How Does Access to Health Care Affect Health and Education? Evidence from School-based Health Center Openings*

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Abstract

The large amount of money spent on expanding access to health care in the US to low-income Americans combined with persistent disparities in health and education across the socioeconomic distribution leads to the important question of how expanding health care access could help address these disparities. This paper examines the provision of primary care health services to low-income students that are delivered through school-based health centers (SBHCs). Using the timing of center entry and exit combined with changes in service levels from year to year at these centers, we estimate how the primary care services provided by SBHCs affect teen pregnancy and high school dropout rates. Our preliminary results indicate that school-based health centers have a large, negative effect on teen birth rates: adding services equivalent to the average SBHC reduces the birth rate for girls 15 and under by 23% and reduces the 16-19 year old birth rate by 8%. These effects are driven solely by centers that offer contraceptive services. Despite the large effect on teen childbearing, we find at most a small effect on high school dropout rates. However, any dropout rate effect is localized to females. These results suggest that primary care health services do not reduce high school dropout rates by much, even when they reduce teen birth rates. This does not mean, however, that SBHCs do not make students better off, as reducing teen fertility may be desirable in its own right.

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

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1 Introduction

Access to affordable health care for low-income Americans has become a pre-eminent policy issue in the US, which is highlighted by the vigorous debate surrounding the passage and implementation of the 2010 Affordable Care Act. Among the benefits of expanding health care access to lower-income families are increased health and lower financial risk of health shocks. To the extent that health care access produces these outcomes, as suggested by previous research (Currie and Gruber, 1996a; Doyle, 2005; Gross and Notowidigdo, 2011; Finkelstein et al., 2012), then it also may support human capital investment among children. There are strong arguments based on human capital theory that both a family's financial position and the health status of children will affect the accumulation of human capital. Indeed, there are large and persistent disparities across the socioeconomic (SES) distribution in cognitive achievement, health care access, and health status that suggest this link might be strong (Currie, Decker and Lin, 2008; Adler and Rehkopf, 2008; Case, Lubotsky and Paxson, 2002; Cunha et al., 2006; Conti, Heckman and Urzua, 2010; Todd and Wolpin, 2007). However, these correlations by themselves are not evidence of a causal effect of health care on educational outcomes, because there likely are unobserved factors associated with socioeconomic status that affect all of these variables as well.

Beginning with the seminar work of Grossman (1972), economists have studied the empirical relevance of the prediction that education should increase health later in life. There currently is mixed evidence on this question (Adams et al., 2003; Cutler and Lleras Muney, 2006; Grossman, 2004; Clark and Royer, 2010), with studies differing substantially with respect to the credibility of the econometric approach used. A main focus of this work is to understand whether education gaps can explain health outcome disparities among older Americans by income or SES. What has received little attention in the previous literature, though, is the question of whether health disparities more generally and health care access disparities in particular among children can explain the large gap that exists in educational outcomes across the SES distribution. In 2012, the US spent $260 billion on Medicaid and the State Children's Health Insurance Program (SCHIP), a large portion of which was on children, which highlights the large amount the US government spends on providing health care for children from low-income families. A policy question of first-order importance is what effect the health care access provided by programs like these have on the educational outcomes of these children.

While access to health insurance among lower-income families receives the bulk of the policy attention, of high importance as well is the provision of health services to the poor. Inadequate access to primary care facilities and doctors among low-income families may preclude them from realizing any benefits of health insurance. This paper examines the effect of providing primary health care services to teens on their health and educational attainment. We make two contributions to the literature. First, we present new evidence on the effect of primary health care services on teen birth rates. Second, we show the first evidence in the literature on the effect of providing primary health care services for low-income children on educational attainment.[1] A major hurdle to studying this question is that health care access is not exogenously assigned: unobserved factors correlated with health care availability are likely to be correlated with educational outcomes as well. We overcome this problem by exploiting the opening and yearly service level changes of school-based health centers (SBHCs) in different school districts in the US. School-based health centers are either government- or privately-sponsored health clinics that are attached to schools and that provide a suite of health services to students. While they vary in size and scope, virtually all clinics provide basic preventative health services to students, and many of them also provide reproductive and contraceptive services. From the National Assembly on School-based Health Care (NASBHC), we obtained data from surveys they conducted of health centers in 1998, 2001, 2004, 2007 and 2011 in the US. Centers are followed longitudinally, and in additional 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. Overall, we observe 2,633 centers over our analysis period, and we examine how these centers affect high school graduation rates as well as teen birth rates.

In addition to generating the first estimates of how health care access affects educational attainment among school-age children, our results are informative about how health care affects

[1] There is a large literature that examines the effect of pre-natal health care and health outcomes on subsequent academic performance (i.e., the "fetal origins" hypothesis). See Almond and Currie (2011) for a review of this work. Typically, these analyses show that pre-natal health has large and long-lasting effects on a child's cognitive development and life outcomes. While the effects of pre-natal health and health care access have been studied extensively, the effect of providing health care to older children on their educational attainment has not been examined in previous work. This is the focus of our analysis.

teen childbearing. Although there is a large literature examining the effects of teen births on educational attainment and a much smaller literature that estimates the effect of family planning services on teen childbearing,[2] the identification concerns associated with all of these questions underscore the importance of generating more evidence based on plausibly exogenous variation in health care and family planning services that can influence teen fertility decisions. We argue school-based health centers provide such a source of variation. Furthermore, given the prevalence of SBHCs in the US and the large rise in their use over the past several decades (see Figure 1), understanding how these centers affect student health and education is an important policy question in its own right.

In order to identify the effect of SBHCs on educational attainment and teen birth rates, we combine the NASBHC survey data with county-level information on births as well as district-level information on high school dropout rates. Our identification strategy uses the changes over time in the service levels these centers provide that is driven by their opening and closing as well as by within-center variation in service levels. We use four measures of SBHC services: days open per week, hours open per week, primary care physician hours per week, and total medical staff hours per week. These measures provide a more accurate depiction of the medical services offered per student, and they also increase our statistical power relative to simply using the number or existence of centers as our treatment measure. Thus, our empirical approach is essentially a difference-in-difference strategy, with the treatment intensity scaled by the amount of services provided by the centers in each area relative to the student population. The main identification concern with our approach is that centers locate based on fixed trends in birth rates or educational outcomes. This issue is compounded by the fact that we cannot fully explain why centers locate in a given area in a given year (or why they close). However, using the panel structure of our data, we see no evidence of selection on pre-treatment trends. The timing of center entry, exit and service changes also varies significantly across school districts, which allows us to include state-by-year fixed effects that give further confidence in the validity of our approach.

Our analysis begins with an examination of the effect of school-based health centers on teen

[2] The only prior study of which we are aware on this topic is Kearney and Levine (2009). They show that state expansion of Medicaid family planning waivers reduced teen birth rates by 4-5%, with the largest impact on women age 18-19.

births. We use US vital statistics data for which the smallest level of geographic identification is the county. Our difference-in-difference estimate therefore is identified off of county-level changes in birth rates of teens that are related to the timing of SBHC openings/closings and service level changes. In our preferred estimates that use physician hours as treatment measures, we find that service changes equivalent to opening one more center lead to reductions in the birth rate per 1000 girls 15 and under of about 0.13, which is about a 23% reduction relative to the baseline birth rate. For 16-19 year olds, the birth rate declines by 3.8 per thousand women, or 8%. However, particularly for 16-19 year olds, there is a large longer-run effect of SBHC services on the order of a 15 percent decline in the birth rate.

Health centers differ significantly in the types of services they provide. One of the most influential services they can provide for teens is contraception. For example, in our data 35.7% of health centers can prescribe or dispense birth control pills on-site, while 35.8% are forbidden from providing this contraceptive service (the remainder can make referrals only). We thus examine SBHC effects separately by whether the center provides any birth control services, whether the center can dispense or prescribe birth control on-site, and whether it cannot provide birth control services. Our estimates support the conclusion that the entire teen birth effect is occurring from centers that have some birth control services, although it does not appear necessary for the center to actually dispense the contraceptives directly. These results suggest that school-based health clinics have sizable negative impacts on teen birth rates when they provide contraceptive services to teens. The birth impacts we find also indicate that SBHCs are increasing teens' access to health services rather than just shifting the provider of those services.

Despite the effectiveness of SBHCs in reducing teen pregnancies, they have at most a small negative effect on high school dropout rates. We measure dropout rates using reported high school diplomas awarded at the district level and US Census and American Community Survey (ACS) data. We find no effect of SBHC services on 10^{th} and 12^{th} grade dropout rates, but our results point to a small reduction in the high school dropout rate among 11^{th} grade students of -0.19% to -0.28% from the opening of an average-sized health center. Estimates using US Census and ACS data are similar, and these results suggest that any effect of SBHCs on high school completion is occurring for females.

The findings of this analysis show that school-based health centers, especially those that offer birth control services, produce large declines in teen childbearing. At least for this health outcome, these centers are quite effective at altering teen health. However, the services provided by these centers have at best a small negative effect on high school dropout rates. Our interpretation of the data is that expanding health care services to the low-income populations targeted by SBHCs does have positive health benefits, which is important in its own right. This is particularly true for teen fertility, where there is an independent policy interest in reducing teen birth rates in the US due to their high levels (Kearney and Levine, 2012). But, the increased access to health care these centers provide does not have much of an effect on high school completion. To our knowledge, this is the first analysis in the literature to estimate the causal relationship between primary health care access among teens and educational attainment. Although health care likely is of high importance for many aspects of students' lives, our results indicate that high school completion is not one of them.

2 School-based Health Centers

School-based health centers (SBHCs) are health clinics that are attached to a specific school.[3] They are funded by some combination of state and federal governments, local school district funds, and private foundations. While they have been in existence since the 1930s, there has been a large increase in their prevalence since the 1990s. Figure 1 shows the distribution of opening years for SBHCs in our data (see Section 3 for a description of these data). Over 85% of these clinics opened after 1989, with over 41% opening after 1997. This expansion has occurred unevenly across states: Figure 2 shows the number of SBHCs in our data in each state. They are located in all but five small states, and the largest concentrations are in the Northeast, Midwest, Southwest and West. However, there also is a large number of centers in Louisiana, Texas and Florida, which highlights the large geographic coverage of school-based health care in

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

the US. Together, Figures 1 and 2 show that in the past two decades, an increasing proportion of low-income students across the United States have been exposed to a health center that is attached to their school.

SBHCs provide services for two main types of students: urban students in school districts serving low-income populations and rural students. As of school year 2010-2011, 54% of the centers were located in urban schools, with 28% located in rural schools and 18% in more suburban areas. Sixty-three percent of the students exposed to a school-based health center are of either African American or Hispanic descent. The focus of the SBHCs is on providing primary care services for the student populations. The majority of centers are attached to high schools, but many centers also provide services for students outside of the school to which they are attached: only 38% of centers report that use is restricted to students in the school. About a quarter of the SBHCs allow for families of the student to use the services, and 25% also allow use by school personnel. Almost 35% of the centers also report that they serve students from other schools. In some cases, the services provided are free to students. However, most centers operate more like traditional clinics and charge patients for services rendered. Due to the location of SBHCs, most students exposed by these centers are Medicaid-eligible, though, so these fees are unlikely to pose a large constraint to access. This feature of SBHCs highlights the fact that the treatment we examine is mostly due to health care *provision*, not due to health insurance access *per se*.

