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

Children from low-income families face persistent barriers to accessing high-quality health care services. Previous research studies have examined the importance of expanding children's health insurance coverage, but there is little prior evidence concerning the impacts of directly expanding primary health care access to this population. We address this gap in the literature by exploring whether teenagers' access to primary health care influences their fertility and educational attainment. We study how the significant expansion of school-based health centers (SBHCs) in the United States since the early 1990's has affected teen fertility and high school dropout rates. Our results indicate that school-based health centers have a negative effect on teen birth rates: adding services equivalent to the average SBHC reduces the 15-18 year old birth rate by 5%. The effects are largest among younger teens and among African Americans and Hispanics. However, primary care health services do not reduce high school dropout rates by very much despite the sizable reductions in teen birth rates

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1 Introduction

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

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

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

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

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

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

Second, our paper is the first to examine how primary health care services affect the educational attainment of children from low-income families. Providing access to primary health care services could increase educational attainment through any effect on child health as well as on family finances. A sizable amount of work has demonstrated that poor health or adverse health events among children are associated with worse long-run outcomes (e.g., Currie et al. 2010;

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

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

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

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

To identify the effect of SBHCs on teen fertility rates and high school dropout rates, we combine the NASBHC survey data with county-level information on births as well as district-level information on high school dropout rates. For births, we use U.S. vital statistics data for which the smallest level of geographic identification is the county. Our main analysis focuses on births among 15-18 year old women, as they are most likely to have been recently enrolled in high school.[4] We measure treatment by whether there is *any* SBHC open in the county or school district as well as by treatment intensity using the primary care staff hours per week and total medical staff hours per week offered by *all* SBHCs in the county or district. These measures provide a comprehensive depiction of the medical services offered to students. As discussed further below, the process of opening an SBHC is typically initiated by hospital administrators

[4]We refer to birth rates among women aged 15-18 as "teen birth rates" throughout this analysis.

who may then spend several years searching for a school to partner with, securing funding, and renovating a space to meet health clinic regulations. The timing of center entry varies significantly across counties and school districts as a result.

There are three potential threats to identification of the causal effects of SBHC services on teen fertility and dropout rates. First, the timing of center entry might be endogenous. In theory, this could bias estimates in either direction; centers might be opening when local officials are relatively resourceful, or when they are worried about unusually high rates of teen pregnancy or high school dropouts. Event study analyses provide extensive evidence that the timing of the initial center entering in a county or school district is not endogenous with respect to pre-treatment trends in our outcomes of interest. We therefore exploit the variation in timing across counties and school districts in initial center entry to identify how SBHC services affect teen outcomes. Second, yearly service level variation after initial entry might be endogenous. Event study analyses suggest this is indeed the case: services hours are targeted to areas that are experiencing higher birth rates, especially right after an initial center opens. We address this issue by estimating an instrumental variables model that uses information about the first center opening in a district/county to predict future service level variation in that district/county. Third, there might be omitted variables, contemporaneous policies or shocks affecting outcomes in the low-income communities where SBHCs locate. All of our analyses control for state-by-year fixed effects, so state-level policy changes and state-level shocks are not a concern. Robustness checks add controls for various types of year-specific income categories; these robustness checks confirm that the main results are not influenced by omitted variables differentially affecting low-income populations. Falsification tests also indicate that coincidental policies or shocks are not a source of concern: we do not see fertility effects for women in their early 20s when health centers opened in local high schools, and we do not find any relationship between SBHCs and per pupil expenditures in schools.

Our findings suggest that SBHCs reduce teen fertility, with relatively large reductions among younger teens, African American teens, and Hispanic teens. Our baseline estimates show that center entry in a county reduces the teen birth rate by 1.3 per 1,000, which is a 3.0% reduction relative to the baseline birth rate. Just using the existence of a center in a county ignores potentially-important service differences across centers. Our preferred estimates examine the effects of changing the primary care or total medical staff hours offered by SBHCs; to facilitate interpretation, we scale the treatment effects to reflect the impact of adding services equivalent to an average-sized SBHC. These results indicate that service changes equivalent to opening an average-sized center lead to a 2.4%-2.7% reduction in births per 1,000 women aged 15-18. The IV results are larger: in our preferred model an average-sized center reduces teen birth rates by over 5%. We prefer the IV estimates because they address the endogeneity concerns related to SBHC service level variation as well as any attenuation bias from measurement error. Further analysis provides suggestive evidence concerning which types of services are most important for reducing teen fertility. The largest effects come from the subset of SBHCs that offer on-site prescriptions of hormone-based contraceptives. Providing teenage girls with access to hormone-based contraceptives, with reduced parental involvement, might be an effective way to reduce teen births.

Despite the effectiveness of SBHCs in reducing teen pregnancies, we find no evidence that they substantially reduce high school dropout rates. We measure high school dropout rates using reported high school diplomas awarded at the district level and U.S. Census and American Community Survey (ACS) data. Our estimates are universally small in magnitude, vary in sign across specifications, and are only rarely statistically significantly different from zero. Even for the largest of these point estimates, we can rule out at the 5% level that increasing primary care service hours equivalent to an average-sized SBHC would reduce high school dropout rates by more than 1.0 percent. The high school years might be too late in a child's life to substantially alter the likelihood of high school completion via improved access to primary health care.

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

2 School-based Health Centers

School-based health centers (SBHCs) are health clinics that are located inside specific schools or elsewhere on the school's property.[5] They are funded by various combinations of state and federal grants, in-kind donations by hospitals, donations from private foundations, and reimbursements from Medicaid and private insurance companies. School districts themselves typically do not provide direct financial support to SBHCs, other than providing space for them on school grounds. While SBHCs have been in existence since the 1930s, a surge in SBHC openings during the 1990's coincided with many states increasing revenues available to SBHCs using newly-available funds from tobacco company lawsuit settlements, cigarette taxes, and Maternal-and-Child-Health block grants from the federal government. Figure 1 shows the distribution of opening years for SBHCs in our data. Almost 83% of these SBHCs opened after 1989, with over 38% opening after 1997. Figure 2 shows the number of SBHCs in our data in each state relative to the size of the school-aged population in 2011. SBHCs are located in all but nine (mostly small) states. An eclectic mix of states such as Delaware, Louisiana, Maine, Maryland, New Mexico, Oregon, and West Virginia have relatively large numbers of SBHCs per high school-aged child.

While cross-state variation in funding policies influenced the growth of SBHCs, our methodological approach is to exploit within-state variation in the timing of SBHC entry. 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.[6] Across similar communities in the same state, the provision of SBHCs may vary depending on relationships between school principals and local health administrators. While the specific requirements differ by state, typically it takes several steps to open the SBHC: 1) conduct a needs assessment to determine lack of access to health

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

[6] Appendix Table A-1 shows characteristics of counties and school districts with and without a SBHC by 2011.

care among students, 2) build a partnership between a school and the local health organization (e.g., hospital, non-profit health clinic), 3) generate a funding plan, 4) find appropriate space in the school, 5) obtain approval from the state/local government, 6) develop a staffing plan that includes mechanisms for coordinating services across agencies, and 7) modify the space in the school so that it meets code for health clinics and has proper equipment. The impetus to open a center in a specific location can come from local health officials, school administrators, or community leaders. States typically require that an application for a new center is sent directly from the health organization that would operate the center, along with appropriate sign-off from the school district that would host the center. Given the bureaucratic and organizational hurdles associated with opening a center, it usually takes several years between initial conception and a center opening. The unpredictability of both the location and timing of center openings provides the variation we need to estimate our models, and we conduct several tests to explore whether this variation is exogenous.

The focus of SBHCs is on providing primary care services for student populations. The majority of centers are attached to high schools, but many centers also provide services for students outside of the school to which they are attached: only 38% of centers report that use is restricted to students in the school. About a quarter of the SBHCs allow for families of the student to use the services, and 25% also allow use by school personnel. Almost 35% of the centers also report that they serve students from other schools. In some cases, the services provided are free to students. However, most centers operate more like traditional clinics and charge patients for services rendered. Due to the location of SBHCs, most students exposed by these centers are Medicaid-eligible, though, so these fees are unlikely to pose a large constraint to access. This feature of SBHCs highlights the fact that the treatment we examine is mostly due to health care *provision*, not due to health insurance access *per se*.

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

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

[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.

drive better educational outcomes. A potential concern with this mechanism is that teens may be quite healthy. If high school students do not require much access to health care, then SBHCs will have little impact on them, at least in the short-run.

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

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

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

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

One recent study of SBHCs in New York City instead identifies the effects of SBHCs by examining longitudinal changes in academic performance among students who enrolled in elementary and middle schools shortly before and shortly after those schools added SBHCs (Reback and Cox 2016). New York is one of the only states in the country where SBHCs are restricted by law to only serve the students enrolled in the hosting school. They find evidence that the addition of SBHCs to elementary or middle schools increases students' scores on standardized tests in math and language arts. Their findings suggest that the health benefits from SBHCs

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

could increase educational attainment, particularly if positive effects on middle school students do not fade during high school. Our work complements this analysis by examining the impacts of SBHCs serving high school students, by examining teen fertility, by providing both short term and longer term estimates, and by providing estimates for the entire US.

3 Data

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

3.1 NASBHC Census of School-based Health Centers

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

Each NASBHC survey contains detailed information on center location (e.g., zip code), services, utilization, days and hours open, what populations the center serves, and staffing hours for both primary care and total medical staff. Primary care staff includes physicians and nurse practitioners only. Total medical staff hours include mental health, dental care, nurse and

[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.

physicians' assistant hours in addition to primary care. Thus, for survey respondents, we have comprehensive information on the level and types of services the center provides for students.

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

One of the drawbacks of our data is that we observe service and staffing levels only for the years in which the surveys were completed. However, for all but 51 centers (or 1.9% of the total centers observed), the opening date is contained in the survey.[10] These center opening dates allow us to use outcome data from before 1998. As Figure 1 demonstrates, 62% of the centers in our data were opened prior to 1998, so the use of these earlier data increases the amount of

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

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 524 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 "teen" birth rates – births per 1,000 women aged 15-18 – in each county and month.[13] To account for the timing differences between conception and birth, we link all births at the month-year level to the school year in which the conception took place assuming a 9 month gestation time. We then aggregate births to the school year-county level to construct a birth rate for each county and school year.

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

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

[13]For the remainder of the analysis, we refer to the birth rate among 15-18 year old women as the "teen birth rate."

