic achievement, health care access, and health status,[1] understanding the extent to which health care services when young affects important life outcomes among youth is of high policy relevance.

In this paper, we examine the effect of providing primary care health services to teens through school-based health centers (SBHCs) on their fertility rates and on their educational attainment. Our analysis makes two contributions to the literature. First, we present the first evidence of the effect of primary health care services on teen birth rates. Whether a teenager gives birth

[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).

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 currently there is very little understanding of what policies are effective in reducing teen births (Kearney and Levine 2012). Providing health care services to teens, and in particular easy-to-access contraception, may be an effective policy tool with which to lower teen fertility rates. Indeed, Kearney and Levine (2009) show that state expansion of Medicaid family planning waivers reduced teen birth rates by 4-5%, with the largest impact on women age 18-19. This paper complements their analysis by examining the role of health care and contraceptive services, *per se*, rather than insurance coverage for contraception.

Second, our paper is the first to estimate the effect of primary health care services on the educational attainment of children from low-income families.[2] Providing access to health care services could increase educational attainment through any effect on child health as well as on family finances. There are strong arguments based on human capital theory that both of these mechanisms can impact the accumulation of human capital. To the extent that SBHCs impact teen birth rates, this also is a potential mechanisms through which they could affect educational attainment.[3] To date, no research exists that credibly estimates the causal effect of primary care health care access among children on their educational attainment in the US.[4]

A major hurdle in estimating the effect of health care services on health and education that has impeded prior research is that health care access is not exogenously assigned: unobserved factors correlated with health care service availability are likely to be correlated with underlying educational and health 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

[2] A sizable amount of work has demonstrated that poor health or adverse health events among children are associated with worse long-run outcomes (Currie et al. 2010; Case, Fertig and Paxson 2005; Case, Lubotsky and Paxson 2002). However, this literature does not examine whether providing primary care health services to these children leads to better outcomes. Historical evidence on hookworm and malaria eradication (Bleakley 2007, 2010) as well points to a potential effect of primary care services, but it is not clear whether we can generalize such evidence to expected impacts today given the far lower current prevalence of deadly and harmful diseases amongst children in the U.S. Finally, there is a large literature that examines the effect of pre-natal health care and health outcomes on subsequent academic performance (i.e., the "fetal origins" hypothesis). See Almond and Currie (2011) for a review of this work. Typically, these analyses show that pre-natal health has large and long-lasting effects on a child's cognitive development and life outcomes. The effect of providing health care services to older children on their educational attainment has not been examined in previous work. This is the focus of our analysis.

[3] There is a large literature examining the effects of teen births on educational attainment that varies considerably in the identifying assumptions and is on the whole inconclusive about whether giving birth as a teenager lowers educational attainment (e.g., Ribar 1994; Hotz, McElroy and Sanders 2005; Fletcher and Wolfe 2009; Klepinger, Lundberg and Plotnick 1999; Geronimus and Korenman 1992; Levine and Painter 2003).

[4] Beginning with the seminal work of Grossman (1972), there is a large body of work examining the opposite question: whether education should increase health later in life. The evidence on this question is mixed (Adams et al., 2003; Cutler and Lleras Muney, 2006; Grossman, 2004; Clark and Royer, 2010), with studies differing substantially with respect to the econometric approach used.

U.S. School-based health centers are either government- or privately-sponsored health clinics that are attached to schools in low-income areas and that provide a suite of primary care health services to students. While they vary in size and scope, virtually all clinics provide basic preventative health services to students, and many of them also provide reproductive health services and contraception. From the National Assembly on School-based Health Care (NASBHC), we obtained data from surveys they conducted of health centers in 1998, 2001, 2004, 2007 and 2011 in the U.S. 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 2,633 centers during our analysis period. Given the prevalence of SBHCs in the U.S. and the large rise in their use over the past several decades (see Figure 1), understanding how these centers affect students is an important policy question in its own right.

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. Our identification strategy uses the changes over time in the service levels these centers provide that is driven by their opening, by within-center variation in service levels over time, and also by center closings. However, we show evidence that center openings provide most of our identifying variation. We measure treatment intensity by the primary care physician hours per week and total medical staff hours per week offered by SBHCs. These measures provide an accurate depiction of the medical services offered per student, and they also increase our statistical power relative to simply using the number or existence of centers as our treatment measure. Thus, our empirical approach is essentially a difference-in-difference strategy, with the treatment intensity scaled by the amount of services provided by the centers in each area relative to the student population. The main identification concern with our approach is that service level variation is based on fixed trends in birth rates or educational outcomes. This issue is compounded by the fact that we cannot fully explain why centers locate in a given area in a given year (or why they close). However, 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. The timing of center entry, exit and service changes also varies significantly across school districts, allowing us to control for state-by-year fixed effects that provide further confidence in the validity of our approach. Furthermore, we verify that our findings are robust to using different treatment intensity measures and to different functional form assumptions about the relationship between SBHC service levels and outcomes.

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 difference-in-difference estimate therefore is identified from county-level changes in birth rates of teens that are related to the timing of SBHC openings/closings and to changes in SBHC service levels. Throughout the analysis, we scale the treatment effects to give the effect of adding services equivalent to an average-sized SBHC, as this is a policy parameter that is straightforward to interpret. Our preferred estimates reveal that service changes equivalent to opening one additional center lead to 0.13-0.17 fewer births per 1,000 girls ages 15 and under, which is between a 16.0% to 21.1% reduction relative to the baseline birth rate. For 16-19 year olds, the birth rate declines by between 3.6-4.7 per thousand women, or 7.8%-9.7%. The fertility effects are localized to those centers that offer contraceptive services, and we find even larger effects once SBHCs have been open for several years. To put the size of these estimates in perspective, SBHC services can explain between 3 and 7 percent of the decline in teen fertility rates since 1990 and can explain 8 to 15 percent of the cross-sectional geographic variation in 15 and under birth rates as well as 3 to 7 percent of the geographic variation in 16-19 year old birth rates. These results suggest that school-based health clinics have sizable negative impacts on teen birth rates, especially when they provide contraceptive services to teens, and that SBHCs are indeed increasing teens' access to health services rather than just shifting the provider of those services.

Despite the effectiveness of SBHCs in reducing teen pregnancies, they only moderately increase high school graduation 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. We find that SBHC services reduce dropout rates for students during 11^{th}

grade but not during 10^{th} or 12^{th} grade. The opening of an average-sized health center reduces the high school dropout rate among 11^{th} grade students by between 0.17 and 0.25 percentage points, which is between 1.1% and 1.6% relative to the baseline dropout rate. Estimates using U.S. Census data and ACS data are similar, and the effects of SBHCs on high school completion are occurring predominantly for female teens rather than male teens.

Our most economically significant finding is that school-based health centers offering birth control services 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 likely 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. Aside from their effects on fertility rates, the services provided by these centers have at most a modest effect on high school graduation rates. To our knowledge, this is the first analysis in the literature to estimate the causal relationship between primary health care access among teens and their fertility rates and educational attainment.

The rest of this paper is organized as follows: Section 2 provides an overview of school-based health centers in the United States. In Section 3, we discuss the various sources of data we use, and Section 4 presents our empirical methodology and discusses the identification assumptions. Section 5 presents our empirical results, and Section 6 concludes.

2 School-based Health Centers

School-based health centers (SBHCs) are health clinics that are located inside specific schools or elsewhere on the schools' 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

[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 (forthcoming) 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.

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 low-income students 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 the 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 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*.

The exact services provided by SBHCs vary across centers. All centers provide primary care services. The specific primary care services do vary, though, and the distribution of primary care services is shown in Figure 3, Panel A. About 85% of centers provide some form of reproductive health service. 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 dispense contraceptives of some form directly, but many of the remainder refer students to other providers for contraception. Referrals are likely to be a very important method through which female students can obtain birth control pill prescriptions. Table 1 shows detailed information about the types of contraceptive services SBHCs offer. Over 35% either can dispense or prescribe the birth control pill, and another 29% can refer patients to other doctors for a prescription. Condoms are dispensed at 30% of centers, and emergency contraception or plan B also are available either directly or through referral at the majority of SBHCs. Table 1 shows that a large proportion of SBHCs provide significant contraceptive services, especially for female students. Because of the location of these centers, female students do not need to be taken to them by parents or guardians, which might make these services particularly relevant for this population.[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 referrals through the primary care doctors for students who need mental health services.

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

[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.

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 the incidence of asthma and obesity also is 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 that has been reported in prior studies. 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. Overall, 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, no nationally-representative study of these centers using methods that can plausibly identify their causal effects on health and education exists. 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. Using a national sample of SBHCs combined with information about the timing of openings and closings of centers and changes in service levels, we provide the first nationally-based analysis of these centers on health and education that also more plausibly handles the selection problems that both the location of SBHCs and their use by particular students in a school are endogenously related to the outcome variables of interest.

One recent study of New York City public schools by Reback and Cox (2014) uses a similar methodology to ours and finds evidence that SBHCs located in elementary and middle schools increase student attendance rates in those schools. Their findings suggest that the health benefits from SBHCs could potentially increase educational attainment, particularly if positive

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

effects on middle school students do not fade during high school. Our work complements this analysis by examining 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 Assembly 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 Assembly 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 2,633 centers serving high school students in 930 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. The total medical staff hours include mental health and dental care hours in addition to primary care. Thus, for survey respondents,

[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.

we have comprehensive information on the level and types of services the center provides for students.

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 or set of schools.

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

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

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 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: $\leq$15 and 16-19. Mean birth rates by age group are shown in Table 2.

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.

[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 also cannot distinguish between actual dropout rate changes and changes in the timing of degree receipt and student transferring behavior. For example, if there is a net loss of the 10^{th}-12^{th} grade cohorts due to transferring out of the school district, this measure will show an increase in dropout rates. However, 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 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 age 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. As teen fertility is a central focus of our study, examining dropout effects for males and females separately is important.

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, closings, and the scope of the services provided. This is essentially a difference-in-difference method, but the treatment is allowed to vary in intensity by the amount of services provided by each center relative to the underlying size of the student population. 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. In particular, we estimate models of the following form:

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

where Y_{cst} is the birth rate per thousand women in county c in year t,[15] 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. The variable of interest in equation (1) is β_1, which shows the effect on the birth rate of an increase in SBHC services. These services are set to zero prior to an SBHC opening. The specific interpretation of β_1 depends on the manner in which the SBHC services are measured. We focus on two different service measures: Primary Care Physician Hours per week and Total Medical Staff Hours per week. The Total Medical Staff Hours differ from Primary Care Hours due to hours from mental health staff, dental staff, physician's assistants and nurse practitioners. In the online appendix, we also show estimates that use Days per Week and Hours per Week as the service measures. As Primary Care Physician 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.

We estimate regressions at the county-year and school district-year levels. 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.[16] 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. The interpretation of β_1 is the effect of an SBHC increasing its service level by an additional hour on the birth rate. When multiplied by the average service level at an SBHC, this estimate shows

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

[16] Our high-school-aged population count includes individuals between the ages of 14 and 19, except for individuals who are 18 or over and have a high school diploma.

the effect of a service increase equivalent to one more average-sized center opening. We focus on this parameter for policy purposes.