The exact services provided by SBHCs vary across centers. All centers provide primary care services. The specific primary care services do vary, though, and the distribution of primary care services is shown in Figure 3, Panel A. About 85% of centers provide some form of reproductive health service. Figure 3, Panel B, shows the distribution of reproductive health services other than contraception provided by SBHCs in 2007-2008. Mostly, these services include testing for sexually transmitted infections, preventive care such as gynecological exams, PAP tests and prenatal care, as well as both abstinence and birth control counseling. Almost 40% of centers also are allowed to dispense contraceptives of some form directly, but many of the remainder refer students to other providers for contraception. Referrals are likely to be a very important method through which female students can obtain birth control pill prescriptions. Table 1 shows detailed information about the types of contraceptive services SBHCs offer. Over 35% either can dispense or prescribe the birth control pill, and another 29% can refer patients to other doctors for a prescription. Condoms are dispensed at 30% of centers, and emergency contraception or plan B also are available either directly or through referral at the majority of SBHCs. Table 1 shows that a large proportion of SBHCs provide significant contraceptive services, especially for female students. Because of the location of these centers, female students do not need to be taken to them by parents or guardians, which might make these services particularly relevant for this population.

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 health outcomes (as measured by teen birth rates) and educational attainment (as measured by high school dropout rates). The main mechanisms through which these centers could impact student educational attainment are twofold. First, access to health care could lead directly to better student health outcomes. To the extent that health enters positively in the production function for educational achievement, these health increases could drive better educational outcomes. A potential concern with this mechanism is that teens may be quite healthy. If high school students do not require much access to health care, then SBHCs will have little impact on them, at least in the short-run.

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

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

Second, access to affordable primary health care can reduce the household's exposure to financial risk from an adverse health event (Gross and Notowidigdo, 2011; Leininger, Levy and Schanzenbach, 2009; Finkelstein et al. 2012). Receipt of primary care services may make students healthier and allow them to address health problems before they worsen and cost more to address. This effect of primary care service provision thus could better the financial position of households, which can lead to higher student academic attainment.[4]

[4]See Michelmore (2013), Dahl and Lochner (2012) and Carneiro and Heckman (2002) for evidence on the positive effect of family

Despite the rise in SBHC prevalence in the US over the past several decades, no nationally-representative study of these centers using methods that can plausibly identify their causal effects on health and education exists. Several prior analyses have examined the relationship between SBHCs and student health and educational achievement, and they typically show a positive relationship between SBHCs and these outcomes (Kerns et al. 2011; Walker et al., 2010; Geierstanger et al., 2004; Kisker and Brown, 1996). However, these studies have several serious shortcomings that we seek to address in this paper. First, all previous analyses have focused on identifying the effect of one SBHC or of several in a particular city or school district. No study of which we are aware has estimated SBHC impacts on health and academic outcomes for the entire United States. Results from the current literature thus are hard to generalize to larger state or national populations. Second, the previous work in this area largely has been cross-sectional in nature, either comparing outcomes across students who do and do not use the SBHC within a school or comparing student outcomes across schools with and without a health center. Although these studies all attempt to control for differences across students and schools that are related to health center access and use as well as to educational outcomes, it is unlikely the set of control variables in the data sets used are sufficient for this purpose. Thus, using cross-sectional methods in this context makes it very difficult to identify the causal effect of SBHCs on student educational attainment. Using a national sample of SBHCs combined with information about the timing of openings and closings of centers and changes in service levels, we provide the first nationally-based analysis of these centers on health and education that also more plausibly handles the selection problems that both the location of SBHCs and their use by particular students in a school are endogenously related to the outcome variables of interest. One recent study by Cox and Reback (2013) in the New York City public schools uses a similar methodology to ours and finds evidence that SBHCs lead to higher student attendance rates. This is direct evidence that the health benefits from SBHCs could increase educational attainment. Our work complements this analysis by examining health outcomes, by directly estimating effects on educational attainment, and by providing estimates for the entire US.

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income on student academic attainment.

3 Data

The data for this analysis come from four sources: 1) National Assembly on School-based Health Care National Census of School-based Health Centers, 2) Live birth data from the US 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) US Census and American Community Survey data on school district dropout rates. Below, we discuss each of these data sources in turn.

3.1 NASBHC Census of School-based Health Centers

Beginning in 1998, the National Assembly on School-based Health Care began surveying school-based health centers about their locations, staffing levels, services provided, usage and the timing of when they first opened. They repeated their survey in 2001, 2004, 2007 and 2011. The survey is designed to be a census in the sense that all centers known to NASBHC are contacted, but there is considerable non-response. In the 1998 survey, 70% of centers contacted responded, and the response rates were 85%, 78%, 64% and 77% in 2001, 2004, 2007 and 2011 surveys, respectively.[5] Across all surveys, we observe 2,633 centers that are attached to 930 school districts throughout the United States. This number of centers is larger than the total number of centers that exists in any one year, which is due to center closures over time.

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

In order to obtain a panel of SBHCs, we link centers over time across the different surveys. The center identification codes NASBHC uses changed over time, so that a unique id does not exist for each center. Instead, we match centers over time by linking them to the school

[5] 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.

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 location school name and state were the same. Due to changes in reported names or school location, many centers had to be hand-matched across waves. All matches were visually inspected to make sure that they were correct based on available information. It is important to highlight that the aggregation to the school district level means that errors made in matching specific centers to each other over time will not affect our results as long as we correctly link centers to school districts. Given the data limitations in the NASBHC data, using school-district level aggregations likely leads to less measurement error than if we had attempted to match each center to a specific school or set of schools.

One of the drawbacks of our data is that we observe service and staffing levels only for the years in which the surveys were completed. However, for all but 51 centers (or 1.9% of the total centers observed), the opening date is contained in the survey.[6] These center opening dates allow us to use outcome data from before 1998. As Figure 1 demonstrates, 58% of the centers in our data were opened prior to 1998, so the use of these earlier data increases the amount of treatment variation considerably. For observations prior to 1998, we assume each SBHC has the same 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

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

center closed when we no longer observe it in our data.[7]

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.[8] 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 are only available for large counties means that our birth analysis is most relevant for the urban school-based health centers.

The vital statistics data give us information on all live births in 793 counties in the US from 1990 through 2011. We end our analysis in 2011 because that is the last year of SBHC survey data to which we have access. Beginning the analysis in 1990 captures 86% of the SBHC opening variation in our data; we are loathe to extend the analysis sample back farther given that the first year we observe SBHC characteristics is in 1998. We construct birth rates per 1000 women in each county for four age groups: $\leq$15 and 16-19. Mean birth rates by age group are shown in Table 2.

The birth data and SBHC data are merged based on the county of the SBHC. The SBHC survey data contain information on which county the center is in, and we base our calculations of SBHC service levels on this variable. To the extent that school districts split county lines, this method will assign each center to the county in which it is located.

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).[9] We use these reports, combined with grade-specific enrollments, to construct a measure of high school dropout rates. Specifically, we estimate the dropout rate

[7]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.

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

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

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

Heckman and LaFontaine (2010) and Mishel and Roy (2006) provide detailed discussions on the problems arising from using the CCD diploma data to calculate graduation rates.[10] The biggest problem surrounding use of these data is associated with the use of 9^{th} grade enrollments, as there is a substantial amount of grade retention in 9^{th} grade. This grade retention is more prevalent for low-SES students as well, and it leads one to understate graduation rates, especially for minority students. Heckman and LaFontaine (2010) show that when one uses 8^{th} grade enrollments instead, this bias is reduced considerably. We instead ignore 9^{th} grade enrollment and focus on enrollment in higher grades that are less problematic. To the extent that SBHCs affect the likelihood of being held back in 9^{th} grade, we thus will miss some of the ways in which these centers influence students paths through high school. However, our estimate should not be seriously affected by the retention rate problems that come with using 9^{th} grade enrollment data.

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

[10]See also the comprehensive review of US high school graduation rates in Murnane (2013).

3.4 US Census and ACS Data

Due to some of the potential problems with the CCD diploma data, we supplement our graduation analysis with 1990 and 2000 Census data as well as the 2005-2011 American Community Survey. Using these data, we calculate for each school district the proportion of 14-17 year olds living in the school district who are not enrolled in school and who do not have a high school degree. This is the 14-17 year old dropout rate. The 18-19 dropout rate is calculated similarly using those age 18-19. It is important to highlight that high school degrees in the Census/ACS include GEDs. Thus, we are unable to determine in our data whether SBHCs are shifting students from a GED to a traditional high school diploma. The evidence on the relatively lower returns to a GED than a high school diploma suggest such a change would be of value (e.g., Heckman and LaFontaine 2006), but our data do not allow us to measure these outcomes separately. However, to the extent that the Census/ACS and CCD graduation rate estimates yield similar results, it suggests that our inability to separate GED and traditional high school diplomas is not a driver of our estimates. Descriptive statistics of the dropout rates in the Census and ACS are shown in Table 2. Because the ACS data are for a period of 3 years, we use the average SBHC service level over those 3 years for each school district.

In addition to providing a check on the NCES-based dropout rates, the Census/ACS data allow us to calculate dropout rates separately by gender. As teen fertility is a central focus of our study, examining dropout effects for males and females separately is important. The Census/ACS data also permit us to control for observable characteristics of respondents, such as race, free or reduced price lunch status, family income and parental education.

4 Empirical Methodology

Our methodological approach to overcoming the inherent endogeneity between health care access, health and educational attainment is to use the variation in student exposure to health care services that is driven by school-based health center openings, closings, and the scope of the services provided. This is essentially a difference-in-difference method, but the treatment is allowed to vary in intensity by the amount of services provided by each center relative to the underlying size of the student population. Due to data limitations, our birth rate analysis and completion rate analysis occur at different levels of aggregation. In the birth data, the county is the most disaggregated level of geography available, so this part of the analysis is done at the county level. In particular, we estimate models of the following form:

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

where Y_{cst} is the birth rate per thousand women in county c in year t, γ is a set of county fixed effects, and δ is a set of state-by-year fixed effects that control for any state-level unobserved shocks in each year. The variable of interest in equation (1) is β_1, which shows the effect on the birth rate of an increase in SBHC services. The specific interpretation of β_1 depends on the manner in which the SBHC services are measured. Throughout, we use four different types of service measures: Days per Week, Hours per Week, Primary Care Physician Hours per week, and Total Medical Staff Hours per week. The Total Medical Staff Hours differ from Primary Care Hours due to hours from mental health staff, dental staff, and physician's assistants. We show estimates using each of these four measures because it is unclear *ex ante* what the correct measure of SBHC size is. As Primary Care Physician and Total Medical Staff Hours are the most comprehensive measures of the medical services provided by school-based health centers, they are our preferred treatment variables.