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).[14] We use these reports, combined with grade-specific 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.[15]

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

The CCD diploma data cannot distinguish between actual dropout rate changes and changes in the timing of degree receipt and student transferring behavior. Thus, this dropout rate will predominantly measure "on time" high school graduation for those in each grade cohort net of transfer. If there is a net loss of the 10^{th}-12^{th} grade cohorts due to transferring out of the

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

[15] Because diploma data are from the spring of each year and the SBHC surveys are in the fall, we lag all graduation rates by one year to align them with the SBHC service data.

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

school district, however, this measure will show an increase in dropout rates. For transferring to create a bias in our estimates, it would have to be correlated with SBHC entry/exit and service changes. While possible, we do not believe such effects would be large. The complications induced by these data are balanced by the fact that they are yearly, allowing us to exploit more within-district variation in SBHC services. Table 2 presents descriptive statistics of dropout rates calculated using these data.

3.4 US Census and ACS Data

We supplement our graduation analysis with 1990 and 2000 Census data as well as with the 2005-2011 American Community Survey. Using these data, we calculate for each school district the proportion of 14-17 year olds living in the school district who are not enrolled in school and who do not have a high school degree. This is the 14-17 year old dropout rate. The 18-19 dropout rate is calculated similarly using those aged 18-19. These data provide several advantages over the diploma data. First, they allow us to distinguish between males and females. Given our focus on teen fertility rates and the fact that males are more at risk of dropping out, it is useful to examine dropout effects by gender. Second, high school degrees in the Census/ACS include GEDs while the diploma data do not. Even though the returns to a GED are lower than the returns to a traditional high school diploma (Heckman and LaFontaine 2006), it is important to distinguish between any shifts across degree types versus any change in overall degree attainment. To the extent that the Census/ACS and CCD graduation rate estimates yield similar results, it suggests that our estimates are not being driven by changes in the proportion of students receiving a GED. A drawback of these data 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 provides a more complete picture of the effect of SBHCs on high school completion. 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. Descriptive statistics of the dropout rates in the Census and ACS are shown in Table 2.

4 Empirical Methodology

Our methodological approach to overcoming the inherent endogeneity between health care access, health and educational attainment is to use the variation in student exposure to health care services that is driven by school-based health center openings and the scope of the services provided. Our baseline model is a straightforward difference-in-differences design that uses variation only from the initial center entry in an area. We compare changes in birth or graduation outcomes in areas that receive their first center relative to areas that do not receive their first center in that year. Due to data limitations, our birth rate analysis and completion rate analysis occur at different levels of aggregation. In the birth data, the county is the most disaggregated level of geography available, so this part of the analysis is done at the county level.[17] 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 aged 15-18 in county c in year t,[18] γ is a set of county fixed effects, and δ is a set of state-by-year fixed effects that control for any state-level unobserved shocks in each year as well as state-year level policies (such as Medicaid). The variable $SBHC$ is an indicator variable equal to 1 if there is a school-based health center in the county and is zero otherwise. Thus, the variable of interest in equation (1) is β_1, which shows the effect on the birth rate of a SBHC entering the county.

The county fixed effects control for any fixed differences across counties in birth rates that are correlated with SBHC treatment. The identifying variation for β_1 comes only from differences in the timing of the first center opening across counties. Identification of β_1 thus rests on several assumptions that are common in difference-in-differences analyses. The first is that the decision to open a center is uncorrelated with trends in teen birth rates. Put differently, counties in which a SBHC will open in the near future should have the same outcome trends as those that will not experience an initial opening in the near future. Of particular concern is whether centers are put into schools where the teen birth rate is declining. If so, equation (1)

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

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

will not be able to distinguish treatment effects from differential secular relative trends. We do not believe, however, that this concern is very relevant in this context. It is far more likely that SBHCs are targeted toward schools that have declining health outcomes. As discussed in Section 2, the timing of when centers open is likely to be related to lack of health care access among students, the desire and ability of a principal or administrator to partner with a local health care provider, space in the school, and demand among the community for expanding health care access for low-income kids. Many of these factors may be related to underlying trends in health or educational attainment, but the sign of any resulting bias would be towards zero.[19] We test directly for whether center entry is related to pre-SBHC birth rate trends with the following "event study" specification:

$$Y_{cst} = \phi + \sum_{\tau=\leq -6}^{\geq 11} \alpha_\tau I(t - t_0 = \tau)_{ct} + \gamma_c + \delta_{st} + \epsilon_{cst}. \qquad (2)$$

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

Another identification concern with difference-in-differences analyses is that secular shocks or unobserved policies that correlate with the timing of the treatment can bias the results. Such shocks are unlikely to be a factor in this analysis, however. Since the timing of the treatment varies across counties, it is doubtful secular shocks exist that are highly correlated with the timing of SBHC entry. That it takes several years for centers to open from when

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

they are initially conceived also makes it unlikely that they are systematically correlated with county-level shocks. As well, the use of state-by-year fixed effects helps control for any state-level policies or shocks that could be correlated with the timing of treatment. Nonetheless, it could be the case that policies disproportionately impacting low-income communities (such as welfare reform and EITC expansions) are passed in similar time periods to when centers entered. In Section 5.1.2, we show our estimates are robust to controlling for separate time effects for low-income counties and to allowing for different state-year fixed effects by whether the county median income in 1990 is below that of the median county in the state. We also conduct falsification tests using birth rates among women in their twenties that confirm that the birth effects are isolated to high-school-aged women. The results of these falsification tests are inconsistent with the idea that important alternative policies or secular trends were correlated with the rollout of SBHCs.

The coefficient β_1 in equation (1) yields the average effect of center entry. This treatment specification omits a large amount of heterogeneity across centers, though, in the amount and type of services offered. From a policy perspective, we are interested more in the services offered through the centers than the centers *per se*. We therefore estimate versions of equation (1) that replace $SBHC_{ct}$ with $Service\ Hours_{ct}$, which are measures of the amount of services provided by each center relative to the underlying size of the student population. Specifically, we focus on two different service measures: Primary Care Staff Hours per week and Total Medical Staff Hours per week. These services are set to zero prior to an SBHC opening. The Total Medical Staff Hours differ from Primary Care Hours due to hours from mental health staff, dental staff, physician's assistants and nurses. In Appendix Table A-2, we also show estimates that use Days per Week or Hours per Week as the service measures. As Primary Care Staff and Total Medical Staff Hours are the most comprehensive measures of the medical services provided by school-based health centers, they are our preferred treatment variables. Means of these treatment measures are shown in Table 2.

Throughout the analysis, the SBHC service variables are constructed by first summing the total amount of each service measure for each county or school district and year. For example, we calculate the total number of medical staff service hours in the county and year across all centers in the county. We then divide by the total high-school-aged population in the county.[20] This provides a measure of the hours of SBHC medical services per high-school-aged student in the county. Finally, we re-scale the measure to be representative of a typical center by multiplying by 1000, which is the approximate average size of a high school in our sample. The method is identical for our school district level regressions, where we sum over districts rather than counties. Using the primary care or medical staff hours as our treatment measures, β_1 is interpreted as the effect on the birth rate of SBHCs increasing their service levels by an additional hour. When multiplied by the average SBHC service level, this estimate shows the effect of a service increase equivalent to one more average-sized center opening. We focus on this parameter for policy purposes.

Variation in primary care and medical staff hours comes from two different sources: 1) openings/closings of SBHCs with different service levels and 2) changes in service levels among open centers from year to year. In addition to the identification assumptions discussed above, we now require that decisions about the amount of services each center offers are uncorrelated with pre-treatment trends in teen birth rates. If service levels rise in areas that were already beginning to experience rising or falling teen birth rates, then our estimates of β_1 will be biased.

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

$$Y_{cst} \quad = \quad \phi + \sum_{\tau = \leq -6}^{\geq 11} \alpha_\tau \textit{Service Hours}_{ct_0} * I(t - t_0 = \tau) + \gamma_c + \delta_{st} + \epsilon_{cst}. \tag{3}$$

The *Service Hours* variable in equation (3) is set to the first observed service level in that county. That is, we set it equal to the service level observed when τ=0, denoted t_0. This model thus tests for selection related to initial service levels as well as time-varying treatment effects by initial service levels. We also estimate a version of this model in which we allow *Service Hours* to vary over time after initial entry, similar to how it is specified in equation (1). Comparing the post-entry estimates across these two versions of this model provides evidence on whether post-entry variation in service levels is exogenous.

Second, in order to account for the potential endogeneity of year-to-year service level varia-

[20] Our high-school-aged population count includes individuals between the ages of 15 and 19.

tion, we employ an instrumental variables strategy. We instrument Primary Care Staff Hours and Total Medical Staff Hours with an indicator for whether there is a center in the county and with a quadratic trend in the time since first center entry. This quadratic time trend is set to zero prior to the first center entering a county. As long as center entry is uncorrelated with pre-entry trends in birth rates, this instrument is valid. Thus, equation (2) is a direct test of the validity of this IV approach. Critically, because the instruments do not contain variation in service levels after the initial center is opened, they will account for any endogeneity in equation (1) in year-to-year service levels.

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

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

$$Y_{dst} = \phi + \sum_{\tau=\leq -6}^{\geq 11} \alpha_\tau I(t - t_0 = \tau)_{dt} + \gamma_d + \delta_{st} + \epsilon_{dst} \tag{5}$$

$$Y_{dst} = \phi + \sum_{\tau=\leq -6}^{\geq 11} \alpha_\tau Service\ Hours_{dt_0} * I(t - t_0 = \tau) + \gamma_d + \delta_{st} + \epsilon_{dst}. \tag{6}$$

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

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

A second source of measurement error is that prior to 1998, the first year of NASBHC data, we cannot observe changes in the level of services provided. For all centers opened before 1998, we use the first observed service levels (typically from the 1998 survey). This could produce further measurement error in the *Service Hours* variables. Finally, aggregation to the county and school district levels could produce measurement error because many students in each county and district do not have centers in their own school buildings. Some aggregation would be appropriate even if it were not necessitated by the data, because 62% of centers are open not only for students in the hosting schools but also for other community residents. 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.[21] This argument supports our contention that the aggregated data can provide informative estimates of the relationship between school-based health centers, teen childbearing, and educational attainment.

5 Results

5.1 Birth Results

5.1.1 Main Estimates

Table 3 presents the baseline estimates of the effect of school-based health centers on teen birth rates. Each cell in the table is from a separate regression, and all standard errors are clustered at the county level. In the first column, we show OLS estimates of β_1 from equation (1). The top row shows results using an indicator for the presence of any center in a county as the treatment measure. When the first SBHC enters a county, the teen birth rate declines by 1.3 per 1000, which represents a 3.0% percent decline. The remaining rows show estimates using

[21] 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.