For the birth rate analysis, equation (1) is estimated at the county-year level and γ_c represents county fixed effects. It is important to highlight that these fixed effects control for any fixed differences across counties in birth rates that are correlated with the intensity of SBHC treatment. The identifying variation for β_1 comes from two sources: 1) SBHC openings/closings and 2) changes in per-student service levels among open centers from year to year. Identification of β_1 in equation (1) thus rests on several assumptions that are common in difference-in-difference analyses. The first is that both the the decision to open or close a center and decisions about the amount of services each center should offer are uncorrelated with trends in teen birth rates (or in academic attainment in the attainment regressions). Put differently, trends in the outcome variables from before a center opens should not predict the future intensity of treatment. Of particular concern is whether centers in general or relatively larger clinics 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 particularly relevant in this context. It is far more likely that SBHC services are targeted toward schools that have declining health and education outcomes. Nonetheless, because we cannot perfectly observe the factors that influence the SBHC location and funding decisions that drive our identifying variation,[17] we test for the existence of pre-SBHC relative trends as a function of future SBHC service levels with the following "event study" specification:

$$\begin{aligned} Y_{cst} &= \phi + \sum_{\tau=-5}^{-1} \alpha_\tau SBHC_{ct_0} I(t - t_0 = \tau) + \sum_{\tau=0}^{10} \alpha_\tau SBHC_{ct} I(t - t_0 = \tau) \\ &\quad + \gamma_c + \delta_{st} + \epsilon_{cst}. \end{aligned} \tag{2}$$

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 equal to zero otherwise. Thus, these variables are zero for counties that have no health centers. We multiply these event time indicators by

[17]We also note that it typically takes several years for centers to open due to bureaucratic requirements, the time it takes to hire staff, and securing space from schools. It therefore is very unlikely that SBHCs can target the timing of their opening to short-run trends in outcomes.

relative service levels to make them comparable to the specification in equation (1). In the pre-period, the $SBHC$ variable is set to the first observed service level for each of the four measures 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 $SBHC$ variable is allowed to vary over time, similar to how it is specified in equation (1).

This event study model allows us to both test for pre-treatment trends as a function of future SBHC service levels 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. In Section 5.2., we also show that our results are robust to using only service levels from the first year the first center in an area opens and to allowing for a post-treatment indicator. These estimates provide further evidence that endogenous center entry is not biasing our results.

A second concern with difference-in-difference 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 for two reasons. First, since the timing of the treatment varies across counties, it is very unlikely secular shocks exist that are highly correlated with the timing of SBHC service changes. Second, the use of state-by-year fixed effects helps control for any state-level policies or shocks that could be correlated with the timing and intensity of treatment.

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:

$$Y_{dst} = \beta_0 + \beta_1 SBHC_{dt} + \gamma_d + \delta_{st} + \epsilon_{dst} \tag{3}$$

$$\begin{aligned} Y_{dst} = {} & \phi + \sum_{\tau=-5}^{-1} \alpha_\tau SBHC_{dt_0} I(t - t_0 = \tau) + \sum_{\tau=0}^{10} \alpha_\tau SBHC_{dt} I(t - t_0 = \tau) \\ & + \gamma_d + \delta_{st} + \epsilon_{dst}. \end{aligned} \tag{4}$$

In equations (3) and (4), we now include district, rather than county, fixed effects. Furthermore, we include controls for parental education, income, student race/ethnicity, and free/reduced price lunch status from the Common Core of Data. The assumptions underlying the identification of the treatment parameters in equations (3) and (4) are essentially identical to those for equations (1) and (2), except instead of there being no differential county-level relative trends, here there must be no differential district-level trends. Equation (4) allows us to test for such trends as well as for time-varying treatment effects.

A final potential methodological issue is the presence of measurement error in our treatment measures. The measurement error in the $SBHC$ variables comes from several sources. 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. 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 $SBHC$ 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 35% of centers are open to students in other schools and that 14% are open to the broader community 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.[18] 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.

[18]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.

5 Results

5.1 Birth Results

Table 3 presents the baseline estimates of the effect of school-based health centers on teen birth rates. In Panel A, we show estimates for the birth rate among girls 15 and under and in Panel B we show estimates for the 16-19 year old birth rate. Each cell in the table comes from a separate regression, with the treatment intensity measure varying across rows. Because birth rates are likely to be serially correlated within county over time, all standard errors are clustered at the county level.

The rows of Table 3 show estimates of β_1 from equation (1) using different treatment intensity measures.[19] Across the two treatment variables, the table shows a consistent negative relationship between SBHC service levels and teen birth rates. 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 0.035, and increasing total physician hours decreases the birth rate by -0.005. These estimates both are negative, sizable in magnitude, and statistically different from zero at the 5% 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, one must multiply the estimates by the average amount of services each center supplies. These means are shown in the first column of Table 2. The Primary Care Staff Hours indicate that opening an average-sized center would reduce under-16 birth rates by 0.17. Using Total Medical Staff Hours, the effect is slightly smaller, at 0.13. Relative to the mean birth rate of 0.79, this translates into birth rate declines of 21.1% and 16.0%, respectively.

The estimates of the effect of SBHCs on births among 16-19 year olds also are consistently negative, large in magnitude, and statistically different from zero across service measures, as shown in Panel B of Table 3. These results suggest that opening a center with the average level of service provision would decrease the birth rate by between 3.6 and 4.7. Relative to the baseline fertility rate of 46.02, an average-sized health center reduces births among 16-19 year olds by between 7.8% and 9.7%.[20] While relatively smaller than the estimates for those 15 and

[19]Appendix Table A-1 contains estimates using Days per Week and Hours per Week as the service measures.

[20]The magnitude of these estimates is similar to the 6.8% decline in birth rates among 18-19 year olds following Medicaid family

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.

One way to frame the size of these effects is to calculate the extent to which SBHC services can explain the recent decline and the geographic variation in birth rates. Kearney and Levine (2012) show that teen birth rates have declined significantly since the early 1990s and that they vary significantly across space in the US. However in their review of the evidence, they highlight that little is understood about why these rates have declined and about the causes of the geographic variation in teen births. School-based health centers have large effects on teen birth rates, and their rise and geographic dispersion potentially can contribute to these aggregate patterns. Martin et al. (2013) show that teen birth rates have declined by 1 per 1,000 for girls 15 and under and by 28.8 for teens 16-19 between 2009 and 2011. The changes in SBHC services between 1990 and 2011, combined with the estimates in Column (i) of Table 3, can explain about 7% of this decline using Primary Care Staff Hours and can explain 3.3% of the decline using Total Medical Staff Hours as the treatment measures. Thus, the rise of SBHCs can explain a modest but non-trivial amount of the aggregate decline in teen birth rates in the US. Furthermore, we can calculate how much of the cross-sectional variance in birth rates is explained by SBHC services. For this calculation, we calculate the decrease in explained variation across US counties in 2012 if SBHC service levels were set to zero. For teens 15 and under, Primary Care Staff Hours can explain 14.7% of the geographic variance in birth rates, while Total Medical Staff Hours can explain 7.5%. Among 16-19 year olds, Primary Care Staff Hours explain 6.7% of the cross-sectional variation in the birth rate, while Total Medical Staff Hours explains 3.0% of the variation. Taken together, these calculations underscore the importance of school-based health center services in helping to explain some of the cross-sectional and time series variation in teen birth rates that prior work has largely been unable to explain.

As discussed above, a central concern with the type of difference-in-difference 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). Figure 5 shows the estimates of α from

planning waiver expansions reported in Kearney and Levine (2009).

equation (2) for birth among teens 15 and under. We have excluded relative year -1 such that all estimates are relative to this year. The dashed lines show bounds of the 95% confidence intervals that we calculated using standard errors that are clustered at the county level. Two patterns emerge from Figure 5. First, in both panels, there is very little evidence of pre-treatment trends in birth rates as a function of future SBHC service levels. If anything, there is a slight upward trend for Primary Care Hours, suggesting our baseline difference-in-difference estimates may understate the magnitude of the effects. In Panel B, there is no evidence of a pre-SBHC trend. The lack of a pre-treatment trend in birth rates provides some confidence in our central identification assumption. Second, there is much evidence of time-varying treatment effects that grow over time. In both panels, the estimates stabilize after about five years. A likely explanation for this delay is that these centers take several years to successfully reach out to students and to learn how to provide services effectively. Taking the average coefficients over years 5-10 shows a larger effect of SBHCs on under-16 year old births than are presented in Table 3. An average-sized SBHC would decrease the birth rate among teens under 16 after five years by between 0.23 and 0.24. Relative to the baseline birth rate, this is between a 28.2% to 30.9% decline. Thus, the declines shown in Figure 5 are quite large and are consistent with school-based health centers significantly reducing births among young teens.

Figure 6 presents similar estimates for 16-19 year olds.[21] As in Figure 5, we again see little evidence of pre-treatment trends that could bias our estimates. The delayed nature of the treatment effect also is evident for this age group, with the estimates again stabilizing after five years. As with the under-16 birth rate, this pattern points to a larger longer-run effect of SBHCs on 16-19 year old births than is suggested by the results in Table 3. Taking the average across coefficients for relative years 5-10 suggests adding a center with average service levels would decrease 16-19 year old birth rates by between 13.6 to 15.2 percent. Taken together, the results in Figures 5 and 6 suggest that opening an average-sized center in a high school will reduce the number of births among teens 19 and under by 7.2 per 1,000 five years later.

As discussed in Section 2, SBHCs differ in the types of services they offer. In particular, only some centers offer contraceptive services. Table 1 shows the proportion of centers that

[21] Appendix Figures A-1 and A-2 show event study estimates using Days Open per Week and Hours Open per Week as the service measures and are very similar to the results in Figures 5 and 6, respectively.

offer different types of contraception. Overall, about 85% of centers offer some type of birth control, either directly or through referral. In columns (ii)-(iv) of Table 3, we examine the effect of SBHCs on birth rates separately by the birth control services offered by the center. In column (ii), we use all centers that offer some type of contraceptive service, including referral. In column (iii), we only examine the SBHCs that dispense or prescribe birth control on-site (about 40% of centers), and in column (iv) we analyze the effect of SBHCs that provide no contraceptive services on teen birth rates.[22]

Despite the somewhat imprecise estimates for the No Birth Control sample, Columns (ii)-(iv) of Table 3 clearly demonstrates that the reduction in teen birth rates due to SBHC services is driven by centers that offer some type of birth control. The similarity between the estimates using centers that provide services on-site relative to those that include referrals only suggests it is not necessary to offer these services directly. These estimates are similar to each other and to the average effects shown in column (i) of Table 3, which perhaps is not surprising given the large number of centers that offer contraceptive services.[23] But, there is much less evidence of an impact of SBHCs on birth rates when a center offers no birth control services, which increases our confidence that the effects we estimate are indeed driven by changes in SBHC service levels.

Table 4 shows birth rate estimates by race and ethnicity. We estimate equation (1) separately for white, black and Hispanic births. Among teens under 16, the marginal effects of a 1 hour change in service on the birth rate are largest for Hispanics and are of similar magnitude for blacks and whites. The estimates for African American teens 15 and under only are significant at the 10% level though. Despite the similarity of the point estimates, the baseline birth rates vary significantly across groups, at 0.45 for whites, 1.38 for blacks and 0.86 for Hispanics. The implied effect of increasing SBHC services to the level of the average SBHC is a decrease in the under 16 birth rate of between 28.3%-37.2% relative to baseline for whites, an 8.0% to 9.2% reduction for blacks, and a decline of between 33.8% and 36.1% for Hispanics. The 16-19 year old birth rate results follow a similar pattern. Mean birth rates for this age group are 41.82, 68.34,

[22]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, and abstinence counseling. The offering of birth control services also may be correlated with other service offerings that can influence births.

[23]Note that the birth control and non-birth control estimates do not need to average to the results in column (i) because the models in columns (ii)-(iv) also allow the fixed effects to vary by center type.

and 71.96 for whites, African Americans and Hispanics, respectively. The estimates in Table 4 for the birth control sample imply that the average SBHC reduces the 16-19 birthrate among whites by between 8.8%-11.4%, among blacks by between 5.4%-6.3% and among Hispanics by between 4.8% and 7.1%. Thus, while SBHCs have the largest proportional impact on white and Hispanic teen birth rates, they reduce teen births of all groups significantly.

5.2 High School Dropout Results

Thus far, we have shown evidence that school-based health centers reduce teen birth rates. These findings also suggest that school-based clinics promote better health outcomes among the teens exposed to them, at least in terms of this observable and important outcome. 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 attainment, and it thus is the focus of our analysis. In Table 5, 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.