We estimate regressions at the county-year and school district-year levels. Throughout the analysis, the SBHC service variables are constructed by first summing the total amount of each service measure for each county or school district and year. For example, we calculate the total number of medical staff service hours in the county and year across all centers in the county. We then divide by the total high school aged population aged 14-19 in the county.[11] This provides a measure of the hours of SBHC medical services per high-school-aged student in the county. Finally, we re-scale the measure to be representative of a typical center by multiplying by 1000, which is the approximate average size of a high school in our sample. The method is identical for our school district level regressions, where we sum over districts rather than counties. The interpretation of β_1 is the effect of an SBHC increasing its service level by an additional hour (or day) on the birth rate. When multiplied by the average service level at an

[11] We exclude from our population counts individuals who are 18 or over and have a high school diploma.

SBHC, 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.

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

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

In equation (2), $I(t - t_0 = \tau)$ is an indicator variable equal to 1 if the observation is τ years away from the first SBHC opening in the county and equal to zero otherwise. Thus, these variables are zero for counties that have no health centers. We multiply these event time indicators by relative service levels to make them comparable to the specification in equation (1). In the pre-period, the $SBHC$ variable is set to the first observed service level for each of the four measures in that county. That is, we set it equal to the service level observed when τ=0, denoted t_0. In the post-period, the $SBHC$ variable is allowed to vary over time, similar to how it is specified in equation (1).

This event study framework allows us to both test for pre-treatment trends as a function of future SBHC service levels by examining $\alpha_{-5} - \alpha_{-1}$ and to test for time-varying treatment effects (given by $\alpha_0 - \alpha_{10}$) that might be missed in equation (1). We examine an event window from relative year -5 to 10 as outside that window we have fewer observations with which to identify each relative time parameter. All observations with relative times to treatment outside this window are dropped from this part of the analysis. However, we include all "never-treated" counties, which constitute the implicit control group in this model.

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

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

$$Y_{dst} = \beta_0 + \beta_1 SBHC_{dt} * Post_t + \tau X_{dt} + \gamma_d + \delta_{st} + \epsilon_{dst} \quad (3)$$

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

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

A final potential methodological issue is the presence of measurement error in our treatment measures. The measurement error in the $SBHC$ variables comes from several sources. One source of measurement error is the fact that, while the NASBHC National Census is designed to cover all health centers, there is not complete coverage in every year. The use of multiple years of data combined with information on the date of opening of the centers should mitigate this problem. But, it is possible there are health centers we do not observe in our data and some we code as closing when they still exist. To the extent that some districts and counties are more heavily treated than our data shows, this should attenuate our estimates. A second source of measurement error is that prior to 1998, the first year of NASBHC data, we cannot observe changes in the level of services provided. For all centers opened before 1998, we use the first observed service levels (typically from the 1998 survey). This could produce further measurement error in the $SBHC$ variables. Finally, aggregation to the county and school district levels could produce measurement error from the fact that many students in each county and district are ostensibly untreated. The fact that 35% of centers are open to students in other schools and that 14% are open to the broader community suggests that some aggregation would be appropriate even if it were not necessitated by the data. Furthermore, SBHCs are concentrated amongst the lowest-SES schools in counties and districts, which also are schools in which teen pregnancy and dropout rates are most prevalent.[12] This argument supports our contention that the aggregated data can provide informative estimates of the relationship between school-based health centers, teen childbearing, and educational attainment.

5 Results

5.1 Birth Results

Table 3 presents the baseline estimates of the effect of school-based health centers on teen birth rates. In column (i), we show estimates for the birth rate among girls 15 and under and in

[12] 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.

column (ii) we show estimates for the 16-19 year old birth rate. Each cell in the table comes from a separate regression, with the treatment intensity measure varying across rows. Because birth rates are likely to be serially correlated within county over time, all standard errors are clustered at the county level.

The rows of Table 3 show estimates of β_1 from equation (1) using different treatment intensity measures. Across treatment variables, the table shows a consistent negative relationship between SBHC service levels and teen birth rates. The interpretation of these coefficients is the effect on the birth rate if the center increases service by one day or hour in a high school. Thus, increasing services by one day decreases the birth rate among girls under 16 by 0.058, increasing center hours by 1 hour leads to a 0.009 decline in the birth rate, and increasing primary care or total physician hours decreases the birth rate by -0.024 and -0.005, respectively. These estimates all are negative and sizable in magnitude, although none of them is statistically significantly different from zero at even the 10% level. A useful way to interpret these estimates is to calculate their implications for the effect of opening an average-sized center. To calculate such an effect, one must multiply the estimates by the average amount of services each center supplies. These means are shown in the first column of Table 2. The Days Open estimates are the largest, and they indicate that opening an average-sized center would reduce the under-16 teen birth rate by -0.20. This is a 35 percent decline relative to the mean birthrate amongst this population of 0.558. The Primary Care Staff Hours and Total Medical Staff Hours estimates are somewhat smaller, although still large, at 18% and 23% relative to the mean, respectively. The results using the Hours Open measure is the smallest, at 10% relative to the mean for an average-sized center. All of these point estimates suggest a large decline in births among young teens due to a school-based health center opening. However, since births by young teens is a rare event, our estimates are imprecise.

Though the estimates across rows in column (i) of Table 3 are consistent in sign, they differ somewhat in magnitude. Our preferred measure among these four is Total Medical Staff Hours, followed closely by Total Primary Care Staff Hours. Though total center hours and days open are informative measures of service provision, the number of hours medical staff are available for patients is likely to capture most closely the level of service provision for each center. We thus favor these treatment measures going forward, although we continue to show all four for completeness and robustness.

The estimates of the effect of SBHCs on births among 16-19 year olds is consistently negative, large in magnitude, and statistically different from zero across service measures, as shown in column (ii). These estimates also exhibit some variability in magnitude across service measures: they suggest opening a center with the average level of service provision would decrease the birth rate by between 2.8 and 8.3. These represent declines of between 6.2% and 18.2% relative to the baseline fertility rate of 45.65. Our preferred treatment measures indicate that the average health center decreases the birth rate by 3.1 to 3.8, or by 7%-8%.[13] While relatively smaller than the estimates for those 15 and under, they still represent sizable declines in the teen birth rate.

As discussed above, a central concern with the type of difference-in-difference analysis we employ is that centers may be targeted at areas based on fixed relative trends. Furthermore, there may be time-varying treatment effects that provide a more detailed picture of how SBHCs influence teen births than allowed by equation (1). Figure 5 shows the estimates of α from equation (2): we have excluded relative year -1 such that all estimates are relative to this year. The dashed lines show bounds of the 95% confidence intervals that we calculated using standard errors that are clustered at the county level. Two patterns emerge from Figure 5. First, across all panels, there is no evidence of pre-treatment trends in birth rates as a function of future SBHC service levels. This provides some confidence in our central identification assumption. Second, there is a sharp and statistically significant decline in births about 5 years after the center opens, which then gradually gets closer to zero over the remaining five years of the event window. To put the size of these estimates in perspective, our preferred service measures suggest that adding an average-sized center would reduce birth rates of under-16 year olds by between 54 and 71 percent relative to the mean after five years. Thus, the declines shown in Figure 5 are quite large and are consistent with school-based health centers reducing young teen births.

Figure 6 presents similar estimates for 16-19 year olds. As in Figure 5, we again see no

[13] The magnitude of these estimates is similar to the 6.8% decline in birth rates among 18-19 year olds following Medicaid family planning waiver expansions reported in Kearney and Levine (2009).

evidence of pre-treatment trends that could bias our estimates. The delayed nature of the treatment effect also is evident for this age group. The birth rate effects get larger in absolute value until year 5, at which time they stabilize. This pattern suggests that the longer-run effects of SBHCs on teen birth is larger than is suggested by the results in Table 3. Taking the average across coefficients for relative years 5-10 suggests adding a center with average service levels would decrease 16-19 year old birth rates by between 12 to 15 percent using the Hours Open, Primary Care Hours and Medical Staff Hours Measures. The Days Open estimate shows a much larger effect of -43%. Together, the results in Figures 5 and 6 demonstrate that there is a delayed effect of SBHCs on births of about 5 years. A likely explanation for this delay is that these centers take several years to successfully reach out to students and to learn how to provide services effectively.

As discussed in Section 2, SBHCs differ in the types of services they offer. In particular, only some centers offer contraceptive services. Table 1 shows the proportion of centers that offer different types of contraception. Overall, about 85% of centers offer some type of birth control, either directly or through referral. In Table 4, we examine the effect of SBHCs on birth rates separately by the birth control services offered by the center. In columns (i) and (iv), we use all centers that offer some type of contraceptive service, including referral. In columns (ii) and (v), we only examine the SBHCs that dispense or prescribe birth control on-site (about 40% of centers). And, in columns (iii) and (vi), we analyze the effect of SBHCs that provide no contraceptive services on teen birth rates.[14]

Despite the somewhat imprecise estimates for the No Birth Control sample, Table 4 clearly demonstrates that the reduction in teen birth rates due to SBHC services is driven by centers that offer some type of birth control. The similarity between the estimates using centers that provide services on-site relative to those that include referrals only suggests it is not necessary to offer these services directly. These estimates are similar to each other and to the average effects shown in Table 3, which perhaps is not surprising given the large number of centers that offer contraceptive services. But, there is much less evidence of an impact of SBHCs on birth rates when a center offers no birth control services, which increases our confidence that

[14] As shown in Figure 3, many of the centers that do not offer contraception do offer other family planning services, such as pregnancy tests, tests for sexually transmitted infections, and abstinence counseling.

the effects we estimate are indeed driven by changes in SBHC service levels. Figures 7-10 show event study estimates for centers that offer any birth control services and for the centers that offer contraceptive services on-site.[15] These estimates are very similar to those shown in Figures 5 and 6 and indicate a large reduction in births post-treatment that peaks five years after centers open. In addition, there is no evidence of pre-treatment trends in any of these figures, which supports the validity of our identification strategy.

Table 5 shows birth rate estimates by race and ethnicity. We estimate equation (1) separately for white, black and Hispanic births. For brevity, we do not show equation (2) results, but similar to the estimates reported above we find no evidence of negative pre-treatment trends. Focusing on the Primary Care and Total Medical Staff Hours estimates among centers that offer any birth control services, the marginal effects of a 1 hour change in service on the under 16 birth rate are largest for Hispanics and are of similar magnitude for blacks and whites. However, the baseline birth rates vary significantly across groups, at 0.24 for whites, 1.10 for blacks and 0.60 for Hispanics. The implied effect of increasing SBHC services to the level of the average SBHC is a decrease in the under 16 birth rate of between 50%-59% relative to baseline for whites and Hispanics, and the effect among African Americans is an 11%-13% reduction relative to baseline. The 16-19 year old birth rate results follow a similar pattern. Mean birth rates for this age group are 40.64, 65.12, and 66.54 for whites, African Americans and Hispanics, respectively. The estimates in Table 5 for the birth control sample imply that the average SBHC with contraceptive services reduces the 16-19 birthrate among whites by between 8%-11%, among blacks by between 5%-6% and among Hispanics by between 6% and 8%. Thus, while SBHCs that provide contraceptive services have the largest proportional impact on white teen birth rates, they reduce teen births of all groups significantly.