Primary Care Staff Hours and Medical Staff Hours as the treatment measures. Across these two treatment variables, the table shows a consistent negative relationship between SBHC service levels and teen birth rates. Ten additional primary care staff hours or medical staff hours per week decreases teen births by 2.18 or 1.08 per 1,000 respectively. A useful way to interpret these estimates is to calculate their implications for the effect of opening an average-sized center. To calculate such an effect, we multiply the estimates by the average amount of services each center supplies (shown in Table 2) and then divide by the average birth rate for this group. The estimates suggest that adding an average-sized center in a county would reduce birth rates by 2.4 or 2.7%. The magnitude of these estimates is similar to, if somewhat smaller than, the 6.8% decline in birth rates among 18-19 year olds following Medicaid family planning waiver expansions reported in Kearney and Levine (2009).

A central concern with the type of difference-in-differences analysis we employ is that centers may be targeted at areas based on preexisting trends. Figure 5 shows the estimates of α from equation (2). We have excluded relative year -1 such that all estimates are relative to this year. The points in the figure show the point estimates of α, while the lines extending from each point show bounds of the 95% confidence intervals that we calculated using standard errors that are clustered at the county level. There is no evidence of negative pre-treatment trends in birth rates. The pre-treatment trend line is flat, especially within 5 years of center entry, and the pre-treatment coefficients are jointly insignificant (p-value of 0.56). These results suggest that center entry is exogenous with respect to teen birth rate trends.

The second pattern evident in Figure 5 is that the long-run effects of SBHCs are much larger than the short-run effect. These are at least three potential explanations for these rising effects. First, repeated exposure during all four years of high school should produce larger effects for students than exposure for a smaller number of years. Second, centers may take time to ingrain themselves in the community. Third, many counties initially opening a center later expand their services and have subsequent center openings. Controlling for state-by-year effects, we find that county-level service hours hit their peak 5 years after the first center opens and district-level service hours hit their peak 8 years after the first center opens.[22]

[22]These tabulations come from event study analyses of how service levels vary after initial center entry. Appendix Table A-6 shows similar estimates that impose a quadratic time trend. While service levels grow modestly in the several years following initial center entry, the majority of the service level variation is driven by the timing of first entry.

While the timing of center openings is exogenous with respect to pre-existing teen fertility rate trends, the amount of services they offer are correlated with these trends. Both initial service levels and post-entry service level variation appear to be related to pre-entry fertility trends (as displayed in Appendix Figure A-1).[23] More services appear to be targeted towards areas experiencing increasing teen fertility rates, which attenuates the OLS estimates that use service hours as the treatment measure. To account for the endogeneity of service levels, we instrument for Primary Care Staff Hours or Medical Staff Hours with the timing of the first center opening. Our instrumental variables are an indicator variable for whether a center has opened and quadratic time trends for the number of years since that first center opened. The results from these IV models are shown in column (ii) of Table 3. The instruments are strong, with first-stage F-statistics above 50.[24] The estimates in column (ii) are considerably larger in absolute value than the OLS estimates and are statistically significantly different from zero at the 5% level. The larger estimates are due to the fact that the instruments account for the targeting of services based on teen fertility rate trends. In our IV models, opening an average-sized center reduces teen birth rates by over 5%. On the whole, the results in Table 3 tell a consistent story that opening an SBHC in a county has a sizable negative effect on teen birth rates on the order of 3-5 percent.

At which age are teens' fertility rates most affected by SBCHs? In theory, SBHCs may affect both younger and older teens. On the younger end, middle school students might also be able to visit centers. On the older end, the impact of centers on sexual behavior and use of contraception may persist beyond a woman's time in high school. Table 4 presents estimates by age, including 19 year olds and those under 15. For each age, we show estimates using the same models and treatment measures as shown in Table 3. A consistent pattern of results emerges in Table 4: health care services from SBHCs reduce teen birth rates among teens of all ages, with the largest proportional effects coming from the youngest teens. For example, in our 2SLS models predicting primary care hours, an average-sized SBHC reduces births among girls 14 and under by 15.2%, among 15-year olds by 12.0% and among 16-year

[23]Panels A and B of Figure A-1 presents evidence that counties with higher initial hours of service have rising birth rates, although the estimates are not jointly significant. The increase in birth rates continues for the first year after the center has opened. In Panels C and D, we hold service hours constant at their initial levels both pre- and post-initial entry and show a steady decline in birth rates after the first center opens. Taken together, these results suggests that the counties continuing to experience relatively high birth rates tend to increase their centers' service hours the most.

[24]First-stage coefficients are shown in Appendix Table A-6.

olds by 9.6%. Among teens aged 17 or 18, the estimated effects are less than 6%. Across model specifications, the estimates for 19 year olds are much smaller and often are not statistically significant; this is sensible, because many of these women are no longer enrolled in high school and may thus have far less access to SBHCs. Proportionally larger effects for younger women is an important finding, because the private and social costs of teen fertility may be highest for the youngest mothers. That SBHCs have such a large effect on young teen births suggests they are most successful at reducing fertility among the population that is of highest concern among policymakers.

SBHCs differ in the types of contraceptive services they offer. About 65% of centers offer some type of birth control, either directly or through referral (see Table 1). In Table 5, we show estimates of equation (1) that allow the effect of Primary Care Staff Hours and Medical Staff Hours to differ by the type of contraceptive services offered by the clinic. We split centers into four groups that together encompass the entire range of birth control offerings in US SBHCs: centers that prescribe hormone-based contraceptives on-site,[25] centers that refer patients for hormone-based birth control but do not offer condoms on-site, centers that refer patients for hormone-based birth control and offer condoms on-site, and centers that do not offer any contraceptive services. Each column in Table 5 comes from a separate regression. The results are broadly consistent with SBHC services most affecting teen birth rates in centers that can prescribe hormone-based birth control, but the estimates are somewhat imprecise and the differences in slopes are not statistically significant at conventional levels. As shown in Figure 3, many of the centers that do not offer contraception do offer other family planning services, such as pregnancy tests, tests for sexually transmitted infections, abstinence counseling, and general health advice that would come with a primary care visit. Table 5 reveals that our results are not driven by condom distribution, which is consistent with theoretical and empirical research arguing that distributing condoms may not reduce (and might increase) teen birth rates (Buckles and Hungerman 2014; Arcidiacono, Khwaja and Ouyang 2012). The results suggest that providing female teenagers with easier access to hormone-based contraception, access that does not require them to go through their parents, may substantially decrease teen fertility rates.

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

SBHCs might also reduce rates of sexually transmitted diseases.[26]

School-based health centers may have a larger effect on African American and Hispanic students than on white students because these centers are targeted at low-income populations. Furthermore, African American and Hispanic teen birth rates are much higher than those of whites, which makes these groups particularly important to study. In Table 6, we show OLS and IV estimates of the effect of SBHCs on teen fertility rates by race/ethnicity. As in Table 3, we also calculate percent effects of opening an average-sized center in order to compare more easily across specifications. There is no evidence that opening a SBHC reduces teen birth rates among whites. The estimates are universally small and are not statistically different from zero. This non-result is likely driven by the fact that our treatment is at the county level, and white students in treated counties are far more likely to be in wealthier areas that do not have a center. Thus, within a treated county, whites are less likely to be actually exposed to a center than black and Hispanic students. As a result, SBHCs have a much larger impact on birth rates among black and Hispanic teens. In the 2SLS models, adding an average-sized SBHC reduces both black and Hispanic teen birth rates by about 8%. Although the Hispanic estimates are imprecise, these results demonstrate that school health centers affect teen births most among racial and ethnic minorities who are more likely to live in low income areas that have such centers.

5.1.2 Robustness Checks

As discussed in Section 4, one of the central identification assumptions underlying our approach is that there are no secular trends or shocks that align with the rollout of SBHCs across areas. Of particular concern is whether federal or state governments passed policies disproportionately affecting cities with higher concentrations of low-income residents during the same time period when many SBHCs opened. Many centers opened in the mid-1990s (Figure 1), a time period in which welfare programs were reformed, the EITC was expanded, and many states were

[26]We estimated state-level models of how SBHC services affect STD rates among teens using data from the U.S. Center for Disease Control, which are shown in Appendix Table A-5. Unlike birth data, data by age group for STDs are available at the state level and not the county level (county level data are not disaggregated by age). We regressed rates of three STDS - gonorrhea, chlamydia, and syphilis – among 15-19 year olds on the number of hours of primary care and total medical staff services provided by school-based health centers in that state, in models controlling for state fixed effects and year effects. Although most of the estimates are not statistically different from zero, they all point to sizable declines in STD rates among teens when SBHC services in the state rise. While the need to aggregate to the state level leaves us with too little power to draw definitive conclusions, these results are suggestive of positive sexual health benefits of SBHCs in addition to lower teen birth rates.

expanding public health insurance programs. The state-year fixed effects should account for these policy changes if they affected teen birth rates in all counties similarly in a state and year. But these policies disproportionately affected low-income communities, so they may have disproportionately affected teen birth rates in these communities. Table 7 shows several robustness checks to compare with the results from Table 3. Columns (i) and (ii) of Table 7 reveal that the results are robust to controlling for state-year-median income fixed effects by allowing the state-year fixed effects to differ based on whether a given county's median income in 1990 was in the bottom half of all counties in that state. Columns (iii) and (iv) of Table 7 show that the results are also robust to controlling for both state-year fixed effects and differential year fixed effects among the bottom 20% of counties in the US according to 1990 median earnings. The estimates in columns (i) through (iv) are similar to those in Table 3, with somewhat larger estimates for the IV models. Table 7 thus suggests that our main results are not upwardly biased by state or national policies aimed at lower-income communities.

Next, we relax the linear functional form assumption between SBHC service levels and outcomes. We do this by controlling separately for SBHC services and for the existence of a center in the county rather than just the interaction of these two measures. This is a more flexible way to model the treatment, and the estimates in column (v) of Table 7 show that this leads to a slightly larger percentage effect of SBHCs on teen fertility. If anything, the functional form embedded in our baseline estimates leads to somewhat conservative estimates.

Another check for the existence of secular trends or shocks that can bias our estimates is to examine whether the short run effects of SBHCs are limited to teen women. If older women also experience declines in birth rates when SBHCs enter, this could be evidence that the emergence of these centers is correlated with other factors affecting fertility rates for women of all ages. This falsification test is complicated by the fact that many older women were treated by SBHCs when they were younger and by the fact that many centers are open to the community at large. We examine birth rates among women aged 20-24 and aged 25-29, and we restrict the sample to counties that did not have a center when women in these age ranges were of high school age. We also restrict our sample to states in which fewer than half of SBHCs report that they serve non-students. Table 8 shows these results; for both age groups, there is no evidence of a decline in births associated with SBHC entry. Indeed, birth rates among 25-29 year olds increased slightly in counties with greater intensity of services from SBHCs. These results are not simply due to the change in sample: column (iii) repeats the analysis on the same sample for 15-18 year olds. The results in column (iii) are similar to those shown in column (i) of Table 3. That the fertility effects of SBHCs are isolated to those who are of high school age strongly supports our identification strategy.