As discussed in Section 3, these dropout rates are essentially one minus the ratio of diplomas issued in a given year divided by the enrolled population two years ago (for 10^{th} grade), one year ago (for 11^{th} grade) or in the current year (for 12^{th} grade). Thus, this dropout rate will measure "on time" high school graduation for those in each grade cohort. The estimates in Table 5 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 were in percentage terms). Using the 10^{th} and 12^{th} grade denominators, there is no evidence of an effect of SBHCs on dropout rates. None of the estimates is statistically significantly different from zero at conventional levels, and the point estimates suggest a very minor negative effect of at most 0.036% due to an average-sized center. The 11^{th} grade estimates, however, are universally negative and statistically significant at the 5% level. Nonetheless, they are modest in magnitude: adding service levels equal to an average center would decrease the 11^{th} grade dropout rate by between 0.17 and 0.25 percentage points across specifications, which is between 1.1 and 1.6 percent of the baseline dropout rate shown in Table 2. In a high school class of 250, these numbers would mean an extra 0.4 to 0.6 students would graduate due to an average-sized SBHC. Thus, Table 5 shows that SBHCs are associated with at most a small decline in the high school dropout rate.

Figures 7, 8 and 9 show the event study estimates from equation (4) for the 10^{th}, 11^{th} and 12^{th} grade dropout rates, respectively. For the 10^{th} and 12^{th} grade dropout rates, the estimates show no relationship between SBHC services in the short or longer-run and dropout rates. However, for the 11^{th} grade dropout rate, Figure 8 shows a significant decline due to SBHC services, but only in relative years 7-10. While these match up relatively well with the timing of the birth declines, they suggest any dropout rate declines from SBHCs come with considerable lags after centers open. The magnitude of these declines still are modest: our preferred service measure estimates suggest adding an average-sized center would reduce the dropout rate after 7 years by 0.25 to 0.38 percent. This would translate into between 0.6 and 1.0 extra person graduating in a class of 250 students. Critically, in each panel of Figures 7-9, there are no pre-treatment trends that suggest a bias in our estimates in either direction.[24]

If the reduction in teen births from SBHCs are an important driver of any reductions in high school dropout rates, the results in Column (i) of Table 5 might mask important heterogeneity by birth control services offered by clinics. In the remaining columns of Table 5, we show results from estimation of equation (1) by the types of contraceptive services offered by SBHCs. Similar to the results in Column (i), the estimates point to at most modest negative impacts of school health centers that tend to be somewhat larger in absolute value among the clinics that offer birth control services. Interestingly, there is no evidence of a negative effect of SBHC services on dropout rates among centers that do not offer access to contraception. As with the birth results, the 11^{th} grade estimates across centers that dispense birth control rather than just provide referrals is minimal. However, for the 10^{th} and 12^{th} grade dropout rates there is some evidence of larger dropout rate effects among centers that actually dispense birth control. While

[24]Event study estimates for the Days per Week and Hours per Week service measures are shown in Appendix Figures A-3 to A-5. The results and conclusions from these alternative service measures are very similar to those from Figures 7-9.

the typically are not statistically different from zero at even the 10% level, they are much larger than the results in Columns (i) and (ii). Hence, there is suggestive evidence of a small, negative effect of SBHCs on 10^{th} and 12^{th} grade dropout rates for centers that directly dispense birth control to students. These results are consistent with the reductions in teen births being a factor in reducing dropout rates.[25]

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), however, argue that miscarriages are not exogenous events; they report adjusted teen birth effects on high school completion of -5 to -10 percent. 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 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).

As discussed in Section 2, many different services offered by SBHCs can contribute to any dropout rate effects we find. However, it is informative to assess the proportion of the 11^{th} grade dropout rate estimate that could be due to reduced teen births. The Total Medical Staff

[25]We also have examined heterogeneity by whether a center offers mental health services. We find no evidence of a larger dropout rate effect amongst centers that offer such services. These results are available from the authors upon request.

Hours estimate in column (i) of Table 3 suggests adding an average-sized SBHC decreases the number of births by 4.5 per 1000 16-19 year olds. Since the average high school is about 1000 students, there are on average 125 female students per grade. Hence, an average-sized SBHC would reduce the number of births in each grade by 0.56. If giving birth reduced the likelihood of obtaining a high school diploma by 20%, then an average-sized SBHC would decrease the number of graduates by 0.11 (=0.56*0.2). If SBHCs only affected birth rates, we thus should see a decline in the dropout rate of 0.045 (=(0.11/250)*100) percent.[26] The 11^{th} grade estimates are larger than this number, suggesting that other aspects of SBHCs likely contribute to the small declines in dropout rates we observe for this grade.[27]

One possible criticism of the dropout rate results is that they are biased towards zero due to the measurement error discussed in Section 4. While measurement error could be attenuating our estimates, it is unlikely that the measurement error is more severe for the dropout rate analysis than it is for the birthrate analysis. Since the dropout rate analysis is at a lower level of aggregation – the school district rather than the county – we would expect there to be more measurement error embedded in the birth rate results. That the birth rate effects are negative and sizable but the dropout rate estimates are much closer to zero suggests that our finding of small dropout rate effects of SBHCs is not being driven by measurement error.

A drawback of using the diploma data, especially if teen childbearing is a primary explanation for any dropout rate declines, 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 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. 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 6. We present estimate for both 14-17 year olds and 18-19 year olds. The estimates from equation (1) for the whole

[26] The female dropout rate would decline by double, or 0.09, assuming male dropout rates are unaffected by births.

[27] Using the larger event study estimates leads to a predicted decline in the dropout rate of 0.07 percent. This still is smaller than the 11^{th} grade dropout estimates shown in Table 5.

sample are broadly similar to those in Table 5, although they are somewhat smaller and less precise. The estimates for the 14-17 year old dropout rates indicate no effect of SBHCs. These estimates are small in absolute value, and their 95% confidence intervals rule out dropout rate effects from adding an average-sized center of more than -0.05%. These results are consistent with the lack of 10^{th} grade effects found using the diploma data. However, the estimates using 18-19 year olds are suggestive that SBHCs reduce dropout rates slightly. For the overall sample in column (iv), the results indicate that adding a primary care staff hour would decrease the dropout rate by about -0.014% and a medical staff hour would lead to a decrease of -0.004%. When multiplied by the average SBHC service size, these effects translate into reductions of about -0.07 percent. These estimates are larger in absolute value than the 12^{th} grade results in Table 5 but smaller in absolute value than the 11^{th} grade ones. They thus are consistent with a modest 11^{th} grade effect and no 12^{th} grade effect.

Table 6 also presents Census/ACS estimates by gender. The results for females are universally larger in absolute value than those for males, which is consistent with some of the impacts we find being driven by fertility changes. Among 14-17 year olds (in column (ii)), adding a health center with the average service level would reduce the dropout rate by 0.01 and 0.04 percent. Among 18-19 year old females (in column (v)), an average-sized center would reduce dropout rates by 0.11-0.13 percent. However, only the Medical Staff Hours estimate is statistically different from zero at even the 10% level. In a class of 125 girls, these estimates imply an average-sized SBHC would lead to 0.14 to 0.16 additional graduates. The results among male students show no evidence of a decline in dropout rates due to school-based health center openings.

Finally, in Table 7, we estimate the effect of SBHCs on dropout rates for females using the centers that provide birth control services. The estimates are very similar to those in columns (ii) and (v) of Table 6. They provide evidence that school-based health centers have at most a small negative effect on female high school dropout rates among the centers that provide teens with contraceptive services, even though they have large negative impacts on birth rates.

5.3 Robustness Checks

The estimates presented thus far are based on several identifying assumptions that are outlined in Section 4. In this section, we present a series of robustness checks that examine the sensitivity of our results and conclusions to these assumptions. First, recall that the dropout estimates in Tables 5-7 include all school districts in the US, while the birth rate estimates include only large counties. In Table 8, we estimate dropout rate models using the Census/ACS 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 for both 14-17 year olds and for 18-19 year olds are extremely similar to baseline. The point estimates and standard errors change little, which suggests that the difference between the birth and dropout findings is not due to the differences in the samples used.[28]

Our main results exploit variation in school-based health center services driven by center entry and exit as well as by within-center changes in service levels over time. Results from estimation of equation (2) suggest that there is no selection on differential pre-SBHC trends as a function of the service levels of the first center that enters an area. But, it could be that within-center variation, center exit and the entry of the centers after the first one in a school district are endogenous with respect to unobserved demand variation in a school or county. In order to assess whether this variation is important in identifying our estimates, we isolate SBHC service variation that is driven *only* by the service level of the first center that enters in a district or county. In the terminology of equation (2), we take $SBHC_{t_0}$ and interact it with the number of years post-entry of the first health center in a county or school district. Note that $SBHC_{t_0}$ is zero prior to first entry and is fixed thereafter. We then use $SBHC_{t_0}$ and $SBHC_{t_0}$ interacted with the number of years since first entry as instruments for yearly SBHC service levels. That is, we instrument SBHC service levels with the service level of the first center in an area in the first year it entered, allowing the effect of this first center service level to vary linearly with time since entry. In this model, service level variation is driven completely by the entry of the first center, which as we show in Figures 5-9 are unrelated to pre-entry trends in births or dropout rates.

[28] 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.

Table 9 presents IV estimates for teen birth rates (Panel A) and for high school dropout rates using diploma data (Panel B). The first-stage F-statistics are large, suggesting this instrument is sufficiently powered. For teen birth rates, the estimates are on the whole slightly larger in absolute value than those in Table 3. This suggests that the within-county variation over time after first entry might bias the OLS estimates slightly towards zero. In Panel B, the estimates also are quite similar to the baseline results. The 11^{th} grade dropout estimate using Total Medical Staff Hours is somewhat smaller although still statistically significantly different from zero at the 5% level. Furthermore, there is more evidence of a small, negative effect of SBHCs on the 12^{th} grade dropout rate. Despite these small difference, the general conclusion that there is a small, negative effect of SBHCs on 11^{th} grade dropout rates and effects that are closer to zero for 10^{th} and 12^{th} grade dropout rates are robust to using this IV model that uses only service level variation from initial center entry.[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 student health aside from the number of hours of services provided, equation (1) will be misspecified. In Table 10, 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 any SBHC in the given year (denoted *Post*). Thus, we are allowing center entry to affect both the intercept and slope, rather than just the slope as in the baseline analysis. In both panels, the estimates suggest not allowing for an intercept shift in equation (1) has little effect on our results. The *Post* estimates are not significantly different from zero at conventional levels, and the SBHC estimates are very similar to baseline.

Finally, in Table 11, we examine whether SBHC service variation is correlated with school expenditures and enrollment. 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 the first column of

[29] In results available upon request, we have also estimated models which use only initial service level variation from each center, by holding these service levels fixed for the remainder of the sample period. These estimates are almost identical to the baseline estimates and are consistent with the results in Table 9, suggesting that the main identifying variation is coming from center entry.

Table 11, we see that there is a very small, positive relationship between SBHC services and per-student expenditures: an extra staff hour is associated with an increase of between 2 and 8 dollars per student. These estimates imply an SBHC with an average level of services is associated with between $37 and $42 in spending per pupil. These expenditure differences are very small relative to the mean per-pupil expenditure of $9,038, representing about a 0.4% increase in expenditures. Such small changes in expenditures are very unlikely to influence our results, especially given the weak association between school spending and student outcomes documented in prior work (e.g., Hanushek 2003). Furthermore, as the next two columns of Table 11 suggest, these per-pupil spending increases are, on average, due to enrollment declines rather than due to increases in total revenue. This pattern of a mild inverse relationship between SBHC services and student enrollments is sensible, given that the only resource which a school must allocate for a health center is physical space. While the estimates in Table 11 are statistically significant, they are sufficiently small that we do not expect resulting school district resource changes to affect fertility and dropout rates.

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. A question of primary importance that has received scant attention in the previous literature is how expanding access to quality primary health care among low-income children will affect their health and educational attainment. In this paper, we use changes in 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-difference 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 16%-21% relative to the baseline fertility rate. For 16-19 year olds, SBHCs reduce the birth rate by 7.7%-9.7%. Furthermore, these effects are localized to the centers that offer some form of contraceptive service for students. Overall, our calculations suggest SBHCs can explain a small but non-trivial part of the decline in teen birth rates and the geographic variation in teen birth rates in the US. Second, we find at most a small effect of SBHCs on high school dropout rates. Our largest estimates indicate increases in health care services equal to the average-sized center would only reduce dropout rates by about 0.25%, and only for students in 11^{th} grade. SBHC impacts on high school completion are localized to females, although our back-of-the-envelope calculations suggest that these centers are likely influencing aspects of health other than teen births to produce even the modest completion rate effects we find. We document as well that SBHC effects are larger in the long run, about 5-7 years after entry of the first center in an area.