Table 5 also contains birth rate estimates for centers that provide no contraceptive services. As in Table 4, the estimates are noisy but are inconsistent with these centers reducing teen childbearing. The one exception is the white 16-19 year old birth rate. The estimates are negative, but except for Days Open are much smaller in absolute value than the estimates for the birth control sample. These results reinforce the findings from Table 4 that the teen pregnancy reductions from SBHCs are driven by the centers that offer contraceptive services.

[15] There are too few centers that do not offer birth control services to estimate equation (2) just using these centers.

5.2 High School Dropout Results

Thus far, we have shown evidence that school-based health centers reduce teen birth rates. These findings suggest that school-based clinics promote better health outcomes among the teens exposed to them, at least in terms of this observable and important outcome. A question of high importance that has received little attention in the literature 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. In Table 6, we present the first evidence in the literature of the effect of providing primary care services to low-income school-age children on high school dropout rates. Due to serial correlation of errors within districts over time, all estimates are accompanied by standard errors that are clustered at the school district level throughout the dropout rate analysis.

As discussed in Section 3, these dropout rates are essentially one minus the ratio of diplomas issued in a given year divided by the enrolled population two years ago (for 10^{th} grade), one year ago (for 11^{th} grade) or in the current year (for 12^{th} grade). Thus, this dropout rate will measure "on time" high school graduation for those in each grade cohort. The estimates in Table 6 are in percent terms, such that a coefficient of 1 would mean that a 1 unit increase in SBHC services would increase dropout rates by 1 percent (rather than by 100% if the dependent variable were in percentage terms). Using the 10^{th} and 12^{th} grade denominators, there is no evidence of an effect of SBHCs on dropout rates. None of the estimates is statistically significantly different from zero at conventional levels, and the point estimates using our preferred service level measures suggest a very minor negative effect of at most 0.04% due to an average-sized center. The 11^{th} grade estimates, however, are universally negative and statistically significantly different from zero at the 5% level. Nonetheless, they are quite small: adding service levels equal to an average center would decrease the 11^{th} grade dropout rate by between 0.19 and 0.86 percent across specifications. Our preferred service measures suggest an effect of between 0.19 and 0.28 percent, which is between 1.2 and 1.8 percent of the baseline dropout rate shown in Table 2. In a high school class of 250, these numbers would mean an extra 0.4 to 0.7 students would graduate due to an average-sized SBHC. Thus, Table 6 shows that SBHCs are associated with at most a modest decline in the high school dropout rate.

Figures 11, 12 and 13 shows the event study estimates from equation (2) for the 10^{th}, 11^{th} and 12^{th} grade dropout rates, respectively. For the 10^{th} and 12^{th} grade dropout rates, the estimates show no relationship between SBHC services in the short or longer-run and dropout rates. However, for the 11^{th} grade dropout rate, Figure 12 shows a significant decline due to SBHC services, but only in relative years 7-10. While these match up relatively well with the timing of the birth declines, they suggest any dropout rate declines from SBHCs come with considerable lags after centers open. The magnitude of these declines still are modest: our preferred service measure estimates suggest adding an average-sized center would reduce the dropout rate after 7 years by 0.28 to 0.42 percent. This would translate into between 0.7 and 1.1 extra person graduating in a class of 250 students. Critically, in each panel of Figures 11-13, there are no pre-treatment trends that suggest a bias in our estimates in either direction.

If the reduction in teen births from SBHCs are an important driver of any reductions in high school dropout rates, Table 6 might mask important heterogeneity by birth control services offered by clinics. In Table 7, we show results from estimation of equation (1) by the types of contraceptive services offered by SBHCs.[16] Similar to the results in Table 6, the estimates point to at most modest negative impacts of school health centers that tend to be somewhat larger in absolute value among the clinics that offer birth control services. As with the birth results, the estimates across centers that dispense birth control rather than just provide referrals is minimal,[17] with larger differences across centers that do and do not offer any contraceptive services. These results are consistent with the reductions in teen births being an important factor in reducing 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.

[16] We do not show equation (2) results by center birth control status in the interest of brevity. These estimates are very similar to those shown in Figures 11-13 and are available upon request from the authors.

[17] The exception to this generalization is for the 12^{th} grade dropout rate, where the effect is much more negative among the birth control dispensing centers than among all centers that offer birth control services.

Ribar (1994) uses age at menarche, OB-GYN availability and state abortion rates as instruments and finds no effect of teen childbearing on high school completion. Hotz, McElroy and Sanders (2005) use natural experiments driven by miscarriages to generate plausibly exogenous variation in teen births. They find a small negative effect of teen childbearing on high school completion. Fletcher and Wolfe (2009), however, argue that miscarriages are not exogenous events; they report adjusted teen birth effects on high school completion of -5 to -10 percent. More closely related to this study, Klepinger, Lundberg and Plotnick (1999) use state-level variation in family planning and abortion services/policies as instruments for teen childbearing. They report that a teen giving birth reduces her educational attainment by 2.5 years. Finally, there are several studies that use sibling fixed effects as well as matching estimators to identify the effect of teen childbearing. While the sibling fixed effects analyses come to very mixed conclusions (Ribar, 1999; Holmlund, 2005; Geronimus and Korenman, 1992), the results from the matching literature point more consistently to a negative effect of teen fertility on educational outcomes (Levine and Painter, 2003; Sanders, Smith and Zhang, 2008).

As discussed in Section 2, many different services offered by SBHCs can contribute to any dropout rate effects we find. However, it is informative to assess the proportion of the 11^{th} grade dropout rate estimate that could be due to reduced teen births. The Primary Care Hours Staff Hours estimate in column (ii) of Table 3 suggests adding an average-sized SBHC decreases the number of births by 3.8 per 1000 16-19 year olds. Since the average high school is about 1000 students, there are on average 250 students per grade. Thus, an average-sized SBHC would reduce the number of births in each grade by 0.95. If giving birth reduced the likelihood of obtaining a high school diploma by 20%, then an average-sized SBHC would decrease the number of graduates by 0.19 (=0.95*0.2). If SBHCs only affected birth rates, we thus should see a decline in the dropout rate of 0.08 (=(0.19/250)*100) percent.[18] The 11^{th} grade estimates are larger than this number, suggesting that other aspects of SBHCs likely contribute to the small declines in dropout rates we observe for this grade.

One possible criticism of the dropout rate results is that they are biased towards zero due to the measurement error discussed in Section 4. While measurement error could be attenuating

[18]Using the larger event study estimates approximately doubles the size of the birth effect, which would imply a decrease in the dropout rate of 0.16 percent. This still is smaller than the 11^{th} grade dropout estimates shown in Table 6.

our estimates, it is unlikely that the measurement error is more severe for the dropout rate analysis than it is for the birthrate analysis. Since the dropout rate analysis is at a lower level of aggregation – the school district rather than the county – we would expect there to be more measurement error embedded in the birth rate results. That the birth rate effects are negative and sizable but the dropout rate estimates are close to zero suggests that our finding of no effect of SBHCs on dropout rates is not being driven by measurement error.

A drawback of using the diploma data, especially if teen childbearing is a primary explanation for any dropout rate declines, is that they do not allow us to distinguish between males and females. It is likely female dropout rates are much more sensitive to births than are male dropout rates. We therefore turn to US Census and American Community Survey data that allow us to calculate age-specific dropout rates by gender. 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 will provide a more complete picture of the effect of SBHCs on high school completion.

Dropout rate estimates using Census/ACS data are shown in Table 8. We present estimate for both 14-17 year olds and 18-19 year olds. The estimates from equation (1) for the whole sample are broadly similar to those in Table 6, although they are somewhat smaller and less precise. The estimates for the 14-17 year old dropout rates indicate no effect of SBHCs. These estimates are universally positive and small, and their 95% confidence intervals rule out dropout rate effects from adding an average-sized center of more than -0.18% to -0.05%. These results are consistent with the lack of 10^{th} grade effects found using the diploma data. However, the estimates using 18-19 year olds are suggestive that SBHCs reduce dropout rates slightly. For the overall sample in column (iv), the results indicate that adding a primary care staff hour would decrease the dropout rate by -0.014% and a medical staff hour would lead to a decrease of -0.004%. When multiplied by the average SBHC service size, these effects translate into reductions of about -0.08 percent. These estimates are larger in absolute value than the 12^{th} grade results in Table 6 but smaller in absolute value than the 11^{th} grade ones. They thus are consistent with a modest 11^{th} grade effect and no 12^{th} grade effect.

Table 8 also presents Census/ACS estimates by gender. The results for females are universally larger in absolute value than those for males, which is consistent with some of the impacts we find being driven by fertility changes. Among 14-17 year olds (in column (ii)), adding a health center with the average service level would reduce the dropout rate by 0.02 and 0.04 percent for our preferred service measures. Among 18-19 year old females (in column (v)), an average-sized center would reduce dropout rates by 0.12-0.14 percent. However, only the Medical Staff Hours estimates are statistically different from zero at even the 10% level. In a class of 125 girls, these estimates imply an average-sized SBHC would lead to 0.15 to 0.18 additional graduates. The results among male students show no evidence of a decline in dropout rates due to school-based health center openings.

Finally, in Table 9, we estimate the effect of SBHCs on dropout rates for females using the centers that provide birth control services. The estimates are very similar to those in columns (ii) and (v) of Table 8. They provide evidence that school-based health centers have at most a small negative effect on high school dropout rates among the centers that provide teens with contraceptive services and have large negative impacts on birth rates.

6 Robustness Checks

The dropout estimates in Tables 6-9 include all school districts in the US, while the birth rate estimates include only large counties. In Table 10, we estimate dropout rate models using the Census/ACS data in which we use only those counties included in the birth rate analysis. These estimates are directly comparable to those in Tables 8 and 9. The results for 14-17 year old females are very similar to baseline, showing no effect of SBHCs on high school dropout rates. For 18-19 year olds, there is even stronger evidence of a small negative effect of SBHCs on female dropout rates. The estimates are larger in absolute value than for the whole sample and are significant at the 5 or 10 percent level in most cases. However, they continue to be small: our preferred service level measures suggest increases in SBHC service levels equal to an average center would reduce female dropout rates by between 0.25 and 0.40 percent. Effects are similar for centers offering birth control, at 0.38 percent.

Our main results exploit variation in school-based health center services driven by center entry and exit as well as by within-center changes in service levels over time. Results from estimation of equation (2) suggest that there is no selection on differential pre-SBHC trends as a function of eventual service levels, but it could be the case that within-center variation is endogenous with respect to unobserved demand variation in a school or county. Thus, in Table 11, we redo our birth analysis using only the initial service level observed for each health center. These estimates contain no within-center service level variation and thus cannot be biased by such variation. These results are extremely similar to, if somewhat less precise than, our baseline results and indicate that within-center service variation is not contributing much to identification.[19]

7 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. The 2010 Affordable Care Act is an example of such a policy, which is designed to provide health insurance (and this health care) for all Americans. Although the ACA will likely close much of the remaining socioeconomic gap in health insurance access, a question of much importance is how expanding access to quality primary health care among low-income children will affect their health and educational attainment.