5.2 High School Dropout Results

The results presented above suggest that school-based clinics promote better health outcomes among the teens exposed to them, at least in terms of birth rates. A question of high importance is whether the changes in teen health caused by these centers, in terms of pregnancy as well as other health outcomes, affect educational attainment. For students in the low-income areas targeted by SBHCs, high school completion is a very important measure of educational attainment, and it thus is the focus of our analysis. In Table 9, we present the first evidence in the literature on the effect of providing primary care services to low-income school-age children on high school dropout rates. Due to serial correlation of errors within districts over time, all estimates are accompanied by standard errors that are clustered at the school district level throughout the dropout rate analysis.

The estimates in Table 9 are in percent terms, such that a coefficient of 1 would mean that a 1 hour increase in SBHC services would increase dropout rates by 1 percent (rather than by 100% if the dependent variable was in percentage terms). Across all models and treatment measures, there is little evidence that SBHCs or SBHC services affect high school dropout rates.[27] Roughly half of the estimates are positive, and only one of the estimates is statistically significant at even the 10% level. Furthermore, the estimates are precise: the 95% confidence intervals show we can rule out declines in dropout rates from an average-sized center of more than -0.5% for 10^{th} grade, -1.0% for 11^{th} grade, and -0.7% for 12^{th} grade.[28]

Figure 6 shows the event study estimates from equation (5) for 10^{th}, 11^{th} and 12^{th} grade

[27] See Appendix Table A-6 for first-stage IV estimates.

[28] Similar to Table 5, we have estimated dropout models that examine heterogeneous SBHC effects by birth control services offered. These are shown in Appendix Table A-3 and do not point to any dropout rate effects in centers that offer access to certain types of contraception. We also have examined effects of service hours among centers that offer mental health services. We find no evidence of a dropout rate effect among centers that offer such services. These results are available from the authors upon request.

dropout rates. Estimates of equation (6) using Medical Staff Hours and Primary Care Staff Hours are shown in Appendix Figures A-2 through A-4. These figures show that the null finding in Table 9 does not mask important heterogeneity in long-run effects or selection on pre-treatment trends. Recall that our dropout rate sample begins in 1998, and as a result we have much fewer observations pre-dating center openings. Thus, the standard error bounds in the pre-treatment period are relatively large. Still, there is little evidence of differential trends prior to center entry, and there is no evidence of a dropout effect post-entry either in the short or long run.

Dropout rate estimates using Census/ACS data are shown in Table 10.[29] Similar to Table 9, we fail to see statistically significant effects of SBHCs on high school dropout rates. The one exception is for women aged 18-19. When we use Primary Care and Medical Staff Hours as the treatment measure, there are small, negative effects of an average-sized SBHC on the dropout rate. However, these estimated effects are no more than one quarter of a percent, are not robust to using a center indicator as the treatment measure, and are not statistically significant at the 5% level. Thus, we view these estimates as being consistent with at most a very small impact of SBHCs on female high school dropout rates.

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

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

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). Our estimates, however, suggest that the teen birth rate declines as well as the other health benefits teens receive as a result of these centers do not substantially affect their likelihood of completing high school.

One explanation for the lack of an effect on dropout rates in the presence of a teen birth effect could be that the birth estimates only use data from large counties. To explore this potential explanation, in Appendix Table A-4 we estimate dropout rate models using the CCD diploma data in which we use only the counties included in the birth rate analysis. The results are extremely similar to baseline and show no effect of SBHC services on high school completion. Thus, the difference between the birth and dropout findings is not due to the differences in the samples used.[30]

Another alternative explanation for the lack of a dropout rate effect is that SBHCs lead to a reduction in school resources that counteract any health effects. These centers are not financed by the school, and they do not use school resources aside from the space that they are allocated. However, it still is possible that SBHCs use other school resources in a manner that might influence our dropout rate estimates, or SBHC entry could be correlated with unobserved trends in school resources. In Table 11, we examine whether SBHC service variation is correlated with school expenditures using data from the 1998-2011 Common Core of Data. We see that there is no relationship between SBHC services and per-student expenditures: the coefficients are small, precisely estimated and are not statistically different from zero at even the 10% level. These results suggest that there are no expenditure changes correlated with SBHC entry or service level variation that could bias the results and conclusions of our analysis.

[30] 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 9.

6 Conclusion

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

We present two broad findings from our empirical analysis. First, we show the SBHCs have negative effects on fertility rates among teenage girls. Adding a center with the average amount of SBHC services leads to a decrease in the 15-18 year old birth rate of about 5% relative to the baseline fertility rate. These effects are larger for younger teens, and they are concentrated among African American and Hispanic teens who are most likely to be exposed to a center. Second, despite the large effect of SBHCs on teen fertility, we find no substantial effect on high school dropout rates.

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

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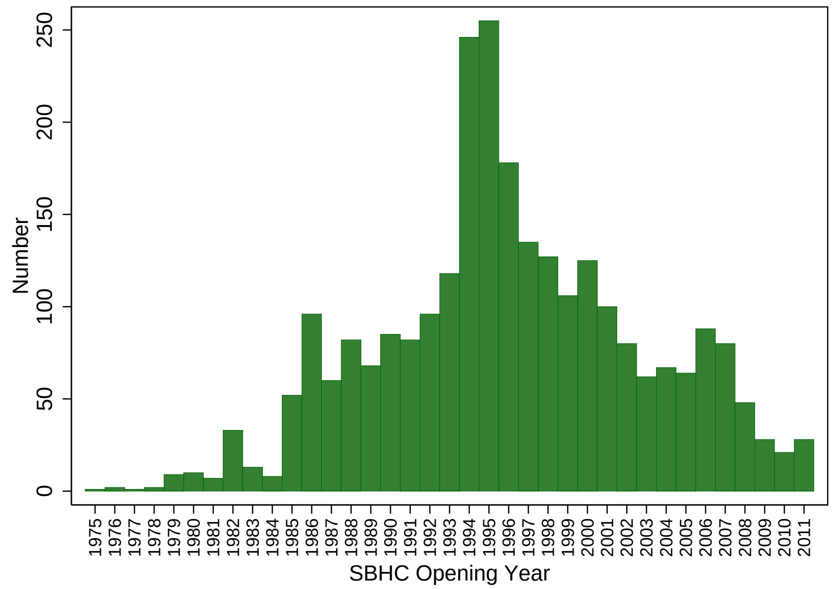
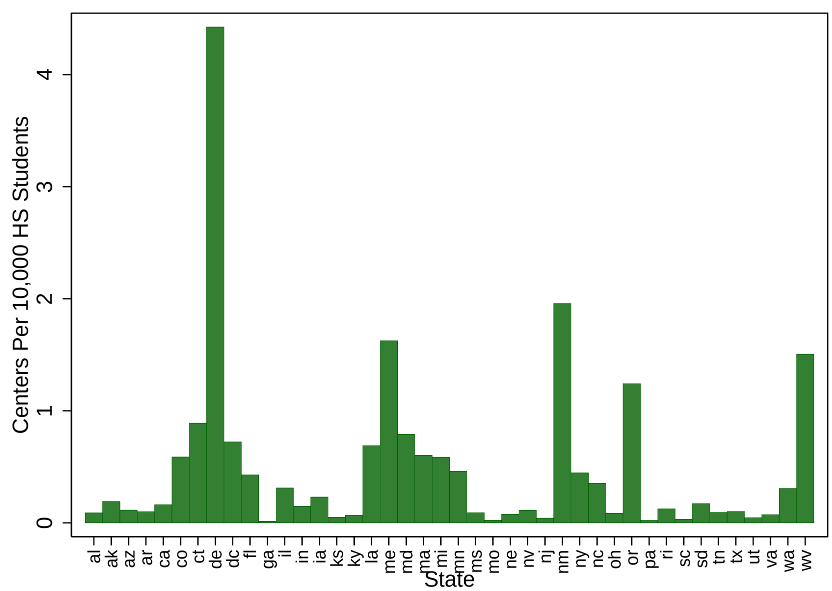
Figure 1: Distribution of SBHC Opening Years



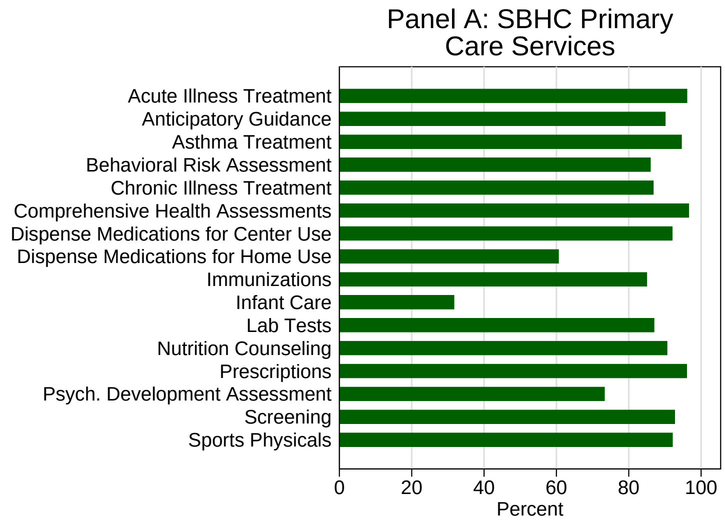
Source: NASBHC School-based Health Center Census, 1998-2011. The figure includes only centers that serve high school students.

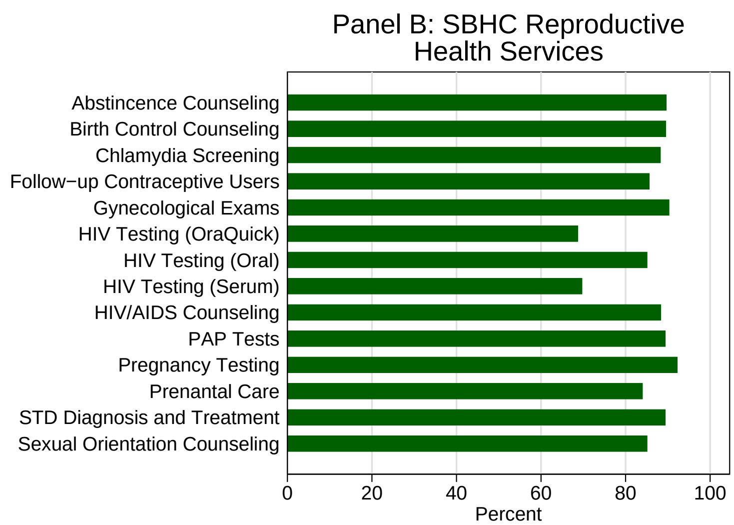
Figure 2: Distribution of SBHCs per 10,000 High School Students Across States



Source: NASBHC School-based Health Center Census, 2011. The figure includes only centers that serve high school students. States without SBHCs (HI, ID, MT, ND, NH, SD, VT, WI, WY) are omitted from the figure.