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). However, for these centers to successfully reduce teen births, the provision of contraceptive services is needed. Another important implication of our results is that the provision of low-cost and convenient primary care services 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 access does not translate to much more educational investment. 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 low-income students.

References

[1] Adams, Peter, Michael D. Hurd, Daniel McFadden, Angela Merrill, and Tiago Ribeiro. 2003. "Healthy, Wealthy, and Wise? Tests for Direct Causal Paths between Health and Socioeconomic Status." *Journal of Econometrics* 112(1): 3–56.

[2] Adler, Nancy E. and David H. Rehkopf. 2008. "U.S. Disparities in Health: Descriptions, Causes, and Mechanisms." *Annual Review of Public Health* 29: 235–252.

[3] Almond, Douglas and Janet Currie. 2011. "Killing Me Softly: The Fetal Origins Hypothesis." *Journal of Economic Perspectives* 25(3): 153-172.

[4] Andrulis, Dennis P. 1998. "Access to Care Is the Centerpiece in the Elimination of Socioeconomic Disparities in Health." *Annals of Internal Medicine* 129(5): 412-416.

[5] Bailey, Martha J. and Andrew Goodman-Bacon. Forthcoming. "The War on Povertys Experiment in Public Medicine: The Impact of Community Health Centers on the Mortality of Older Americans." *American Economic Review.*

[6] Bleakley, Hoyt. 2007. "Disease and Development: Evidence from Hookworm Eradication in the American South." *The Quarterly Journal of Economics* 122(1): 73117.

[7] Bleakley, Hoyt. 2010. "Malaria Eradication in the Americas: A retrospective Analysis of Childhood Exposure." *American Economic Journal: Applied Economics* 2(2): 145.

[8] Bleakley, Hoyt. 2010. "Malaria Eradication in the Americas: A retrospective Analysis of Childhood Exposure." *American Economic Journal: Applied Economics* 2(2): 145. Brown, David, Amanda E. Kowalski, and Ithai Lurie. 2014. "Medicaid as an Investment in Children: What is the Long-Term Impact on Tax Receipts?" Yale University Working Paper, available at http://www.econ.yale.edu/ ak669/medicaid.latest.draft.pdf, last accessed 10/7/2014.

[9] Case, Ann, Darren Lubotsky, and Christina Paxson. 2002. "Economic Status and Health in Childhood: The Origins of the Gradient." *American Economic Review* 92(5): 1308–1334.

[10] Case, Anne, Angela Fertig, and Christina Paxson. 2005. "The Lasting Impact of Childhood Health and Circumstance." *Journal of Health Economics* 24(2): 365-389.

[11] Clark, Damon and Heather Royer. 2013. "The Effect of Education on Adult Mortality and Health: Evidence from Britain." *American Economic Review* 103(6): 2087-2120.

[12] Cohodes, Sarah, Daniel Grossman, Samuel Kleiner, and Michael F. Lovenheim. 2014. "The Effect of Child Health Insurance Access on Schooling: Evidence from Public Insurance Expansions." NBER Working Paper No. 20178.

[13] Conti, Gabriella, James Heckman and Sergio Urzua. 2010. "The Education-Health Gradient." *American Economic Review* 100(2): 234–238.

[14] Cuhna, Flavio, James J. Heckman, Lance Lochner, and Dimitriy Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." In *Handbook of the Economics of Education*, Vol. 1, ed. Eric Hanushek and Finis Welch, 697-812. Amsterdam: Elsevier.

[15] Currie, Janet and Jonathan Gruber. 1996. "Health Insurance Eligibility, Utilization of Medical Care, and Child Health." *Quarterly Journal of Economics* 111(2): 431–466.

[16] Currie, Janet, Sandra Decker and Wanchuan Lin. 2008. "Has Public Health Insurance For Older Children Reduced Disparities in Access to Care and Health Outcomes?" *Journal of Health Economics* 27(6): 1567–1581.

[17] Cutler, David M. and Adriana Lleras-Muney. 2006. "Education and Health: Evaluating Theories and Evidence." NBER Working Paper No. 12352.

[18] Dahl, Gordon B. and Lance Lochner. 2012. "The Impact of Family Income on Child Achievement: Evidence from the Earned Income Tax Credit." *American Economic Review* 102(5): 1927–1956.

[19] Finkelstein, Amy, Sarah Taubman, Bill Wright, Mira Bernstein, Jonathan Gruber, Joseph P. Newhouse, Heidi Allen, Katherine Baicker and Oregon Health Study Group. 2012. "The Oregon Health Insurance Experiment: Evidence from the First Year." *Quarterly Journal of Economics* 127(3): 1057–1106.

[20] Fletcher, Jason M. and Barbara L. Wolfe. 2009. "Education and Labor Market Consequences of Teenage Childbearing: Evidence Using the Timing of Pregnancy Outcomes and Community Fixed Effects." *Journal of Human Resources* 44(2): 303–325.

[21] Flores, Glenn. 2010. "Technical ReportRacial and Ethnic Disparities in the Health and Health Care of Children." *Pediatrics* 125(4): e979–e1020.

[22] Gross, Tal and Matthew J. Notowidigdo. 2011. "Health Insurance and the Consumer Bankruptcy Decision: Evidence from Expansions of Medicaid." *Journal of Public Economics* 95(7-8): 767–778.

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

[24] Grossman, Michael. 1972. "On the Concept of Health Capital and the Demand for Health." *Journal of Poltical Economy* 80(2): 223–255.

[25] Grossman, Michael. 2004. "The Demand for Health, 30 Years Later: A Very Personal Retrospective and Prospective Reflection." *Journal of Health Economics* 23(4): 629–636.

[26] Geronimus, Arlene T. and Sanders Korenman. 1992. "The Socioeconomic Consequences of Teen Childbearing Reconsidered." *Quarterly Journal of Economics* 107(4): 1187–1214.

[27] Hanushek, Eric A. 2003. "The failure of Inpute-Based Schooling Policies." *The Economic Journal* 113(485): F64-F98.

[28] Harris, Kathleen Mullan, Penny Gordon-Larsen, Kim Chantala, and J. Richard Udry. 2006. "Longitudinal Trends in Race/Ethnic Disparities in Leading Health Indicators From Adolescence to Young Adulthood." *Archives of Pediatric Adolescent Medicine* 160: 74–81.

[29] Heckman, James J. and Paul A. LaFontaine. 2006. "Bias-corrected Estimates of GED Returns." *Journal of Labor Economics* 24(3): 661–700.

[30] Heckman, James J. and Paul A. LaFontaine. 2010. "The American High School Graduation Rate: Trends and Levels." *Review of Economics and Statistics* 92(2): 244–262.

[31] Holmlund, Helena. 2005. "Estimating Long-Term Consequences of Teenage Childbearing: An Examination of the Siblings Approach." *Journal of Human Resources* 40(3): 716–743.

[32] Hotz, Joseph V., Susan William McElroy and Seth G. Sanders. 2005. "Teenage Childbearing and Its Life Cycle Consequences: Exploiting a Natural Experiment." *Journal of Human Resources* 40(3): 683–715.

[33] Kaestner, Robert, T. Joyce and A. Racine. 2001. "Medicaid Eligibility and the Incidence of Ambulatory Care Sensitive Hospitalizations for Children." *Social Science and Medicine* 52(2): 305-313.

[34] Kearney, Melissa S. and Phillip B. Levine. 2009. "Subsidized Contraception, Fertility, and Sexual Behavior." *The Review of Economics and Statistics* 91(1): 137-151.

[35] Kearney, Melissa S. and Phillip B. Levine. 2012. "Why is the Teen Birth Rate in the United States So High and Why Does It Matter?" *Journal of Economic Perspectives* 26(2): 141-166.

[36] Kearns, Suzanne E.U., Michael D. Pullmann, Sarah Cusworth Walker, Aaron R. Lyons, T.J. Cosgrove, and Eric J. Bruns. 2011. "Adolescent Use of School-Based Health Centers and High School Dropout." *Archives of Pediatrics & Adolescent Medicine* 165(7): 617-623.

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

[38] Klepinger, Daniel, Shelly Lundberg and Robert Plotnick. 1999. "How Does Adolescent Fertility Affect the Human Capital and Wages of Young Women?" *Journal of Human Resources* 34(3): 421-448.

[39] Leininger, Lindsey, Helen Levy and Diane Schanzenbach. 2009. "Consequences of SCHIP Expansions for Household Well-Being." *Forum for Health Economics & Policy (Frontiers in Health Policy Research)* 13(1), Article 3.

[40] Levine, David I. and Gary Painter. 2003. "The Schooling Costs of Teenage Out-of-Wedlock Childbearing: Analysis with a Within-school Propensity-score-matching Estimator." *The Review of Economics and Statistics* 85(4): 884–900.

[41] Martin, Joyce A., Brady E. Hamilton, Stephanie J. Ventura, Michelle JK Osterman, and T. J. Mathews. 2013. "Births: Final Data for 2011." National Vital Statistics Report 62, no. 1: 1-90.

[42] Michelmore, Katherine. 2013. "The Effect of Income on Educational Attainment: Evidence from State Earned Income Tax Credit Expansions." Mimeo.

[43] Mishel, Lawrence and Joydeep Roy. 2006. *Rethinking High School Graduation Rates and Trends*. Washington, D.C.: Economic Policy Institute.

[44] Murnane, Richard J. 2013. "U.S. High School Graduation Rates: Patterns and Explanations." *Journal of Economic Literature* 51(2): 370–422.

[45] Reback, Randall and Tamara Lalovic Cox. 2014. "Where Health Policy Meets Education Policy: School-based Health Centers in New York City." Mimeo.

[46] Ribar, David C. 1994. "Teenage Fertility and High School Completion." *Review of Economics and Statistics* 76(3): 413–424.

[47] Ribar, David C. 1999. "The Socioeconomic Consequences of Young Women's Childbearing: Reconciling Disparate Evidence." *Journal of Population Economics* 12(4): 547–565.

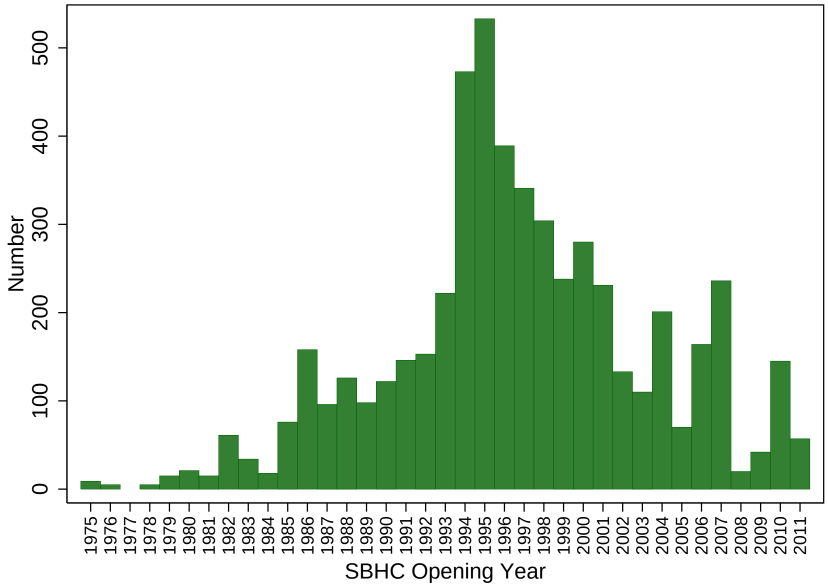
[48] Sanders, Seth, Jeffrey Smith and Ye Zhang. 2008. "Teenage Childbearing and Maternal Schooling Outcomes: Evidence from Matching." University of Michigan Working Paper.

[49] Smedley, Brian D., Adrienne Y. Stith, and Alan R. Nelson. 2003. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academies Press.