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

We present two broad findings from our empirical analysis. First, we show the SBHCs have large, negative effects on birth rates among girls 15 and under and among teens 16-19. Adding

[19] In results available upon request, we also have conducted this robustness check with dropout rates as our dependent variable. The results are very similar to baseline.

a center with the average amount of SBHC services leads to a decrease in the under 16 year old birth rate of 23% relative to the baseline fertility rate. For 16-19 year olds, SBHCs reduce the birth rate by 8%. Furthermore, these effects are localized to the centers that offer some form of contraceptive service for students. Second, we find at most a small effect of SBHCs on high school dropout rates. Our largest estimates indicate increases in health care services equal to the average-sized center would only reduce dropout rates by about 0.28%, and only for students in 11^{th} grade. SBHC impacts on high school completion are localized to females, although our back-of-the-envelope calculations suggest that these centers are likely influencing aspects of health other than teen births to produce even the modest completion rate effects we find.

There are several implications of our results that are important for public policy. One central message of our findings is that SBHCs are a useful tool to reduce teen birth rates in the US, which are amongst the highest in the industrialized world (Kearney and Levine, 2012). However, for these centers to successfully reduce teen births, the provision of contraceptive services is needed. Another important implication of our results is that the provision of low-cost and convenient primary care services has at most a small effect on students' decisions to drop out of high school. This is not to suggest that providing such services does not improve these students' lives, but it does suggest that any positive health benefits of this care access does not translate to much more educational investment. Our work highlights the importance of further study of the linkages between health care access, health outcomes and educational investment decisions to determine whether there are aspects of health care provision that could support educational investment among low-income students.

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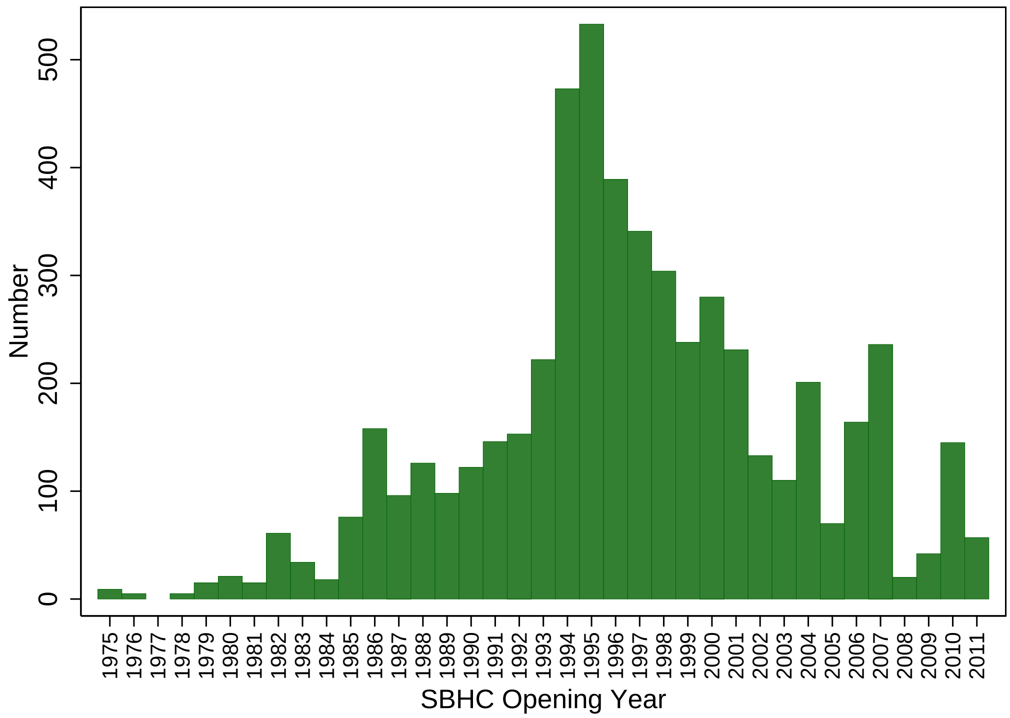
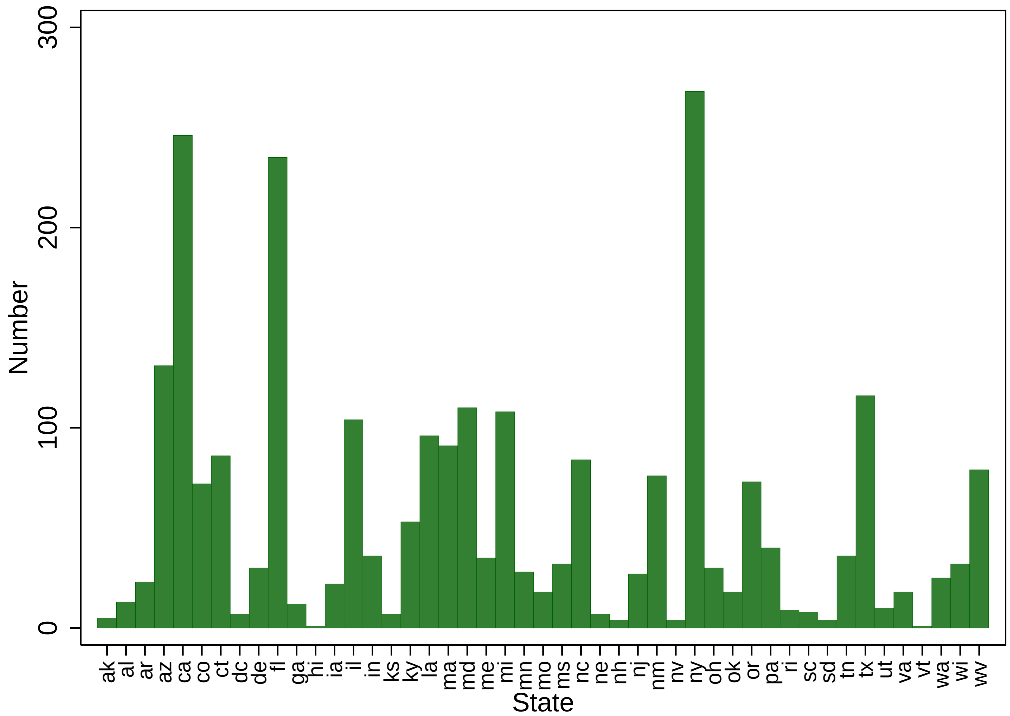
Figure 1: Distribution of SBHC Opening Years



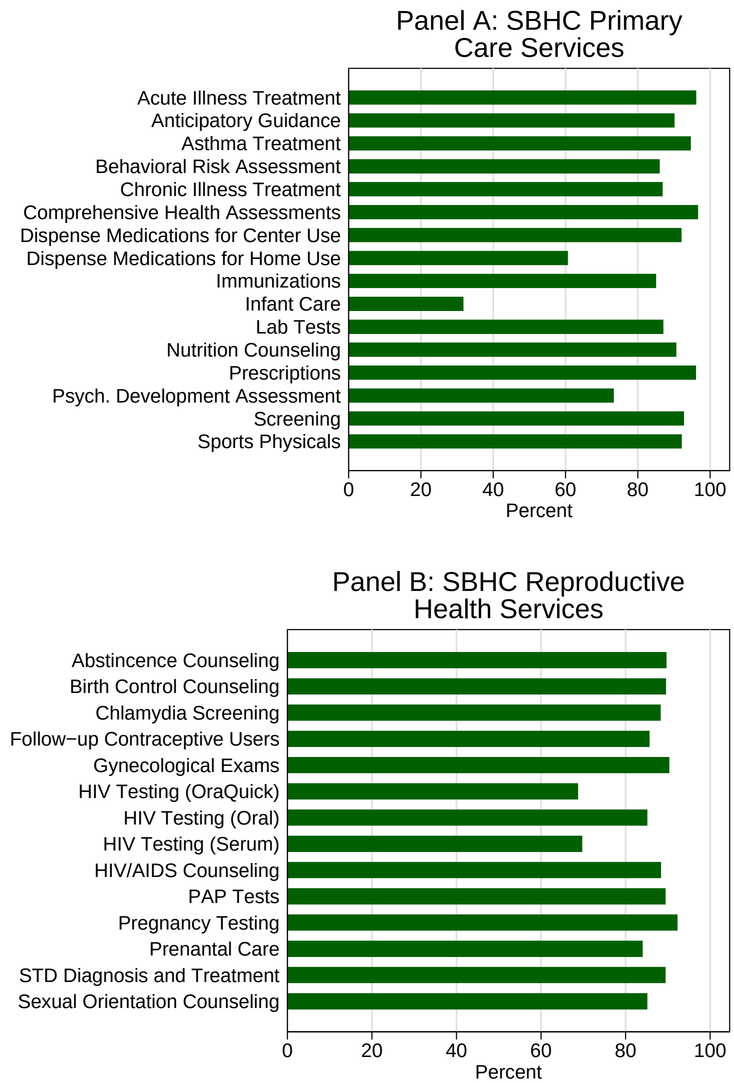
Source: NASBHC School-based Health Center Census, 1998-2011.

Figure 2: Distribution of SBHCs Across States



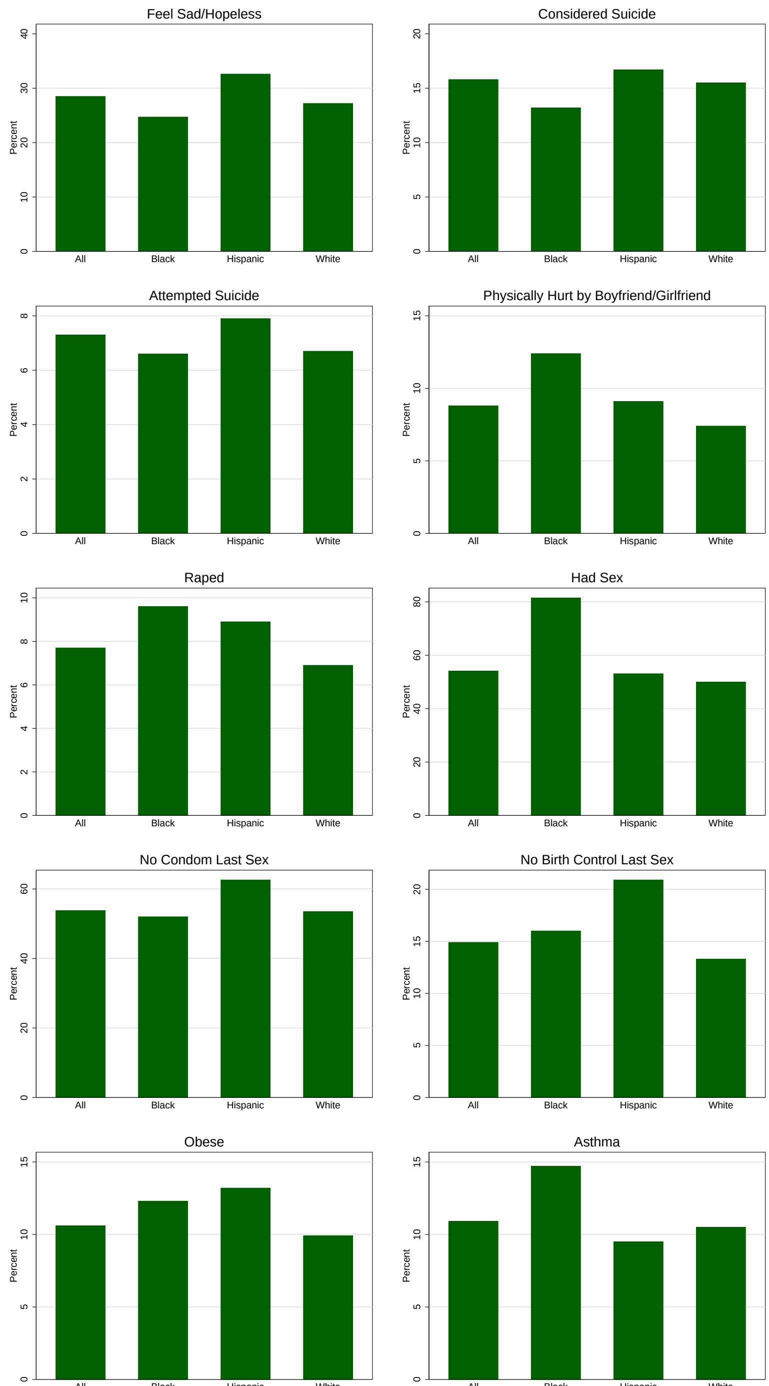
Source: NASBHC School-based Health Center Census, 1998-2011. The five states without SBHCs (ID, MT, ND, SD, WY) are omitted from the figure.