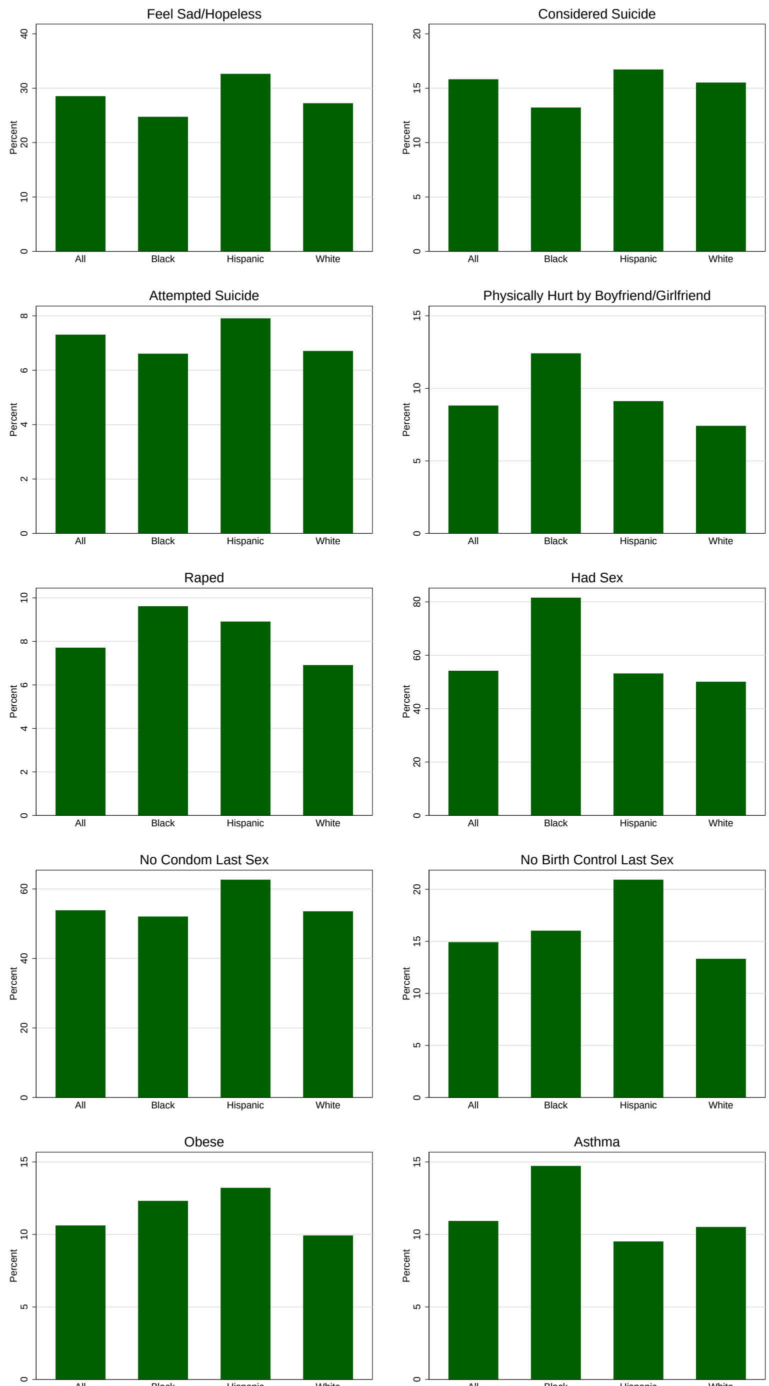
Figure 3: Primary Care and Non-Contraceptive Reproductive Health Services Provided by SB-HCs





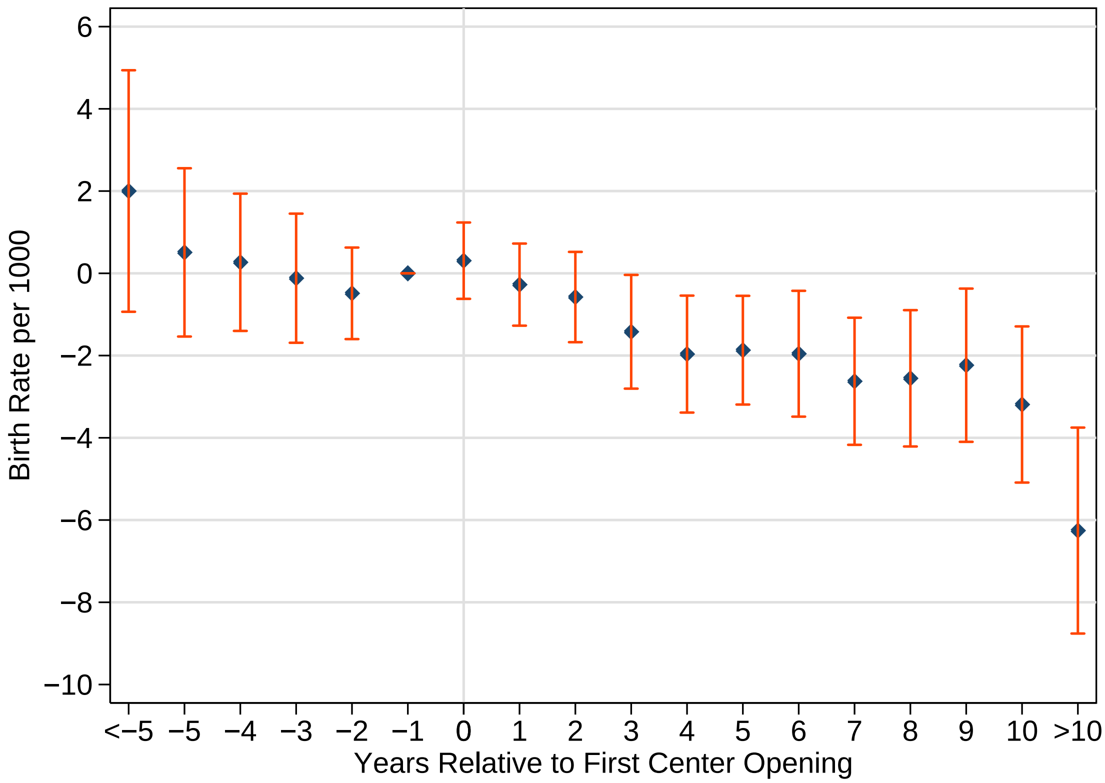
Source: These figures are reproduced from the 2007-2008 School-based Health Centers National Census annual report, available at http://www.sbh4all.org/atf/cf/%7Bcd9949f2-2761-42fb-bc7a-cee165c701d9%7D/NASBHC%202007-08%20CENSUS%20REPORT%20FINAL.PDF. The reproductive care service tabulations show the percent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

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



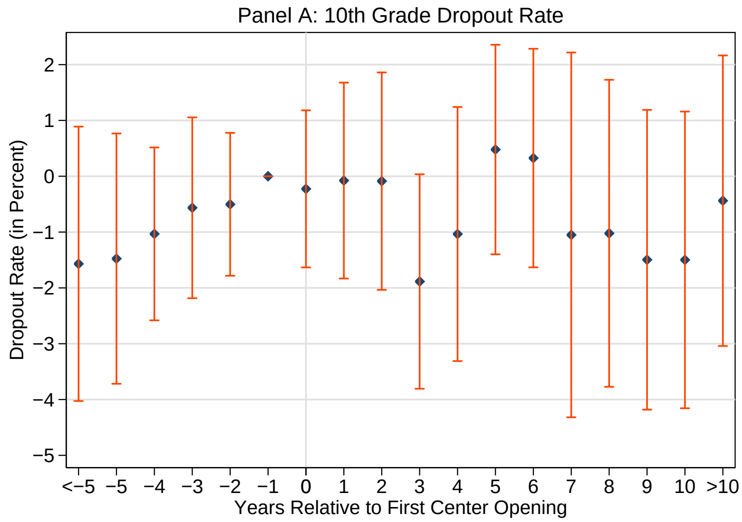
Source: 2011 Youth Risk Behavior Surveillance System (YRBSS).

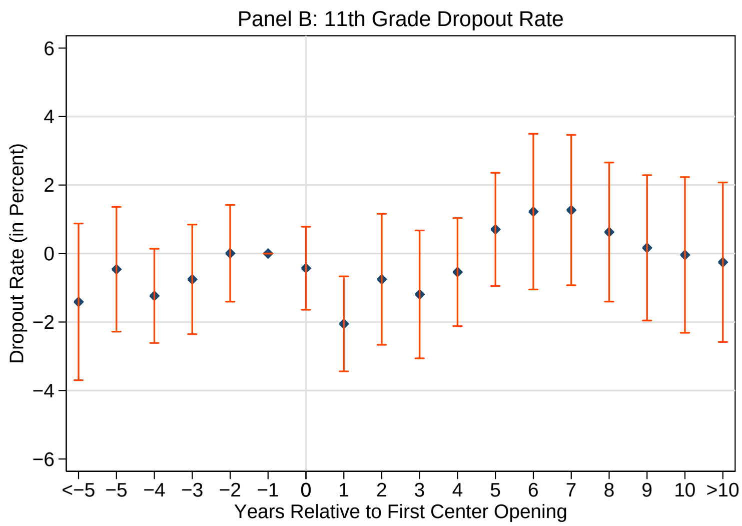
Figure 5: Event Study Estimates of the Effect of SBHC Entry on Teen Birth Rates (per 1000 women)