[50] Todd, Petra E. and Kenneth I. Wolpin. 2007. "The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps." *Journal of Human Capital* 1(1): 91–136.

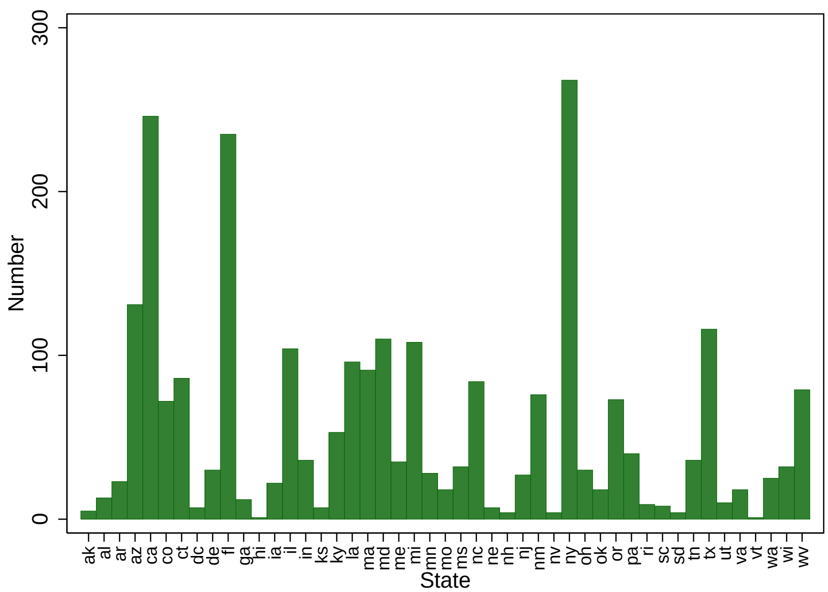
[51] Walker, Sarah Cusworth, Suzanne E.U. Kerns, Aaron R. Lyon, Eric J. Bruns, and T.J. Cosgrove. 2010. "Impact of School-Based Health Center Use on Academic Outcomes." *Journal of Adolescent Health* 46: 251-257.

Figure 1: Distribution of SBHC Opening Years



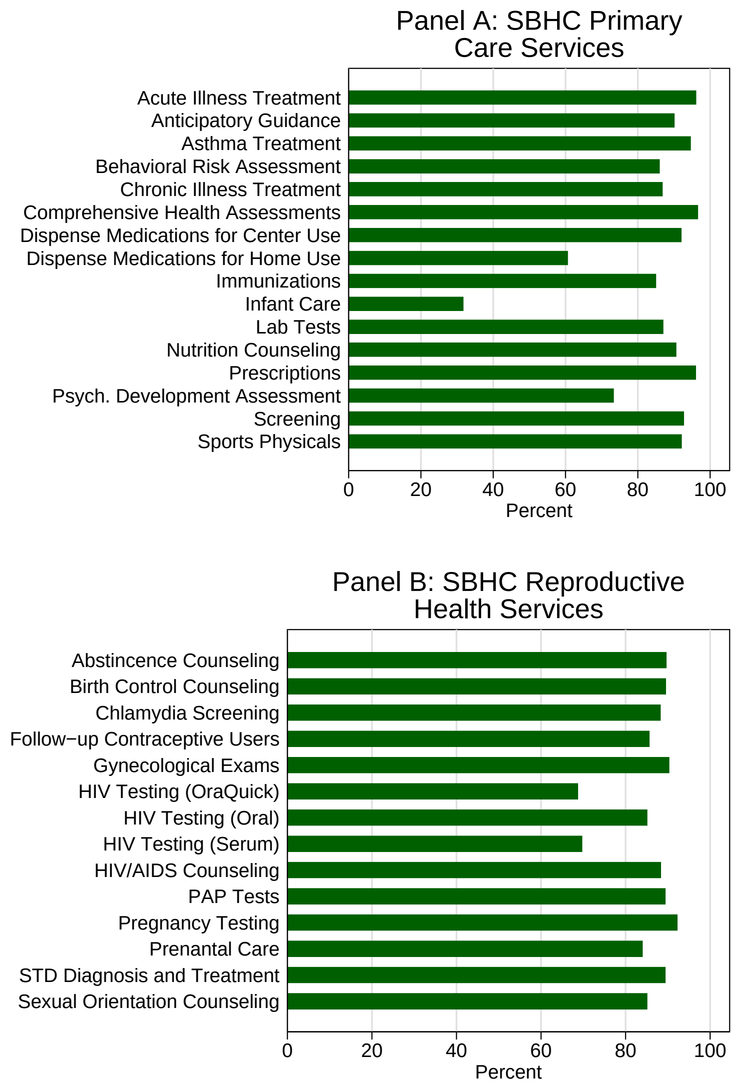
Source: NASBHC School-based Health Center Census, 1998-2011.

Figure 2: Distribution of SBHCs Across States



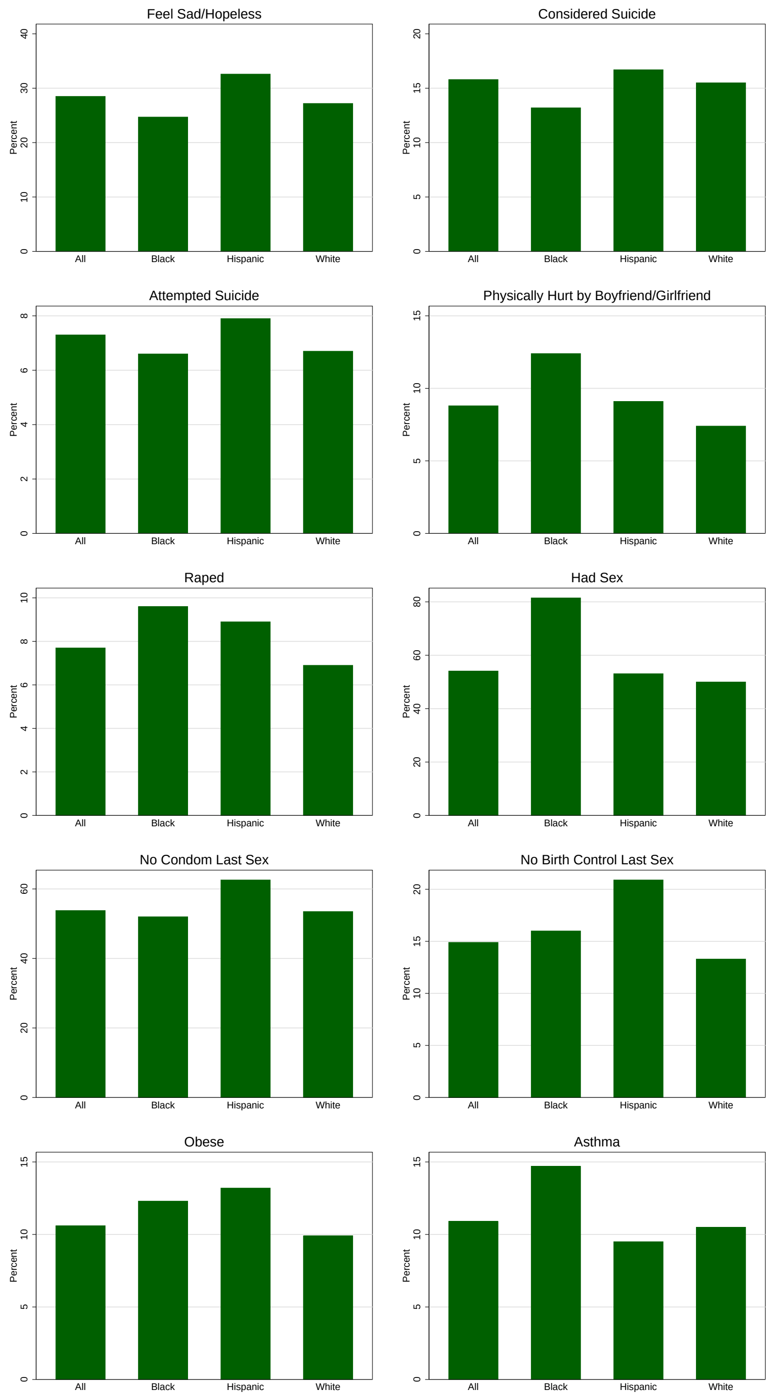
Source: NASBHC School-based Health Center Census, 1998-2011. The five states without SBHCs (ID, MT, ND, SD, WY) are omitted from the figure.

Figure 3: Primary Care and Reproductive Services Provided by SBHCs



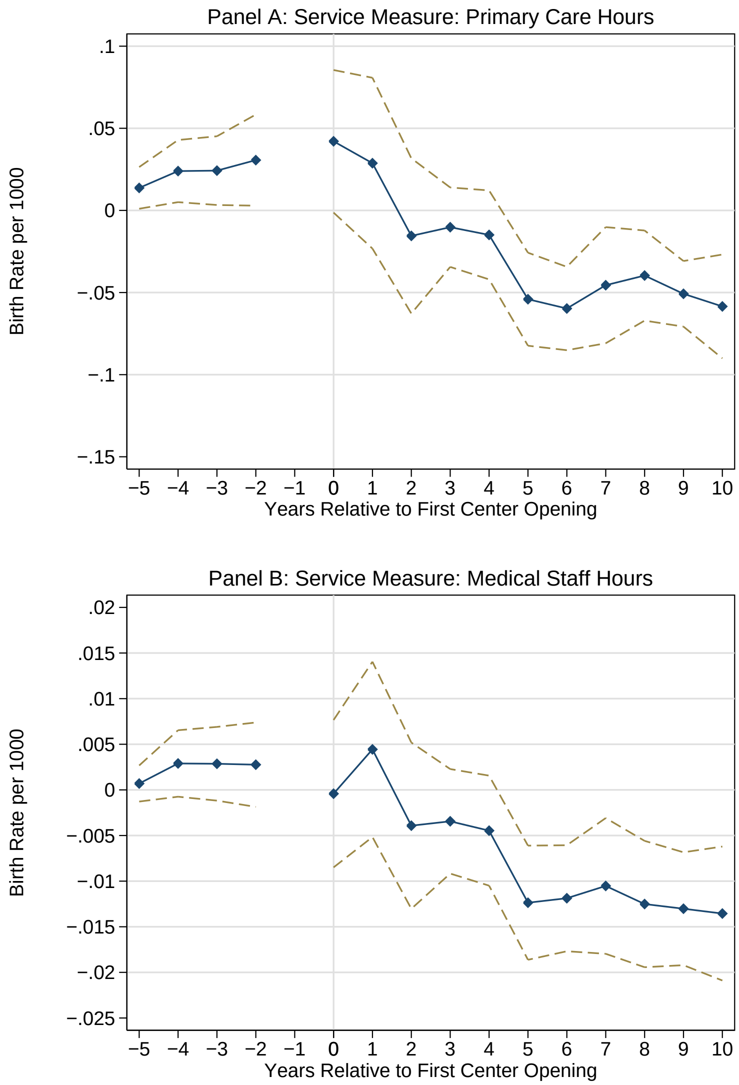
Source: These figures are reproduced from the 2007-2008 School-based Health Centers National Census annual report, available at http://www.sbh4all.org/atf/cf/%7Bcd9949f2-2761-42fb-bc7a-cee165c701d9%7D/NASBHC%202007-08%20CENSUS%20REPORT%20FINAL.PDF. The reproductive care service tabulations show the percent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