Figure 3: Primary Care and Reproductive Services Provided by SBHCs



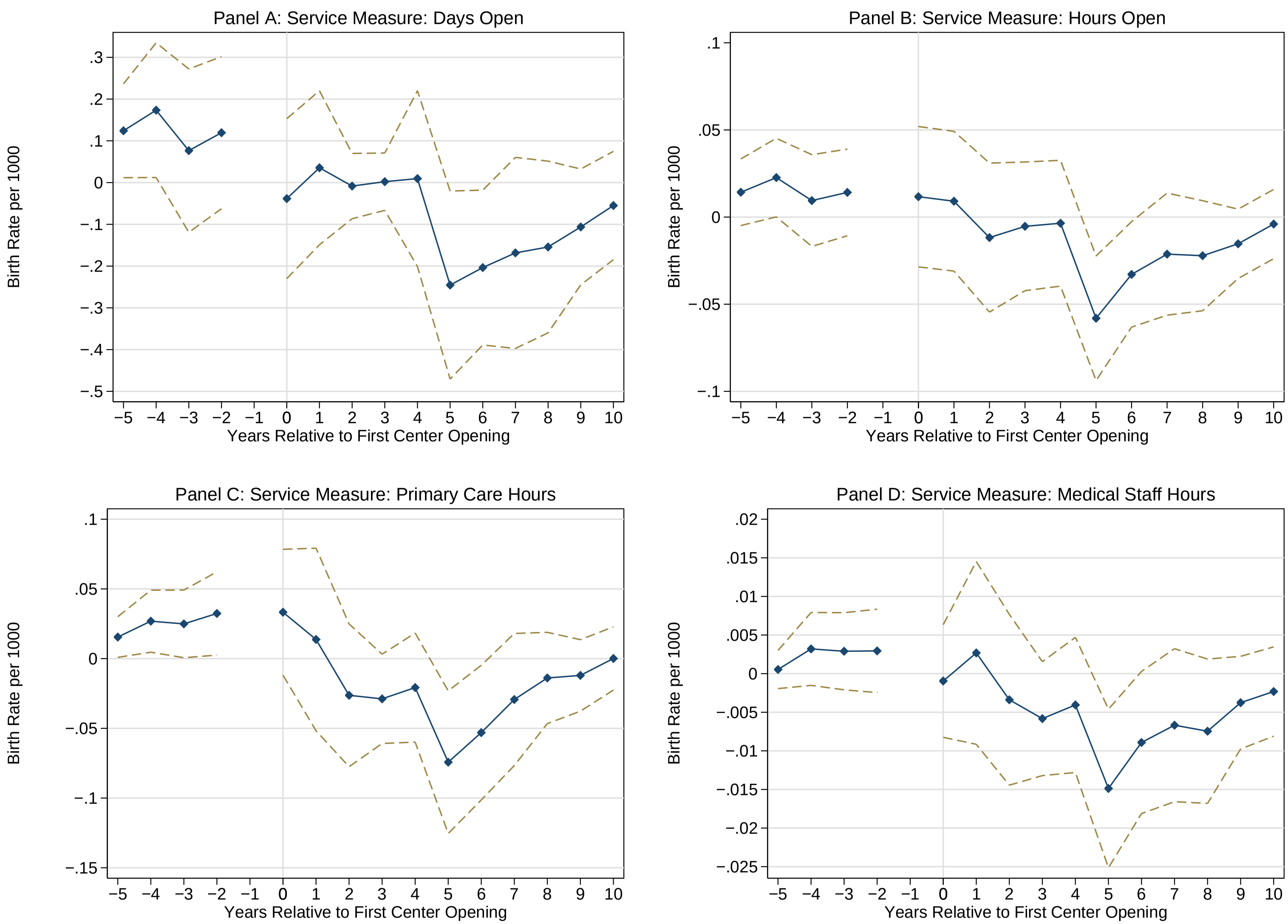
Source: These figures are reproduced from the 2007-2008 School-based Health Centers National Census annual report, available at http://www.sbh4all.org/atf/cf/%7Bcd9949f2-2761-42fb-bc7a-cee165c701d9%7D/NASBHC%202007-08%20CENSUS%20REPORT%20FINAL.PDF. The reproductive care service tabulations show the percent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

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



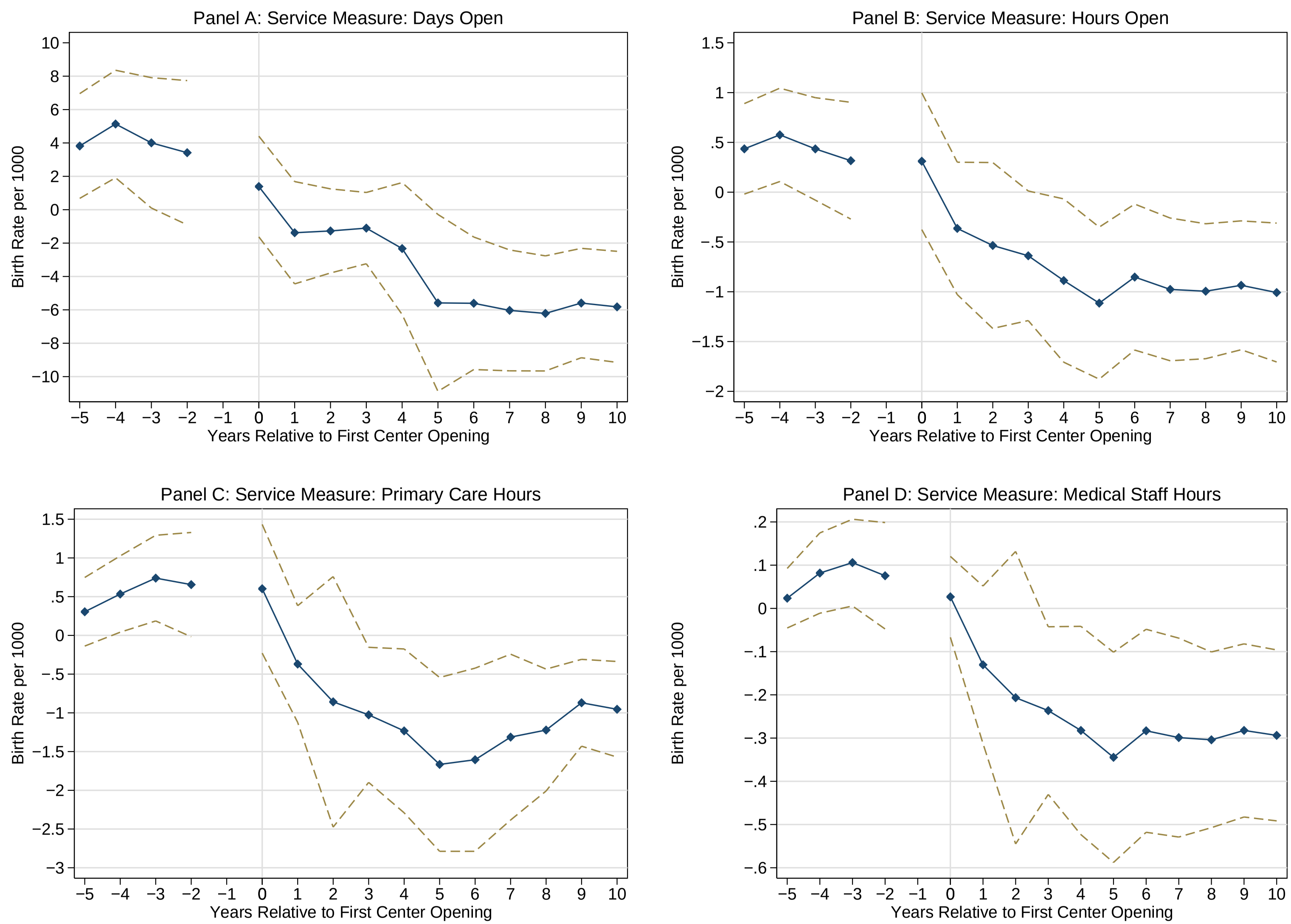
Source: 2011 Youth Risk Behavior Surveillance System (YRBSS).