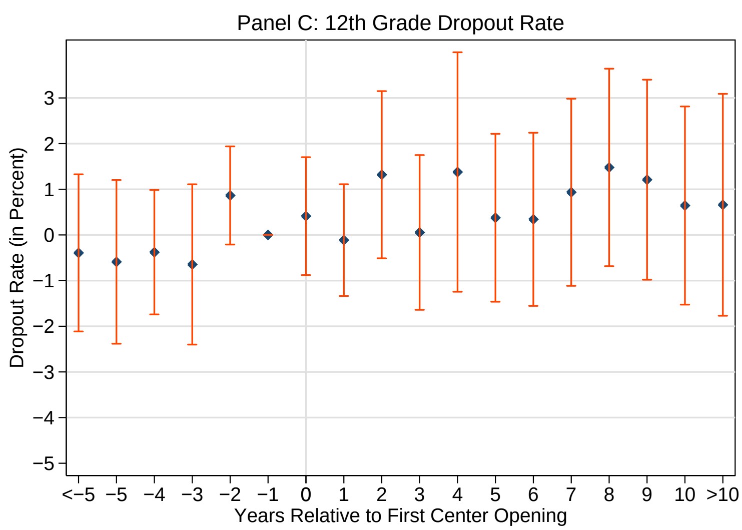


Authors' estimates of equation (2) as described in the text. The dependent variable is 15-18 year old birth rates per 1000. Each point shows the coefficient estimate on the service measure or center indicator interacted with the relative time to the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the county level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure 6: Event Study Estimates of the Effect of SBHC Entry on High School Dropout Rates (in Percent) – Diploma Data







Authors' estimates of equation (5) as described in the text. Each point shows the coefficient estimate on the total medical staff hours service measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Table 1: Percent of Health Centers Providing Different Contraceptive Services

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

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

Table 2: Descriptive Statistics of Analysis Variables

Variable	Mean	SD
Treatment Measures		
Center Indicator	0.174	0.379
Primary Care Staff Hours per Week	0.876	4.970
Primary Care Staff Hours per Week (in districts with any center)	4.881	10.761
Primary Care Hours with Hormones Prescribed On Site	2.054	7.442
Primary Care Hours with Hormones Referred, No Condoms	2.019	7.059
Primary Care Hours with Hormones Referred & Condoms Dispensed	0.136	1.389
Primary Care Hours with No Birth Control Services	0.665	3.289
Medical Staff Hours per Week	1.910	10.363
Medical Staff Hours per Week (in districts with any center)	10.987	22.762
Medical Staff Hours with Hormones Prescribed On Site	4.790	16.241
Medical Staff Hours with Hormones Referred, No Condoms	4.149	14.504
Medical Staff Hours with Hormones Referred & Condoms Dispensed	0.466	3.956
Medical Staff Hours with No Birth Control Services	1.569	7.170
Outcome Measures		
Birth Rate per 1,000 Women Aged 15-18	44.28	21.60
10^{th} Grade Dropout Rate (%)	22.39	12.18
11^{th} Grade Dropout Rate (%)	15.43	9.79
12^{th} Grade Dropout Rate (%)	9.28	8.75
14-17 Dropout Rate (%)	10.08	20.59
Female 14-17 Dropout Rate (%)	9.98	20.73
Male 14-17 Dropout Rate (%)	10.16	20.66
18-19 Dropout Rate (%)	15.50	8.20
Female 18-19 Dropout Rate (%)	14.81	7.34
Male 18-19 Dropout Rate (%)	15.82	7.34

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

Table 3: The Effect of SBHC Services on Teen Birth Rates per 1000 Women

	OLS (i)	2SLS (ii)
Treatment Measure		
Center Indicator	-1.333** (0.474)	
% Effect of Average Center	-3.0%	
Primary Care Staff Hours	-0.218* (0.115)	-0.492** (0.176)
% Effect of Average Center	-2.4%	-5.4%
Medical Staff Hours	-0.108** (0.046)	-0.228** (0.079)
% Effect of Average Center	-2.7%	-5.7%
First-stage F-Stat (Primary Care)		51.34
First-stage F-Stat (Medical Staff)		53.93

Notes: Authors' estimates of equation (1) as described in the text. The dependent variable is 15-18 year old birth rates per 1000. Each cell comes from a separate regression. In column (ii), Primary Care Staff Hours and Medical Staff Hours are instrumented with an indicator for whether there is a center in the county as well as a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Percent effects for the Center Indicator results are calculated by dividing the coefficient by the mean birth rate. The percent effects for the staff hours estimates show the percent effect relative to the mean for a center with the average number of primary care or medical staff hours. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 4: The Effect of SBHC Services on Teen Birth Rates per 1000 Women, by Age

	Mother's Age					
	≤14	15	16	17	18	19
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
OLS						
Center Indicator	-0.082**	-0.842**	-1.229**	-0.938*	-1.836**	-1.101**
	(0.025)	(0.258)	(0.409)	(0.504)	(0.595)	(0.560)
% Effect of Average Center	-8.9%	-7.0%	-4.8%	-2.2%	-2.8%	-1.3%
OLS						
Primary Care Staff Hours	-0.016**	-0.129**	-0.201**	-0.222*	-0.257**	-0.194
	(0.007)	(0.052)	(0.119)	(0.113)	(0.131)	(0.128)
% Effect of Average Center	-8.6%	-5.3%	-3.8%	-2.5%	-1.9%	-1.1%
2SLS						
Primary Care Staff Hours	-0.029**	-0.296**	-0.506**	-0.285	-0.684**	-0.374
	(0.008)	(0.091)	(0.142)	(0.184)	(0.259)	(0.257)
% Effect of Average Center	-15.2%	-12.0%	-9.6%	-3.2%	-5.2%	-2.1%
OLS						
Medical Staff Hours	-0.008**	-0.055**	-0.097**	-0.106**	-0.128**	-0.070
	(0.003)	(0.022)	(0.041)	(0.049)	(0.058)	(0.074)
% Effect of Average Center	-9.1%	-5.0%	-4.1%	-2.7%	-2.2%	-0.9%
2SLS						
Medical Staff Hours	-0.013**	-0.132**	-0.230**	-0.136*	-0.319**	-0.186
	(0.004)	(0.041)	(0.064)	(0.083)	(0.116)	(0.115)
% Effect of Average Center	-15.0%	-12.1%	-9.8%	-3.5%	-5.4%	-2.4%
Mean Birth Rate	0.93	11.98	25.85	43.41	64.57	86.31

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

Table 5: The Effect of SBHC Services on Teen Birth Rates per 1000 Women, by Birth Control Services

Service Measure: Birth Control Services	Primary Care Staff Hours (i)	Medical Staff Hours (ii)
Hormones Prescribed On Site	-0.628** (0.271)	-0.239* (0.134)
Hormones Referred, No Condoms	-0.244 (0.161)	-0.144 (0.093)
Hormones Referred & Condoms Dispensed	-0.221 (0.551)	-0.108 (0.113)
No Birth Control Services	-0.567 (0.363)	-0.238** (0.079)

Notes: Authors' estimates of equation (1) as described in the text. The dependent variable is 15-18 year old birth rates per 1000. Each column comes from a separate regression. The birth control service measures include the number of service hours of each type in centers with the given birth control policy. The birth control policy groups are exhaustive and mutually exclusive. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 6: The Effect of SBHC Services on Teen Birth Rates per 1000 Women, by Race/Ethnicity

	OLS			2SLS		
Race/Ethnicity:	White (i)	Black (ii)	Hispanic (iii)	White (iv)	Black (v)	Hispanic (vi)
Treatment Measure						
Center Indicator	0.138	-1.400*	-3.204*			
	(0.244)	(0.828)	(1.757)			
% Effect of Average Center	0.7%	-2.4%	-4.7%			
Primary Care Staff Hours	0.006	-0.157	-0.677*	-0.026	-0.928**	-1.113
	(0.052)	(0.157)	(0.373)	(0.096)	(0.375)	(0.773)
% Effect of Average Center	0.2%	-1.3%	-4.8%	-0.6%	-7.9%	-7.9%
Medical Staff Hours	0.004	-0.120*	-0.410**	-0.011	-0.408**	-0.532
	(0.019)	(0.067)	(0.170)	(0.043)	(0.168)	(0.347)
% Effect of Average Center	0.2%	-2.3%	-6.6%	-0.6%	-7.8%	-8.5%
Mean Birth Rate	19.60	57.66	68.35	19.60	57.66	68.35

Notes: Authors' estimates of equation (1). The dependent variable is 15-18 year old birth rates per 1000. Each cell comes from a separate regression. In columns (iv)-(vi), Primary Care Staff Hours and Medical Staff Hours are instrumented with an indicator for whether there is a center in the county as well as a quadratic in the number of years since a center was first opened in the county (set equal to zero in the years prior to a center first opening). All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. Percent effects for the Center Indicator results are calculated by dividing the coefficient by the mean birth rate for the age and racial/ethnic group. The percent effects for the staff hours estimates show the percent effect relative to the mean for a center with the average number of primary care or medical staff hours. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: The Effect of SBHC Services on Teen Birth Rates – Robustness Checks

	State-Year-Median Income Fixed Effects		Year-Bottom 20% Income Fixed Effects		Allowing for Level Shifts
	OLS	IV	OLS	IV	OLS
Treatment Measure	(i)	(ii)	(iii)	(iv)	(v)
Center Indicator	-1.238**		-1.280**		
	(0.478)		(0.492)		
% Effect of Average Center	-2.8%		-2.9%		
Primary Care Staff Hours	-0.216**	-0.648**	-0.193*	-0.506**	-0.121
	(0.107)	(0.174)	(0.105)	(0.173)	(0.118)
Center Indicator					-1.120**
					(0.535)
% Effect of Average Center	-2.4%	-7.1%	-2.2%	-5.6%	-4.0%
Medical Staff Hours	-0.110**	-0.288**	-0.097**	-0.234**	-0.060
	(0.042)	(0.077)	(0.040)	(0.078)	(0.052)
Center Indicator					-1.089**
					(0.529)
% Effect of Average Center	-2.7%	-7.1%	-2.5%	-5.8%	-4.0%
First-stage F-Stat (Primary Care)		50.45		52.09	
First-stage F-Stat (Medical Staff)		52.64		54.81	

Notes: Authors' estimation as described in the text. The dependent variable is 15-18 year old birth rates per 1000. *Center Indicator* is an indicator variable equal to 1 if any school-based health center exists in the county. All results contain county fixed effects. Estimates in columns (i) and (ii) include state-year-median income fixed effects, where median income is an indicator for whether the 1990 median household income in the county is above the median household income in the state in 1990. Estimates in columns (iii) and (iv) include state-year fixed effects and year fixed effects interacted with an indicator for the county being in the bottom 20% of median household income in 1990. Estimates in column (v) contain state-year fixed effects. 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 8: The Effect of SBHC Services on Birth Rates Among Older Women Without Access to a SBHC