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



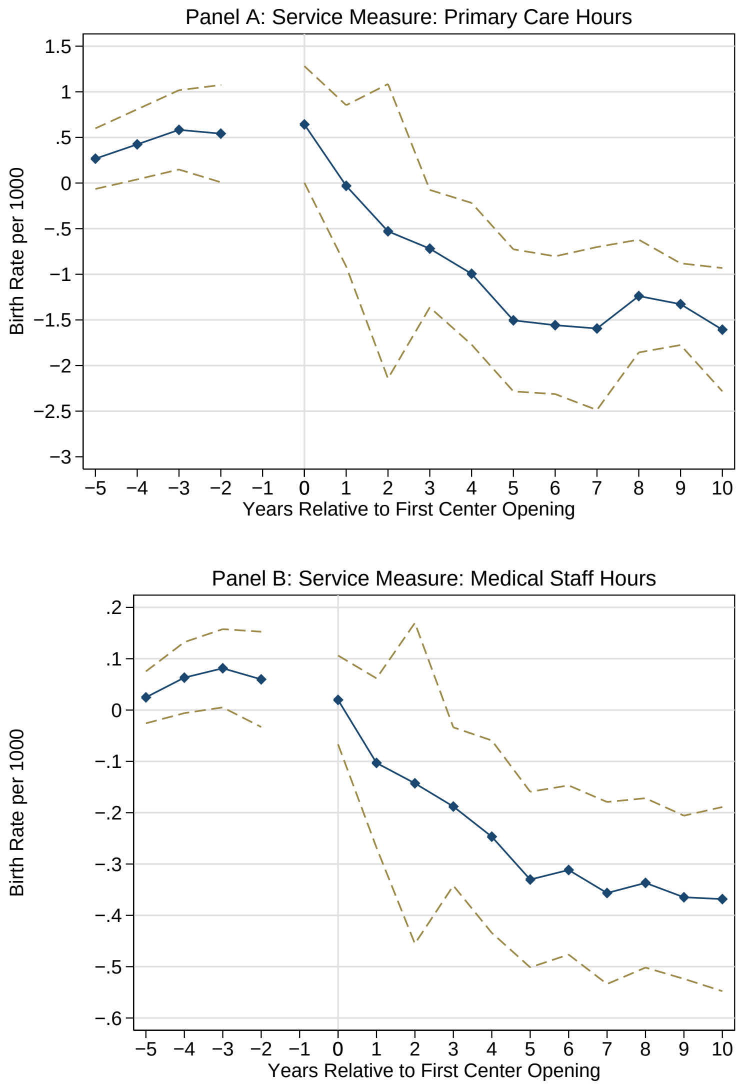
Source: 2011 Youth Risk Behavior Surveillance System (YRBSS).

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



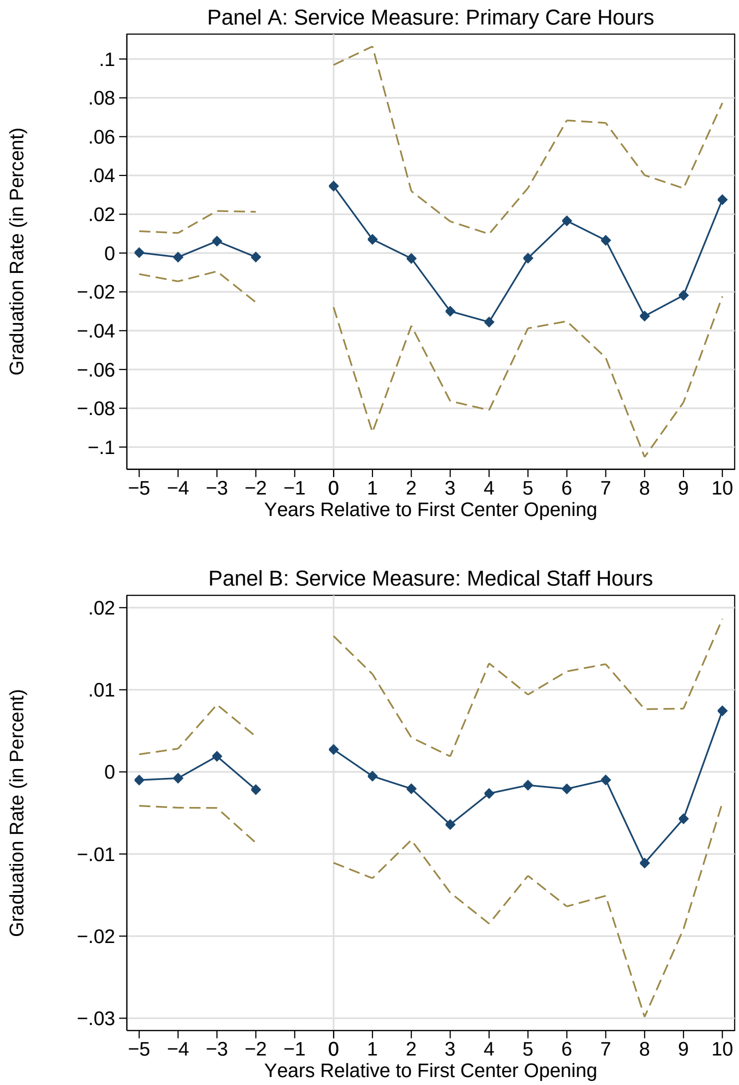
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 or in counties that have no centers are included in the regressions. The dashed lines 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 Services on 16-19 Birth Rates (per 1000 women)



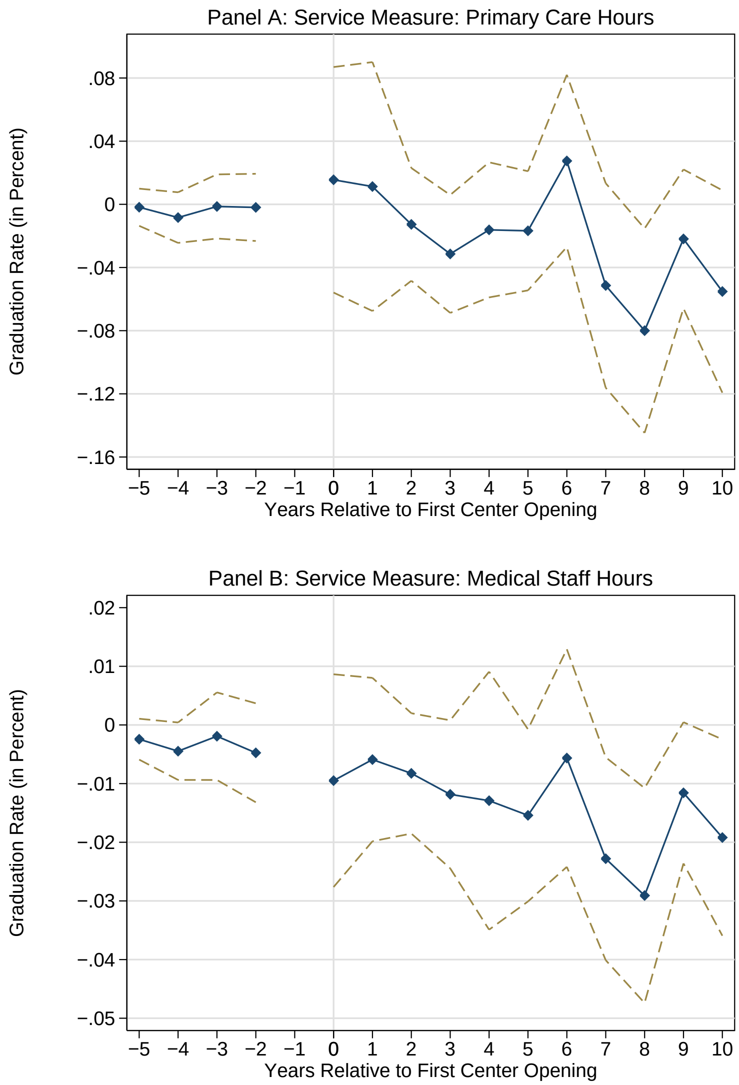
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 or in counties that have no centers are included in the regressions. The dashed lines 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 SBHC Services on 10^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



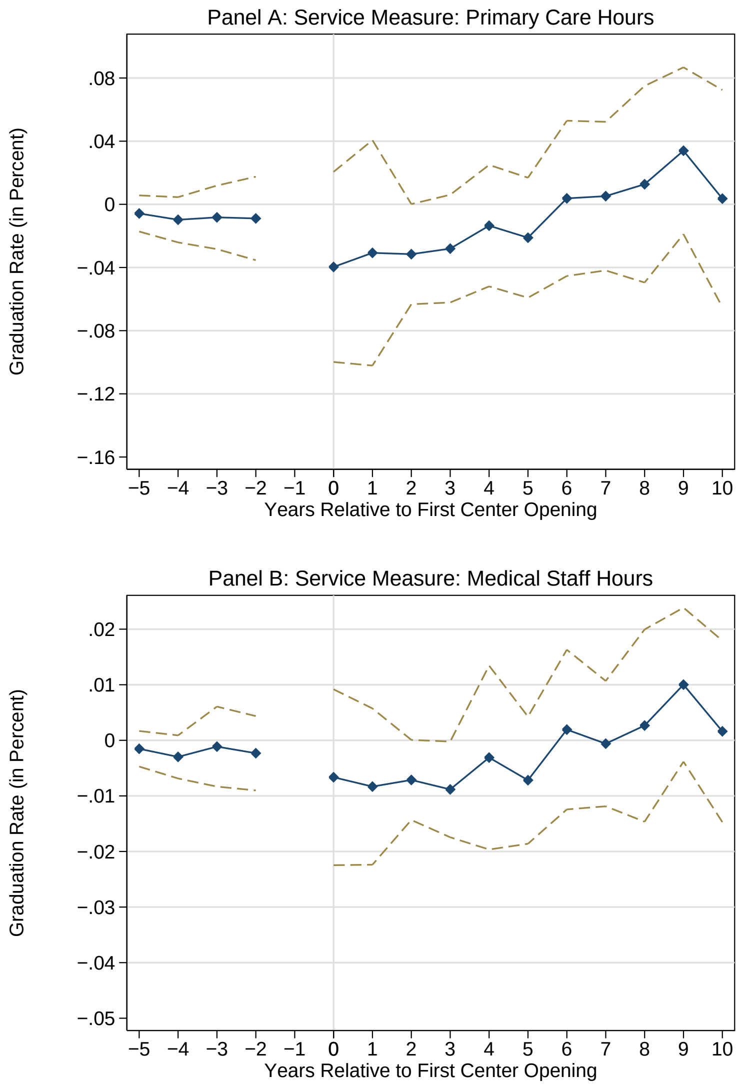
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 or in school districts that have no centers are included in the regressions. The dashed lines 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 8: Event Study Estimates of the Effect of SBHC Services on 11^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time 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 or in school districts that have no centers are included in the regressions. The dashed lines 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 9: Event Study Estimates of the Effect of SBHC Services on 12^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time 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 or in school districts that have no centers are included in the regressions. The dashed lines 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 (Male)	30.1	4.1	27.5	43.4
Condoms (Female)	20.2	5.8	30.6	38.3
Dental Dams	13.2	6.0	30.12	50.7
Diaphragm	6.9	8.3	38.0	46.8
Birth Control Pills	21.0	14.7	28.5	35.8
Birth Control Shot (Depo-Provera)	24.4	7.3	30.5	37.8
Implant	4.6	6.2	44.8	44.4
Patch	13.9	11.9	33.2	41.0
Ring (NuvaRing)	15.6	11.6	31.9	40.9
Emergency Contraception	19.0	10.4	28.8	41.8
IUD	4.1	6.3	47.1	42.5
Spermicides	9.9	11.2	32.5	46.4

Source: 2011 National Alliance on School-based Health Care census data.