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



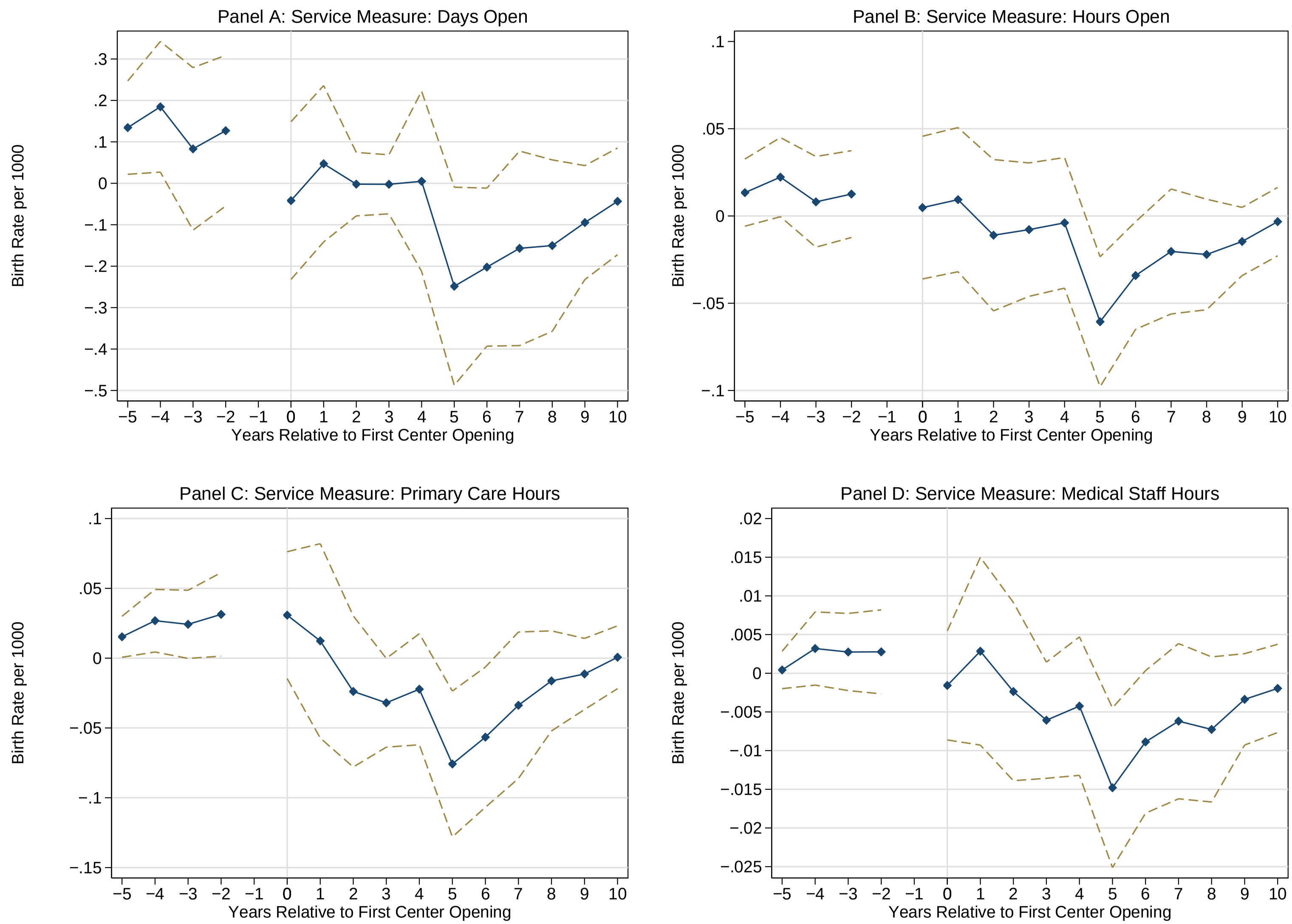
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

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



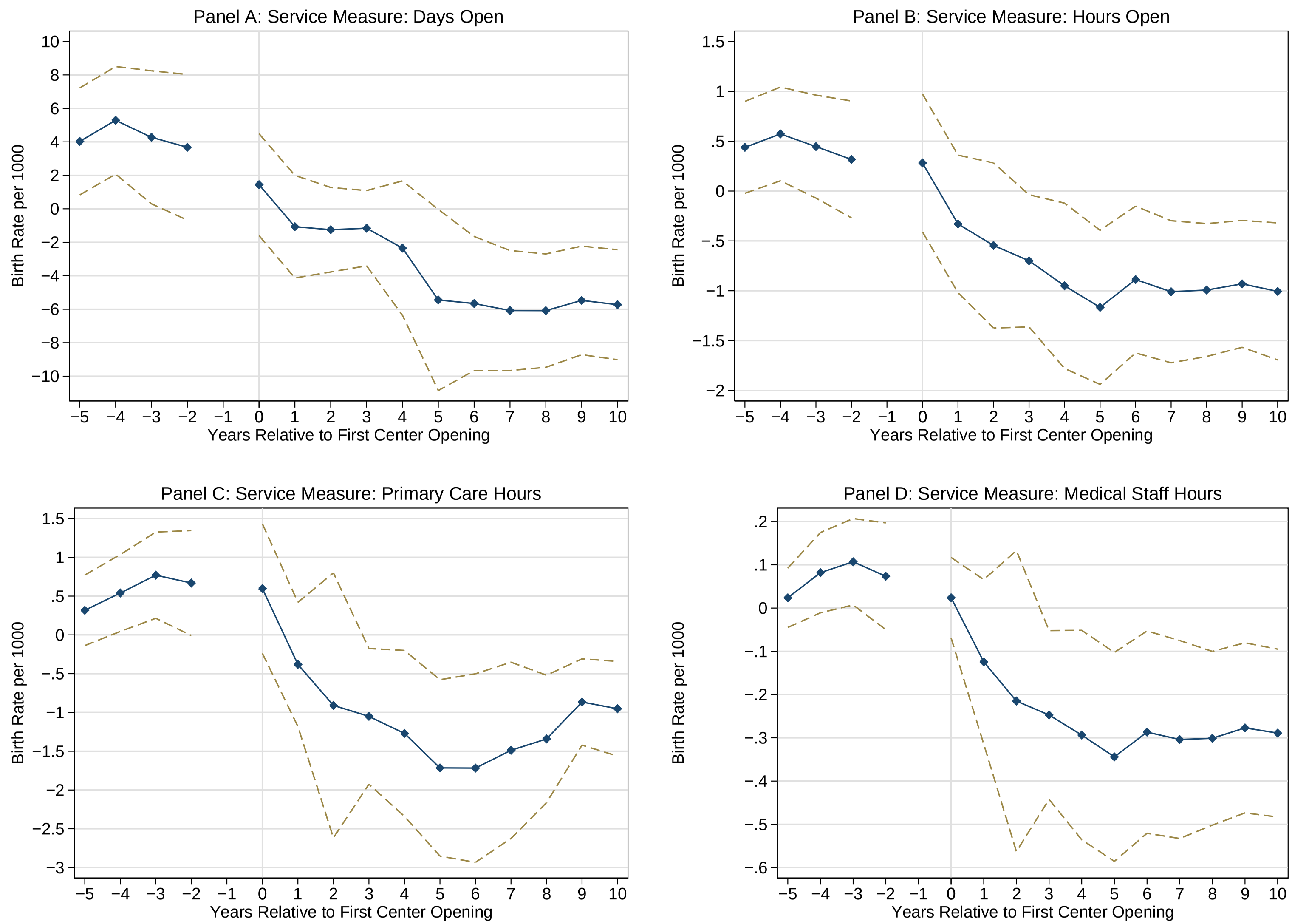
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

Figure 7: Event Study Estimates of the Effect of SBHC Services Among Centers that Provide Any Contraceptive Services on Under-16 Birth Rates (per 1000 women)



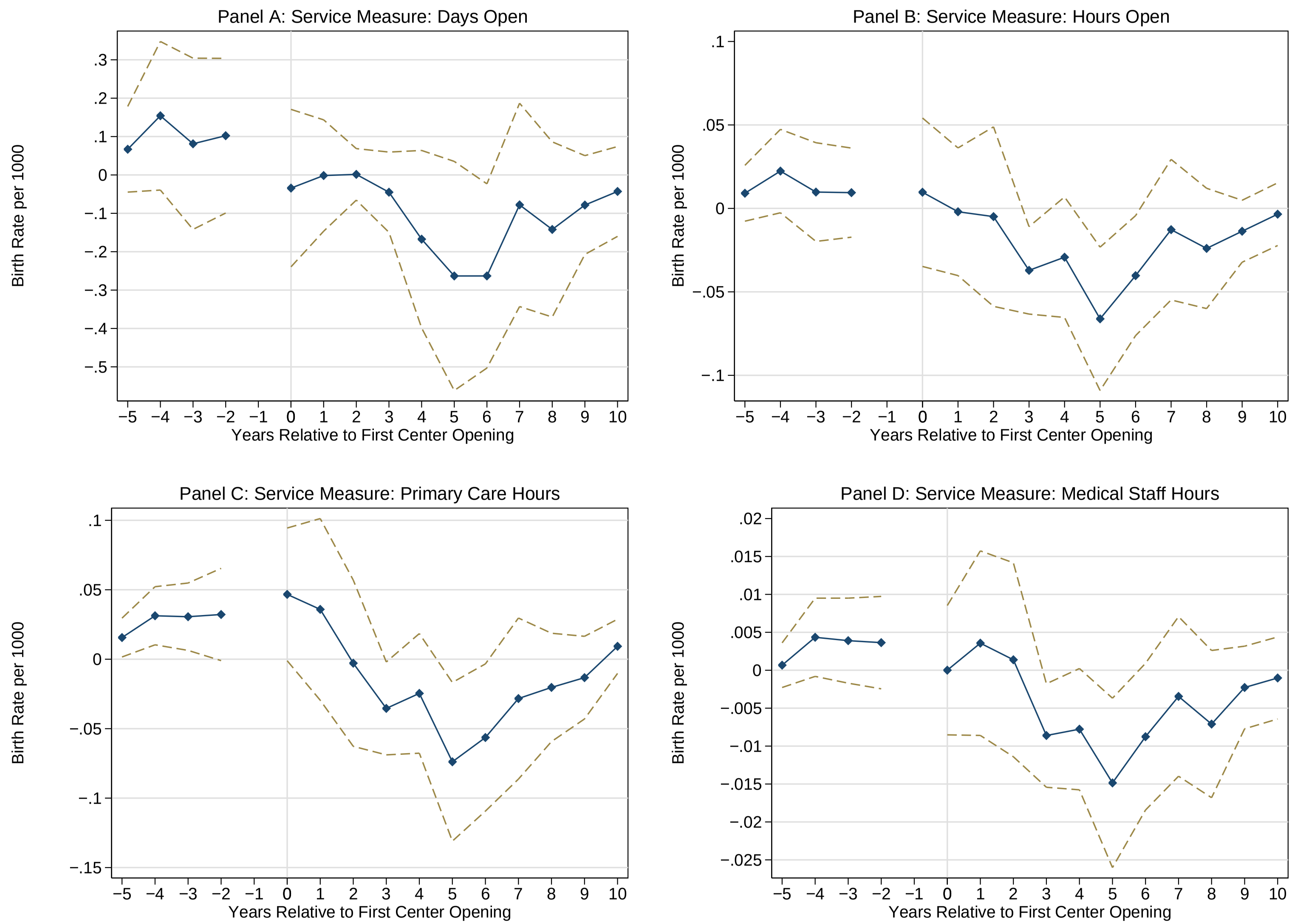
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

Figure 8: Event Study Estimates of the Effect of SBHC Services Among Centers that Provide Any Contraceptive Services on 16-19 Birth Rates (per 1000 women)