	Mother's Age		
	20-24	25-29	15-18
Treatment Measure	(i)	(ii)	(iii)
Center Indicator	0.421	-0.067	-1.674*
	(1.130)	(0.770)	(0.906)
Primary Care Staff Hours	0.101	0.399**	-0.454**
	(0.128)	(0.115)	(0.178)
Medical Staff Hours	0.023	0.138**	-0.123*
	(0.059)	(0.059)	(0.075)
Mean Birth Rate	100.58	114.19	44.28

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. The sample consists of states in which less than half of centers report they are accessible to those who do not attend the school in which they are located and are restricted to counties in which there were no centers when the women in each age group were of high school age. 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 9: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data

	OLS			2SLS		
Grade:	10^{th}	11^{th}	12^{th}	10^{th}	11^{th}	12^{th}
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Treatment Measure						
Center Indicator	0.576	0.014	0.600			
	(0.426)	(0.529)	(0.442)			
Primary Care Staff Hours	-0.006	-0.023	-0.003	0.064	-0.024	0.154*
	(0.012)	(0.020)	(0.013)	(0.086)	(0.097)	(0.091)
% Effect of Average Center	-0.03%	-0.13%	-0.01%	0.31%	-0.12%	0.75%
Medical Staff Hours	-0.005	-0.010	-0.003	0.042	-0.003	0.068
	(0.006)	(0.007)	(0.006)	(0.042)	(0.048)	(0.042)
% Effect of Average Center	-0.02%	-0.05%	-0.01%	0.20%	-0.02%	0.33%
First-stage F-Stat (Primary Care)					44.18	
First-stage F-Stat (Medical Staff)					45.51	

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

Table 10: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Census/ACS Data

	14-17 Year Olds			18-19 Year Olds		
	All	Female	Male	All	Female	Male
Treatment Measure	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Center Indicator	-0.124	-0.123	-0.141	0.484	0.234	0.682
	(0.148)	(0.169)	(0.155)	(0.503)	(0.610)	(0.555)
Primary Care Staff Hours	-0.005	-0.002	-0.007	-0.011	-0.052*	0.013
	(0.005)	(0.006)	(0.005)	(0.020)	(0.028)	(0.024)
% Effect of Average Center	-0.02%	-0.01%	-0.03%	-0.05%	-0.25%	0.06%
Medical Staff Hours	-0.002	-0.001	-0.003	-0.002	-0.025*	0.018
	(0.002)	(0.003)	(0.003)	(0.010)	(0.015)	(0.012)
% Effect of Average Center	-0.01%	-0.01%	-0.01%	-0.01%	-0.12%	0.04%

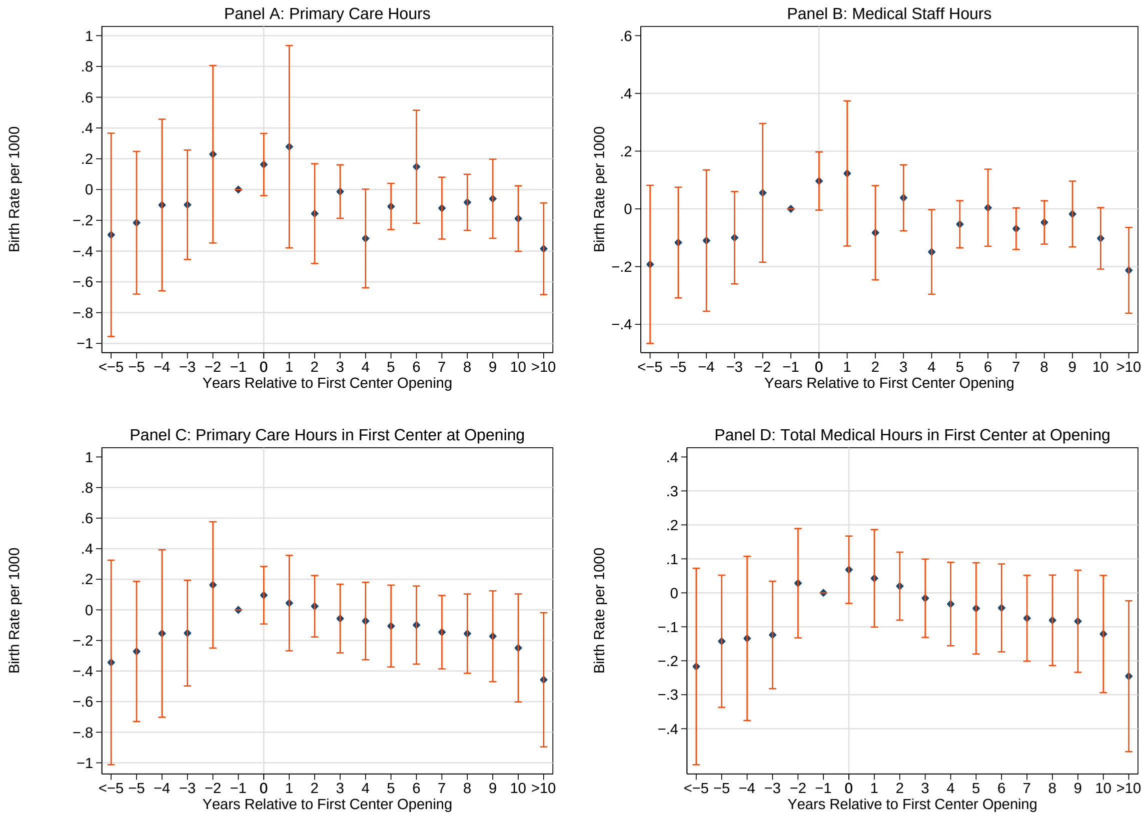
Notes: Authors' estimates of equation (4) using 1990 and 2000 Census data as well as 2005-2011 ACS data. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district that does not report attending school and that does not have a high school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

Table 11: The Relationship Between SBHC Services and Per-Student Expenditures

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

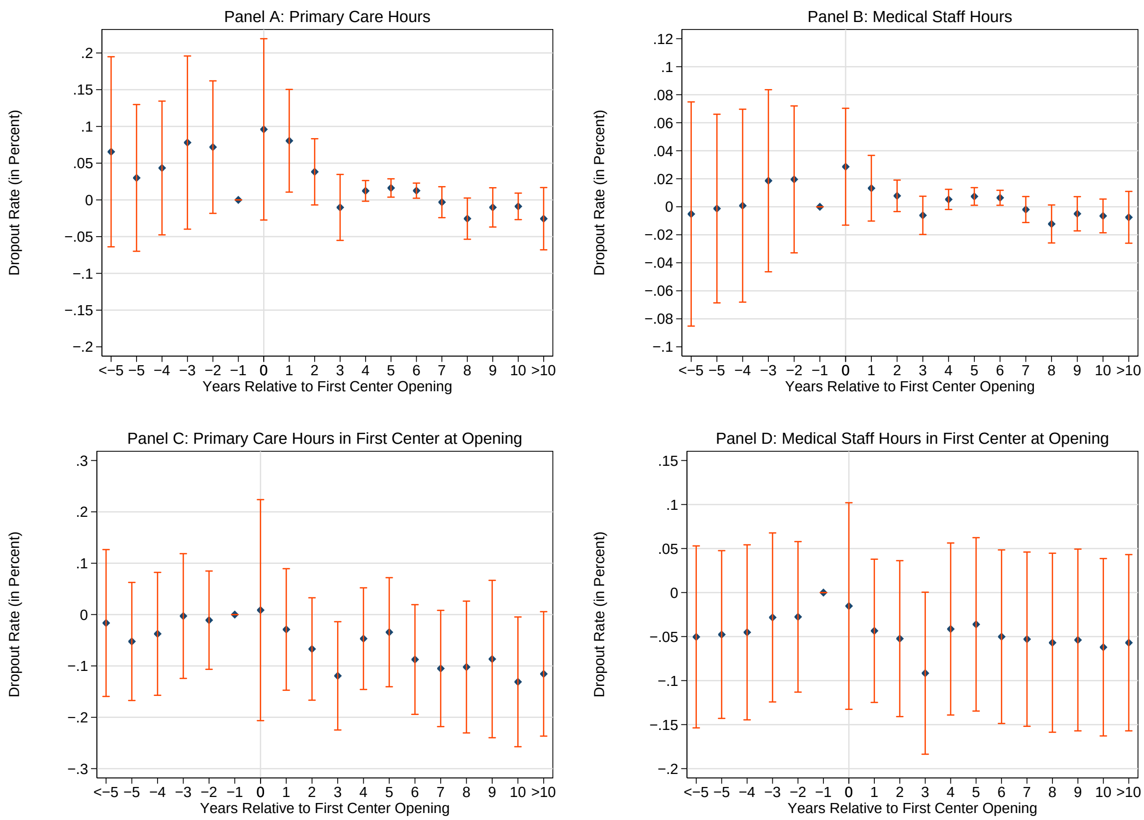
Notes: Authors' estimation as described in the text using data from the 1998-2011 Common Core of Data. All estimates include school district and state-by-year fixed effects. Regressions are weighted by the high school aged population in the school district. Standard errors clustered at the school district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

Figure A-1: Event Study Estimates of the Effect of SBHC Services on Teen Birth Rates (per 1000 women)