Table 2: Descriptive Statistics of Analysis Variables

Variable	Mean	SD
Primary Care Staff Hours per Week	0.924	3.554
Primary Care Staff Hours per Week (for centers)	4.759	6.842
Medical Staff Hours per Week	4.058	13.321
Medical Staff Hours per Week (for centers)	18.103	23.184
Birth Rate per 1,000 Women $\leq$15	0.790	0.920
Birth Rate per 1,000 Women 16-19	46.019	23.052
10^{th} Grade Dropout Rate	0.225	0.122
11^{th} Grade Dropout Rate	0.155	0.098
12^{th} Grade Dropout Rate	0.093	0.088
14-17 Dropout Rate	0.105	0.213
Female 14-17 Dropout Rate	0.104	0.215
Male 14-17 Dropout Rate	0.106	0.214
18-19 Dropout Rate	0.360	0.216
Female 18-19 Dropout Rate	0.353	0.236
Male 18-19 Dropout Rate	0.363	0.227

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, with the "for center" tabulations showing mean treatment levels amongst 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 and Center Birth Control Status

Panel A: Births per 1,000 Women Age $\leq$15

Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Primary Care Staff Hours	-0.035**	-0.034**	-0.031**	0.032
	(0.009)	(0.009)	(0.009)	(0.046)
Medical Staff Hours	-0.007**	-0.006**	-0.006**	0.004
	(0.002)	(0.002)	(0.002)	(0.009)

Panel B: Births per 1,000 Women Age 16-19

Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Primary Care Staff Hours	-0.939**	-0.928**	-0.834**	-0.023
	(0.230)	(0.229)	(0.184)	(0.558)
Medical Staff Hours	-0.198**	-0.202**	-0.163**	-0.047
	(0.066)	(0.066)	(0.048)	(0.074)

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. 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 4: The Effect of SBHC Services on Birth Rates (per 1000 women) by Race

Panel A: Births per 1,000 Women Age ≤15

Treatment Measure	White (i)	Black (ii)	Hispanic (iii)
Primary Care Staff Hours	-0.035**	-0.023*	-0.065**
	(0.011)	(0.014)	(0.017)
Medical Staff Hours	-0.007**	-0.007*	-0.016**
	(0.002)	(0.004)	(0.003)

Panel B: Births per 1,000 Women Age 16-19

Treatment Measure	White (i)	Black (ii)	Hispanic (iii)
Primary Care Staff Hours	-0.997*	-0.906**	-1.067**
	(0.277)	(0.267)	(0.337)
Medical Staff Hours	-0.204**	-0.202**	-0.189*
	(0.075)	(0.064)	(0.084)

Notes: Authors' estimates of equation (1). Each cell comes from a separate regression. 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 High School Dropout Rates (in Percent) – Diploma Data

Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Panel A: 10^{th} Grade Dropout Rate				
Primary Care Staff Hours	-0.003	-0.007	-0.023	0.053
	(0.013)	(0.014)	(0.020)	(0.056)
Medical Staff Hours	-0.001	-0.002	-0.005	0.009
	(0.003)	(0.003)	(0.004)	(0.010)
Panel B: 11^{th} Grade Dropout Rate				
Primary Care Staff Hours	-0.035**	-0.039**	-0.039*	0.005
	(0.014)	(0.015)	(0.021)	(0.030)
Medical Staff Hours	-0.014**	-0.015**	-0.014**	-0.005
	(0.004)	(0.005)	(0.007)	(0.007)
Panel C: 12^{th} Grade Dropout Rate				
Primary Care Staff Hours	-0.004	-0.004	-0.027	-0.002
	(0.016)	(0.016)	(0.022)	(0.029)
Medical Staff Hours	-0.002	-0.002	-0.008*	-0.001
	(0.004)	(0.004)	(0.005)	(0.007)

Notes: Authors' estimates of equation (1) using NCES CCD high school diploma data from 1998-2010. 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. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. 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 6: 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)
Primary Care Staff Hours	-0.004	-0.003	-0.003	-0.014	-0.023	-0.003
	(0.003)	(0.004)	(0.003)	(0.011)	(0.015)	(0.014)
Medical Staff Hours	-0.0012*	-0.002*	-0.001	-0.004	-0.007*	-0.002
	(0.0007)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)

Notes: Authors' estimates of equation (1) 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 who does not report attending school and who do 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. 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 by Birth Control Status Using Census Data – Females by Birth Control Status

	14-17 Year Olds		18-19 Year Olds	
Treatment Measure	Birth Control (i)	Birth Control Dispensed (ii)	Birth Control (iii)	Birth Control Dispensed (iv)
Primary Care Staff Hours	-0.002	-0.002	-0.016	-0.021
	(0.005)	(0.006)	(0.018)	(0.022)
Medical Staff Hours	-0.001	0.0001	-0.005	-0.004
	(0.001)	(0.001)	(0.005)	(0.006)

Notes: Authors' estimates of equation (1) 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 who does not report attending school and who do not have a high school degree. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. 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 8: The Effect of SBHC Services on High School Dropout Rates by Birth Control Status Using Census Data – Estimates Using Large Counties

	14-17 Year Olds			18-19 Year Olds		
	All	Female	Male	All	Female	Male
Treatment Measure	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Primary Care Staff Hours	-0.005	-0.003	-0.005	-0.014	-0.022	-0.004
	(0.004)	(0.005)	(0.004)	(0.013)	(0.018)	(0.017)
Medical Staff Hours	-0.001	-0.001	-0.001	-0.005	-0.008*	-0.003
	(0.001)	(0.001)	(0.001)	(0.003)	(0.005)	(0.004)

Notes: Authors' estimates of equation (1) using 1990 and 2000 Census data as well as 2005-2011 ACS data. The sample is comprised of the large counties that constitute the birth rate analysis sample. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district who do not report attending school and who do not have a high school degree. All estimates include school district and state-by-year fixed effects, and the regressions are weighted 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 9: The Effect of SBHC Services on Teen Birth and HS Dropout Rates, Using First Entry Service Levels as an Instrument

Panel A: Births per 1,000 Women		
	≤15	16-19
Treatment Measure	(i)	(ii)
Primary Care Staff Hours	-0.084**	-1.790**
	(0.007)	(0.131)
1*st* Stage F-stat	1153.8	1176.2
Medical Staff Hours	-0.005**	-0.129**
	(0.001)	(0.023)
1*st* Stage F-stat	2549.5	2586.5

Panel B: High School Dropout Rate			
	10^{th} Grade	11^{th} Grade	12^{th} Grade
Treatment Measure	(i)	(ii)	(iii)
Primary Care Staff Hours	-0.024	-0.042**	-0.022
	(0.018)	(0.017)	(0.016)
1*st* Stage F-stat	38.8	37.9	37.2
Medical Staff Hours	-0.003	-0.004**	-0.005
	(0.004)	(0.002)	(0.003)
1*st* Stage F-stat	78.1	88.4	79.4

Notes: Authors' estimates of equation (1), instrumenting service levels with the service level of the initial entrant and the service level of the initial entrant interacted with the number of years post-entry. 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). Standard errors clustered at the county level (Panel A) or school district level (Panel B) are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 10: The Effect of SBHC Services on Teen Birth and HS Dropout Rates, Allowing for Level Shift

Panel A: Births per 1,000 Women		
	≤15	16-19
Treatment Measure	(i)	(ii)
Primary Care Staff Hours	-0.037**	-0.941*
	(0.010)	(0.248)
Post	0.021	0.031
	(0.034)	(0.670)
Medical Staff Hours	-0.007**	-0.202**
	(0.002)	(0.075)
Post	0.024	0.236
	(0.037)	(0.776)

Panel B: High School Dropout Rate			
	10^{th} Grade	11^{th} Grade	12^{th} Grade
Treatment Measure	(i)	(ii)	(iii)
Primary Care Staff Hours	-0.006	-0.033**	-0.0004
	(0.013)	(0.015)	(0.016)
Post	0.006	-0.004	-0.008
	(0.004)	(0.006)	(0.006)
Medical Staff Hours	-0.002	-0.013**	-0.0003
	(0.003)	(0.005)	(0.004)
Post	0.006	-0.004	-0.008
	(0.004)	(0.006)	(0.006)

Notes: Authors' estimation as described in the text. *Post* is an indicator variable equal to 1 if any school-based health center exists in the county. 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). 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 11: The Relationship Between SBHC Services, District Expenditures and Student Enrollment

	Dependent Variable:		
	Per Student Expenditures	Log Enrollment	Log Expenditures
Treatment Measure	(i)	(ii)	(iii)
Primary Care Staff Hours	8.78**	-0.002**	-0.0009**
	(2.75)	(0.0003)	(0.0003)
Medical Staff Hours	2.07**	-0.0003**	-0.0002**
	(0.63)	(0.0001)	(0.0001)

Notes: Authors' estimation using as described in the text using data from the 1990-2011 Common Core of Data. All estimates include county 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.

Table A-1: The Effect of SBHC Services on Birth Rates (per 1000 women) Using Alternative Service Measures, by Age and Center Birth Control Status

Panel A: Births per 1,000 Women Age ≤15				
Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control
Days Open per Week	-0.113**	-0.106**	-0.109**	0.034
	(0.048)	(0.047)	(0.046)	(0.143)
Hours Open per Week	-0.022**	-0.022**	-0.022**	0.006
	(0.008)	(0.009)	(0.008)	(0.023)

Panel B: Births per 1,000 Women Age 16-19				
Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Days Open per Week	-3.297**	-3.243**	-2.682**	-2.740
	(1.301)	(1.286)	(1.105)	(1.843)
Hours Open per Week	-0.676**	-0.709**	-0.629**	-0.155
	(0.211)	(0.221)	(0.194)	(0.290)

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. 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-2: The Effect of SBHC Services on High School Dropout Rates (in Percent) Using Alternative Service Measures – Diploma Data

Panel A: 10^{th} Grade Dropout Rate

Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Days Open per Week	0.045	0.006	-0.031	0.206*
	(0.074)	(0.081)	(0.104)	(0.109)
Hours Open per Week	0.004	0.0004	-0.011	0.008
	(0.010)	(0.011)	(0.015)	(0.023)

Panel B: 11^{th} Grade Dropout Rate

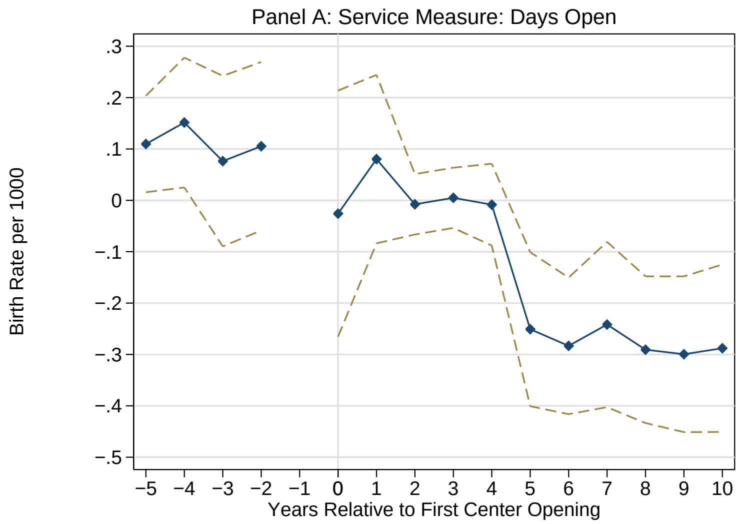
Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Days Open per Week	-0.257**	-0.312**	-0.332**	0.094
	(0.109)	(0.123)	(0.176)	(0.118)
Hours Open per Week	-0.037**	-0.041**	-0.045**	-0.015
	(0.014)	(0.016)	(0.024)	(0.016)

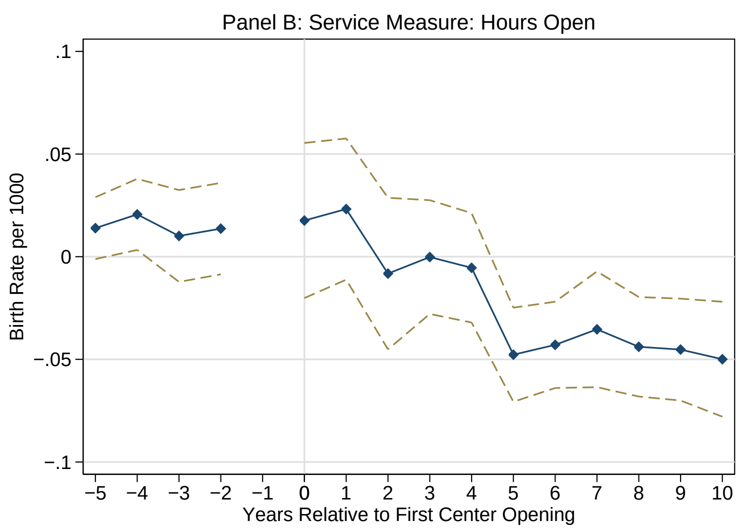
Panel C: 12^{th} Grade Dropout Rate

Treatment Measure	Full Sample (i)	Birth Control (ii)	Birth Control Dispensed (iii)	No Birth Control (iv)
Days Open per Week	0.010	-0.002	-0.081	0.038
	(0.076)	(0.082)	(0.114)	(0.131)
Hours Open per Week	-0.002	-0.003	-0.021	-0.005
	(0.012)	(0.012)	(0.018)	(0.019)

Notes: Authors' estimates of equation (1) using NCES CCD high school diploma data from 1998-2010. 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. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. 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.

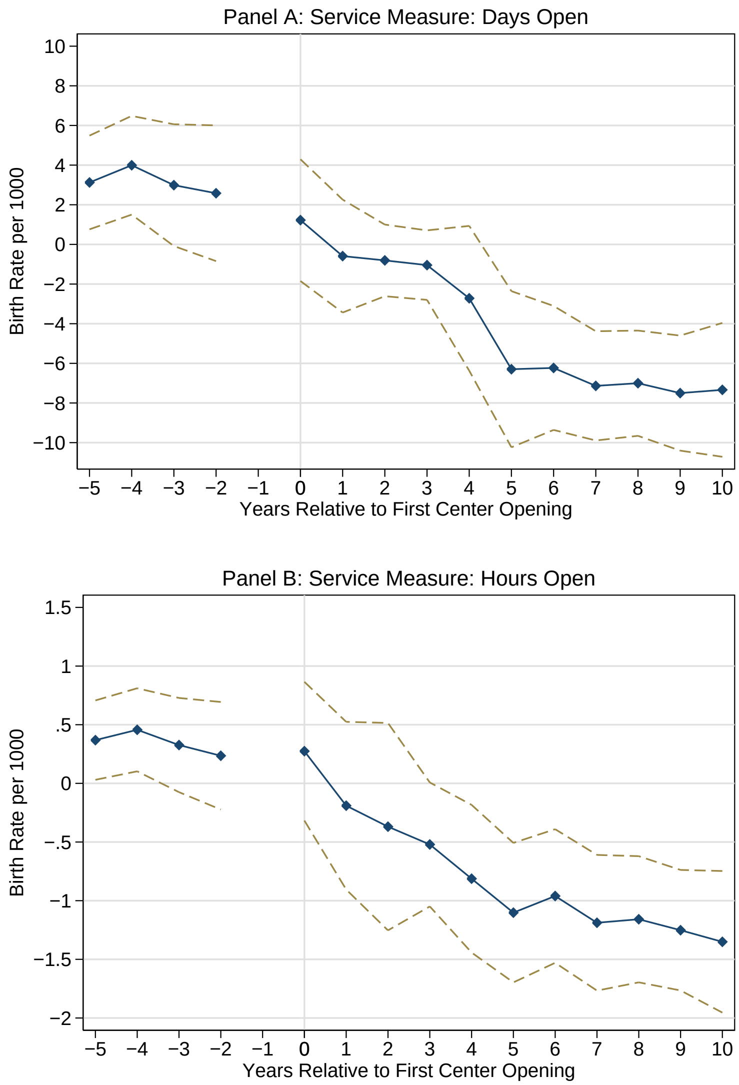
Figure A-1: Event Study Estimates of the Effect of SBHC Services on Under-16 Birth Rates (per 1000 women) Using Alternative Service Measures





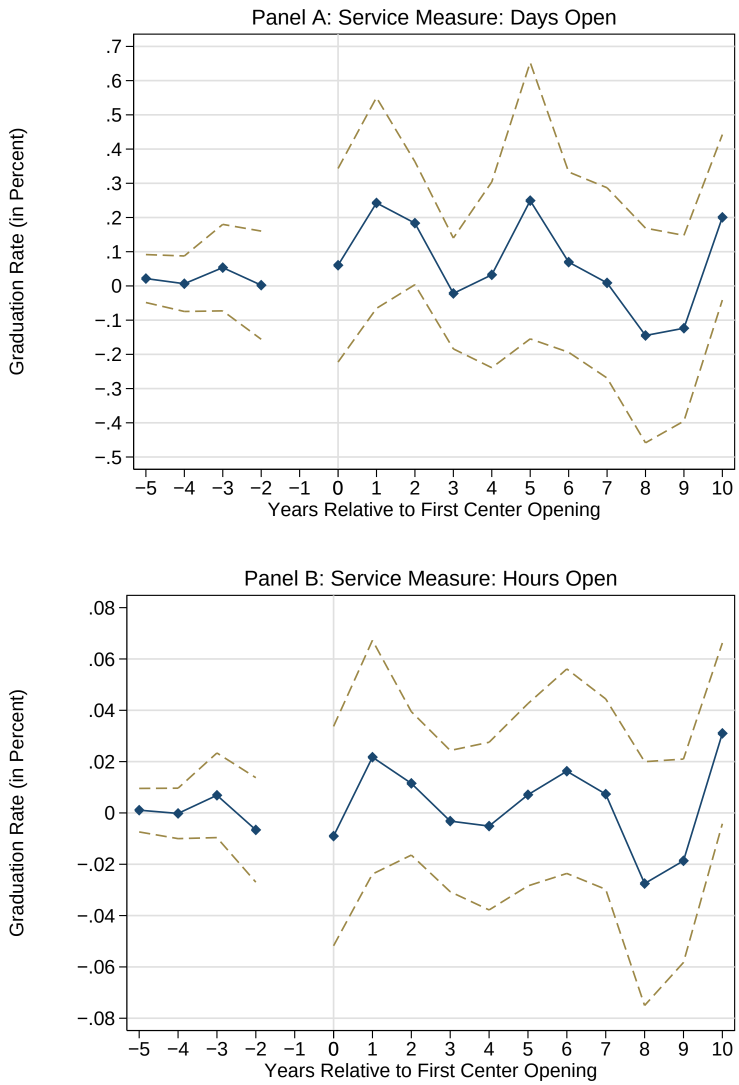
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 or in counties that have no centers are included in the regressions. The dashed lines 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 A-2: Event Study Estimates of the Effect of SBHC Services on 16-19 Birth Rates (per 1000 women) Using Alternative Service Measures



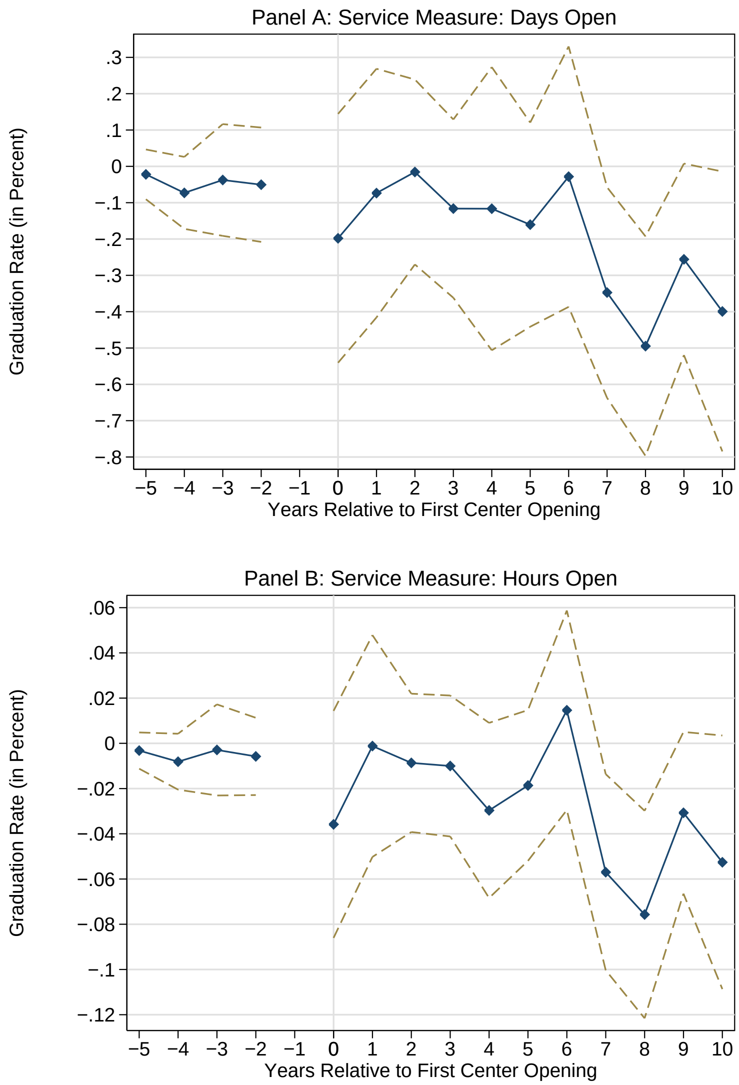
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regression are weighted by the high school aged population in the county. Only observations with relative years between -5 and 10 or in counties that have no centers are included in the regressions. The dashed lines 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 A-3: Event Study Estimates of the Effect of SBHC Services on 10^{th} Grade High School Dropout Rates (in Percent) Using Alternative Service Measures – Diploma Data



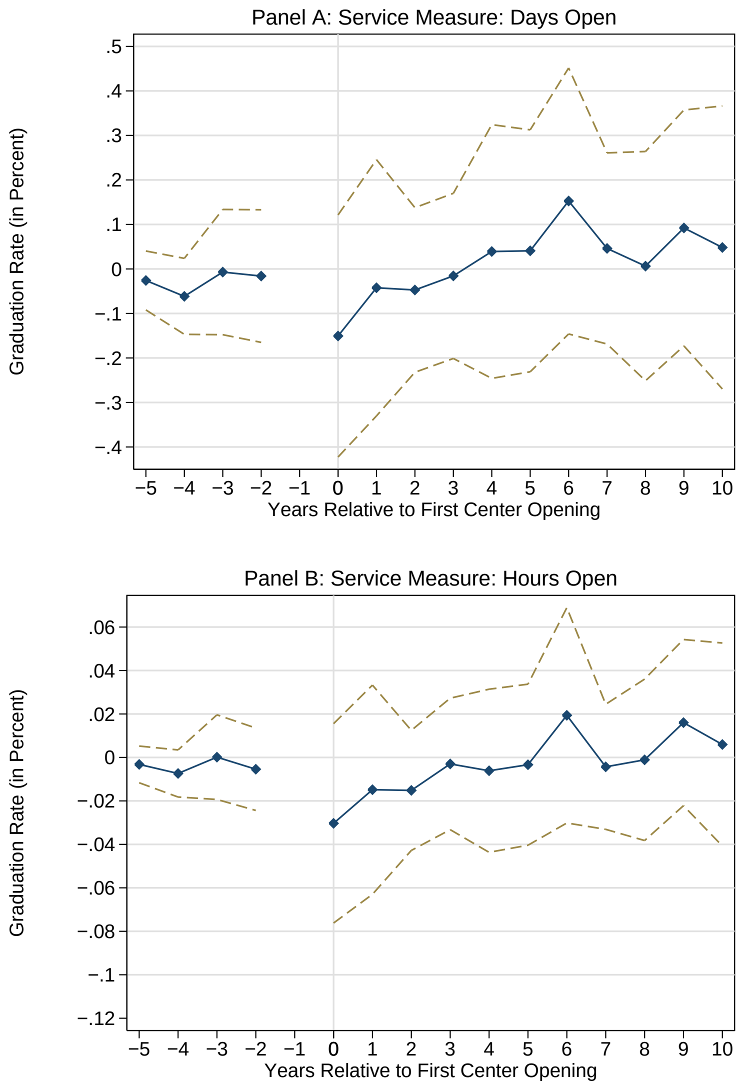
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. Only observations with relative years between -5 and 10 or in school districts that have no centers are included in the regressions. The dashed lines 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-4: Event Study Estimates of the Effect of SBHC Services on 11th Grade High School Dropout Rates (in Percent) Using Alternative Service Measures – Diploma Data



Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time 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 or in school districts that have no centers are included in the regressions. The dashed lines 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-5: Event Study Estimates of the Effect of SBHC Services on 12^{th} Grade High School Dropout Rates (in Percent) Using Alternative Service Measures – Diploma Data



Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time 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 or in school districts that have no centers are included in the regressions. The dashed lines 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.