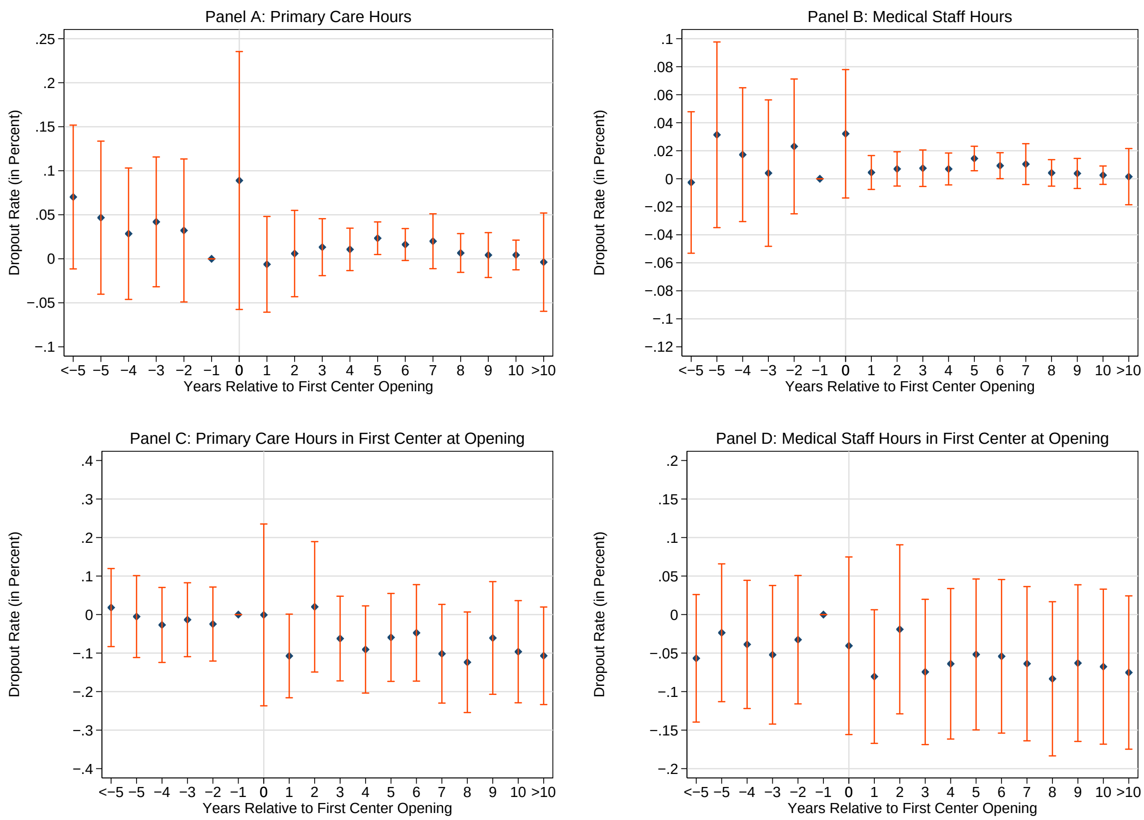
Authors' estimates of equation (3) as described in the text. The dependent variable in each panel is 15-18 year old birth rates per 1000. Each point shows the coefficient estimate on the service measure interacted with the relative time to the first center opening in the county. All estimates include county and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the county. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the county level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure A-2: Event Study Estimates of the Effect of SBHC Primary Care and Medical Staff Services on 10th Grade High School Dropout Rates (in Percent) – Diploma Data



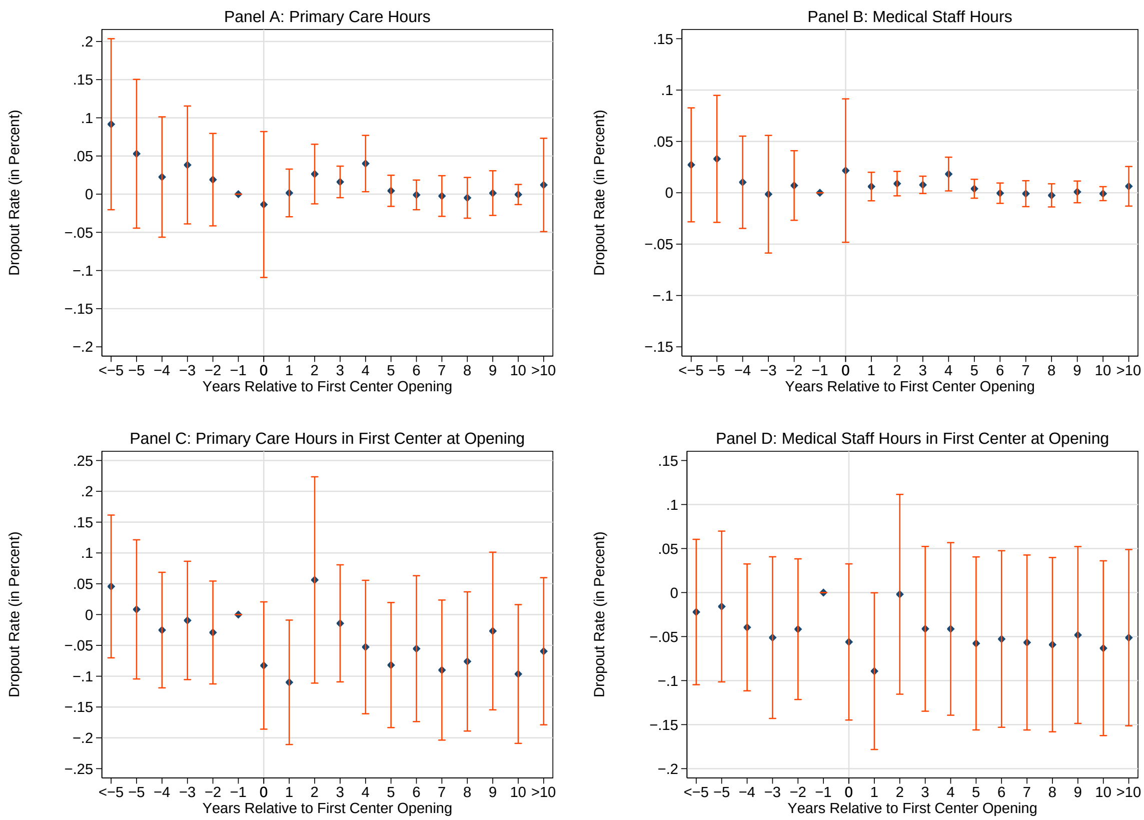
Authors' estimates of equation (6) as described in the text. Each point shows the coefficient estimate on the service hours measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure A-3: Event Study Estimates of the Effect of SBHC Primary Care and Medical Staff Services on 11^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equation (6) as described in the text. Each point shows the coefficient estimate on the service hours measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Figure A-4: Event Study Estimates of the Effect of SBHC Primary Care and Medical Staff Services on 12^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



Authors' estimates of equation (6) as described in the text. Each point shows the coefficient estimate on the service hours measure interacted with the relative time to the first center opening in the school district. All estimates include school district and state-by-year fixed effects, and the regressions are weighted by the high school aged population in the school district. The lines extending from each point show the bounds of the 95% confidence intervals that are calculated using standard errors clustered at the school district level. Relative year -1 is omitted, so all estimates are relative to this year.

Table A-1: 1990 Census Characteristics of Counties and School Districts by Treatment Status

Variable	Counties: Ever Treated	Counties: Never Treated	School Districts: Ever Treated	School Districts: Never Treated
Median Rent	466.49	429.43	401.09	370.35
Median Home Price	102146	79490	78517	69882
Median HH Income	31454	30946	26342	28363
Median Family Income	37057	36196	30950	32879
% Housing Occupied	90.64	91.30	87.70	87.23
% Urban	81.38	72.00	62.83	37.39
% Below Poverty	12.71	11.31	17.23	13.93
% w/ Public Assistance	7.39	6.07	9.67	7.13
% Inc. from Public Assistance	1.39	0.77	1.41	1.00
% w/ Wage Income	78.13	78.87	78.07	79.36
% Unemployed	4.10	3.60	5.18	4.05
% Not in Labor Force	34.07	33.86	37.34	36.93
% Male	48.58	48.91	48.78	49.21
% Black	11.79	8.85	11.93	4.71
% Hispanic	9.23	4.05	11.52	4.42
% Asian	2.55	1.36	1.81	0.80
% Other Race	1.06	0.63	1.90	1.74
% Under 6 Years Old	8.84	8.83	7.52	7.08
% 6-19 Years Old	19.54	20.26	22.18	22.55
% 20-34 Years Old	25.34	24.94	24.20	21.42
% 35-64 Years Old	33.96	33.88	33.28	34.65
% Institutionalized	1.32	1.32	1.24	1.07
% No HS Degree	22.90	22.31	28.55	25.98
% Some College	27.95	28.03	24.33	24.10
% BA+	19.81	17.84	15.31	14.42
% Married w/ Kids	25.94	28.50		
% Single w/ Kids	8.12	7.14		

Sources: 1990 Census Summary File 3 (counties) and School District Tabulation data. All tabulations use only the counties and school districts in the respective analysis sample.

Table A-2: The Effect of SBHC Services on Teen Birth and HS Dropout Rates Using Alternative Service Measures

Panel A: Births per 1,000 Aged 15-18	
Treatment Measure	(i)
Days Open per Week	-1.256*
	(0.742)
Hours Open per Week	-0.529**
	(0.167)

Panel B: High School Dropout Rate

Treatment Measure	10^{th} Grade (i)	11^{th} Grade (ii)	12^{th} Grade (iii)
Days Open per Week	-0.038	-0.219*	-0.142
	(0.084)	(0.127)	(0.103)
Hours Open per Week	-0.003	-0.033	-0.011
	(0.016)	(0.020)	(0.018)
Average Days per Week		0.553	
Average Hours per Week		3.596	

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

Table A-3: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data, by Birth Control Services

	Primary Care Staff Hours			Medical Staff Hours		
Grade:	10^{th}	11^{th}	12^{th}	10^{th}	11^{th}	12^{th}
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Birth Control Services						
Hormones Prescribed On Site	-0.014	-0.004	0.001	-0.008	-0.002	0.001
	(0.012)	(0.014)	(0.014)	(0.006)	(0.007)	(0.007)
Hormones Referred, No Condoms	-0.0001	-0.050	-0.015	-0.001	-0.019	-0.008
	(0.001)	(0.041)	(0.025)	(0.010)	(0.016)	(0.011)
Hormones Referred & Condoms Dispensed	0.079	0.089	0.034	0.027	-0.029	-0.043
	(0.063)	(0.064)	(0.057)	(0.021)	(0.064)	(0.047)
No Birth Control Services	-0.001	-0.024	0.018	-0.014	-0.014	0.007
	(0.031)	(0.032)	(0.031)	(0.017)	(0.017)	(0.015)

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

Table A-4: The Effect of SBHC Services on High School Dropout Rates (in Percent) – Diploma Data Using Large Counties

Grade:	10^{th} (i)	11^{th} (ii)	12^{th} (iii)
Treatment Measure			
Center Indicator	0.546 (0.492)	0.153 (0.483)	0.642 (0.392)
Primary Care Staff Hours	-0.004 (0.011)	-0.032 (0.021)	-0.010 (0.013)
Medical Staff Hours	-0.004 (0.005)	-0.012* (0.006)	-0.005 (0.006)

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

Table A-5: The Effect of SBHC Services on STD Rates per 1000 15-19 Year Olds

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

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

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

Table A-6: First-Stage Estimates from Instrumental Variables Models

	Birth Rates		Dropout Rates	
Service Measure:	Primary Care	Medical Staff	Primary Care	Medical Staff
Center Indicator	2.657**	5.843**	4.919**	10.684**
	(0.221)	(0.474)	(0.441)	(0.933)
Time Since First Entry	0.033	-0.026	0.253**	0.289**
	(0.034)	(0.083)	(0.066)	(0.120)
(Time Since First Entry)^2	-0.0003	0.004	-0.002	-0.001
	(0.002)	(0.005)	(0.002)	(0.003)

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