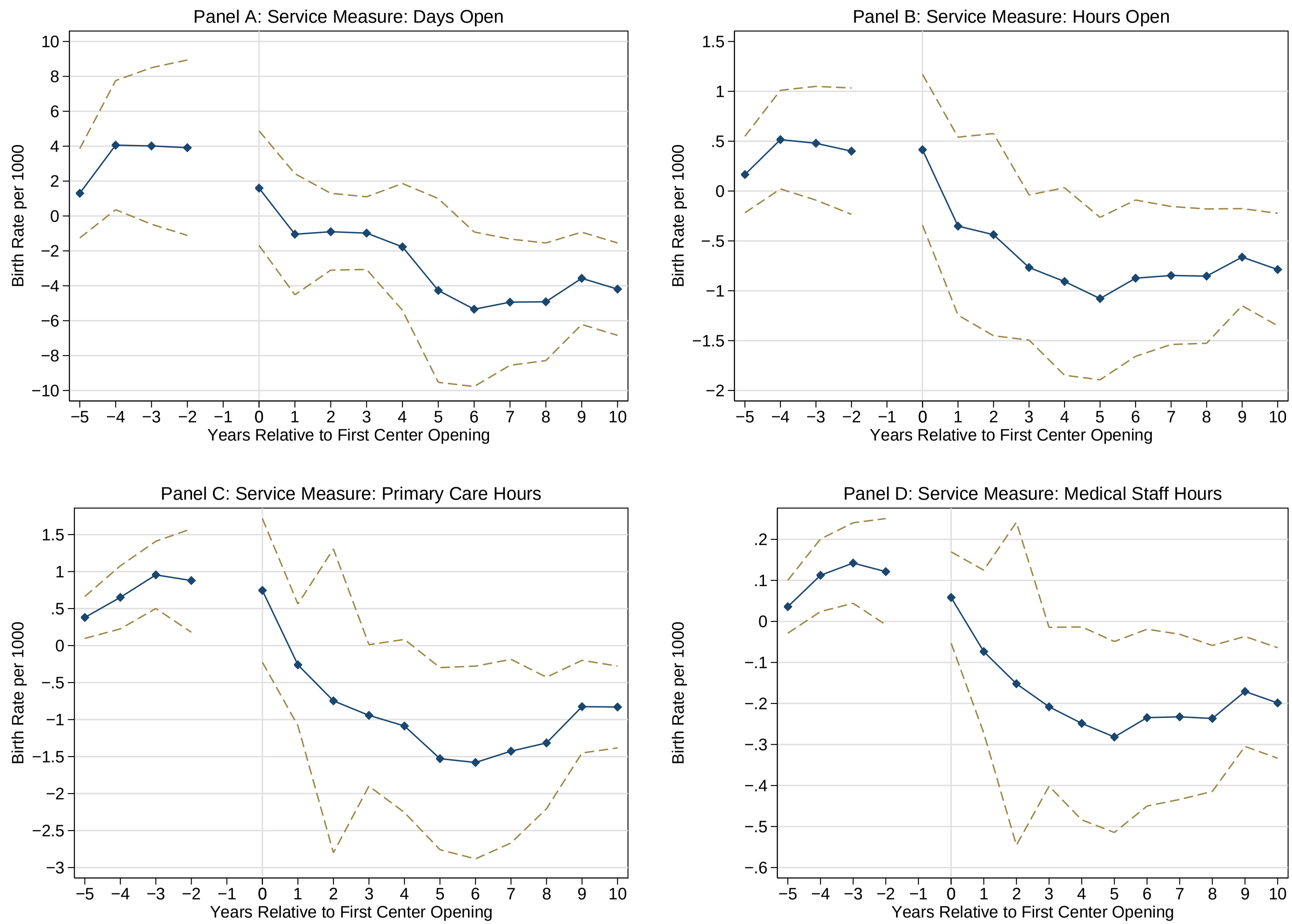
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

Figure 9: Event Study Estimates of the Effect of SBHC Services Among Centers that Provide Contraceptive Services On-Site on Under-16 Birth Rates (per 1000 women)



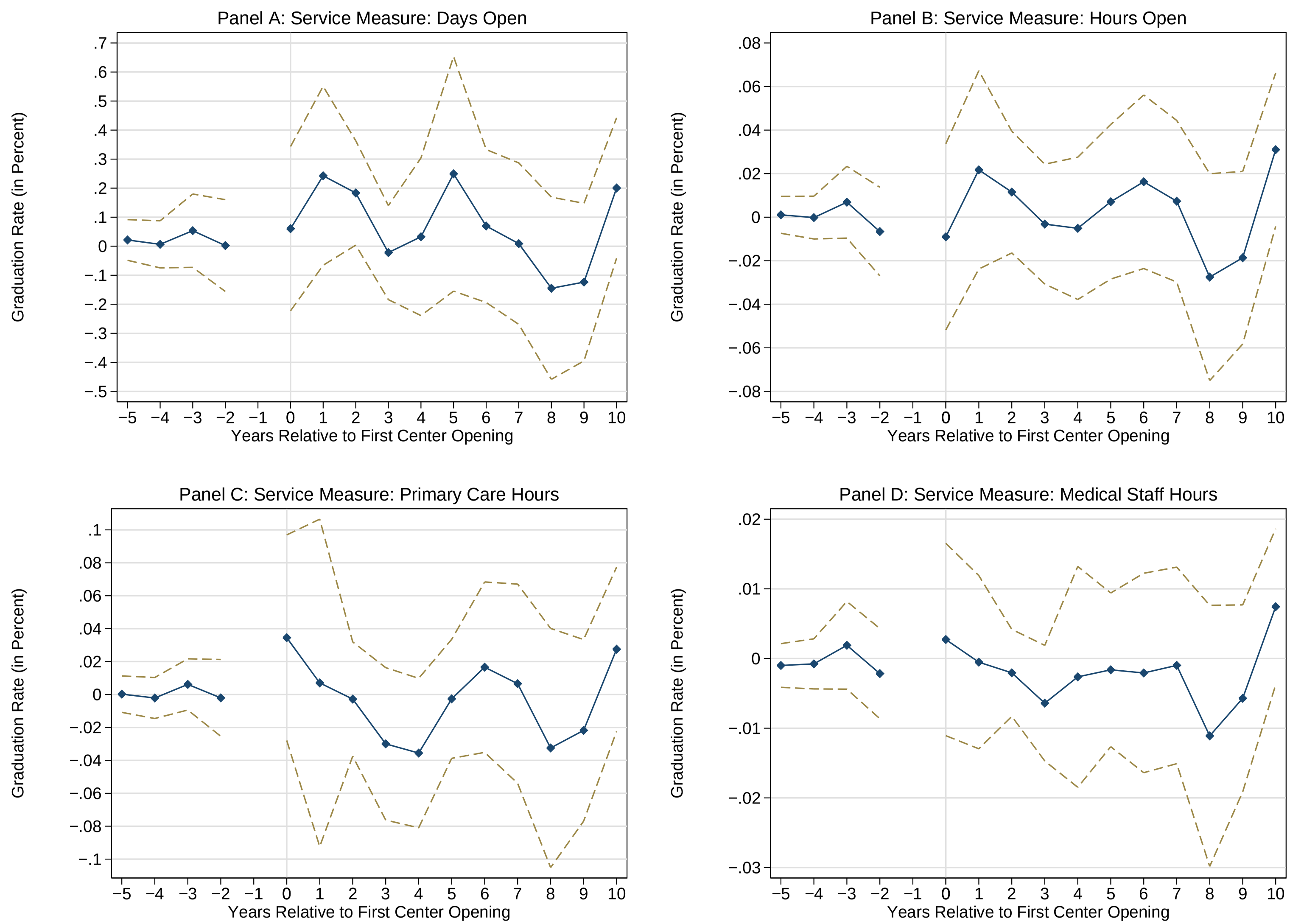
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

Figure 10: Event Study Estimates of the Effect of SBHC Services Among Centers that Provide Contraceptive Services On-Site on 16-19 Birth Rates (per 1000 women)



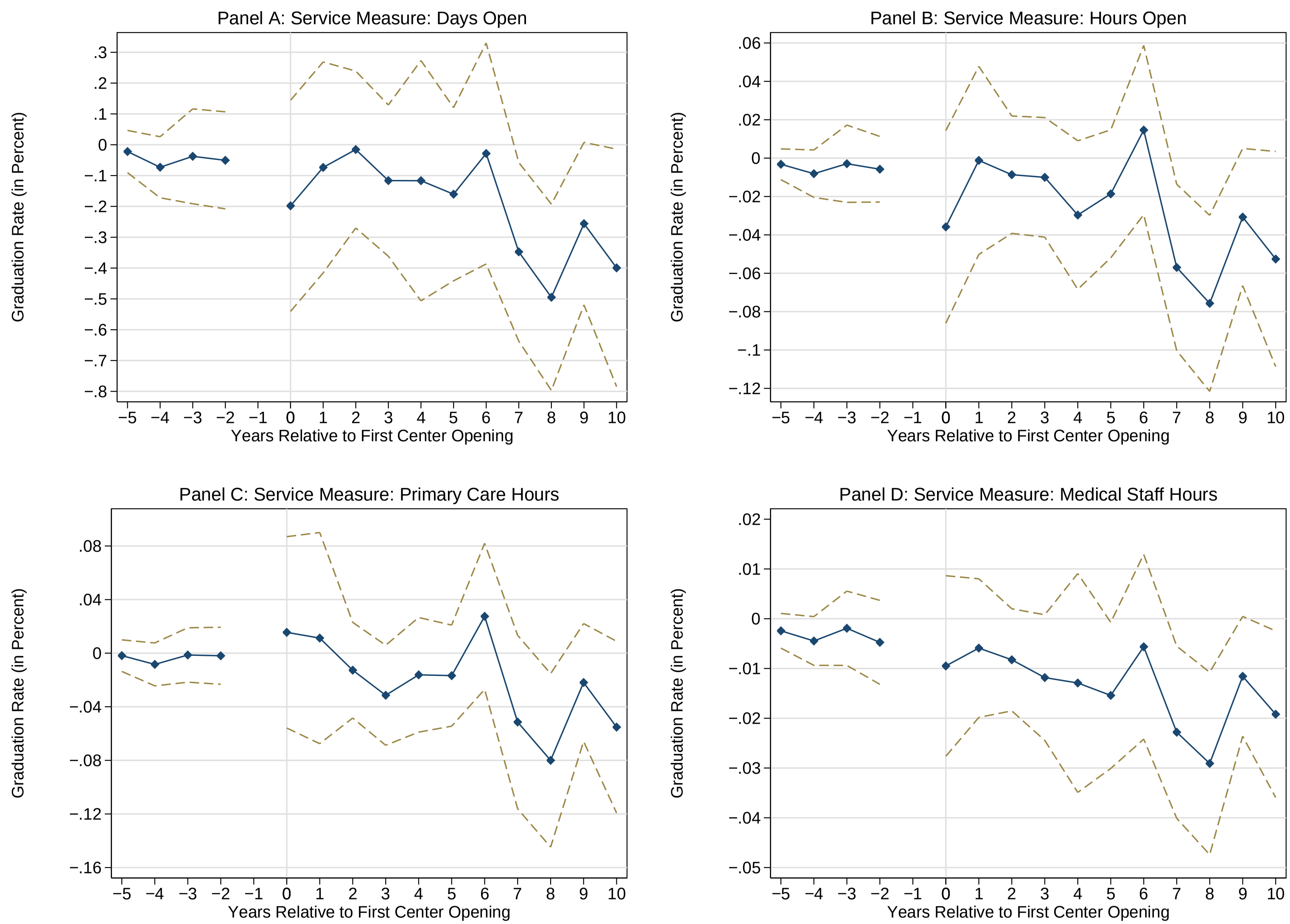
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the county. All estimates include county and state-by-year fixed effects and are weighted by the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

Figure 11: Event Study Estimates of the Effect of SBHC Services on 10^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



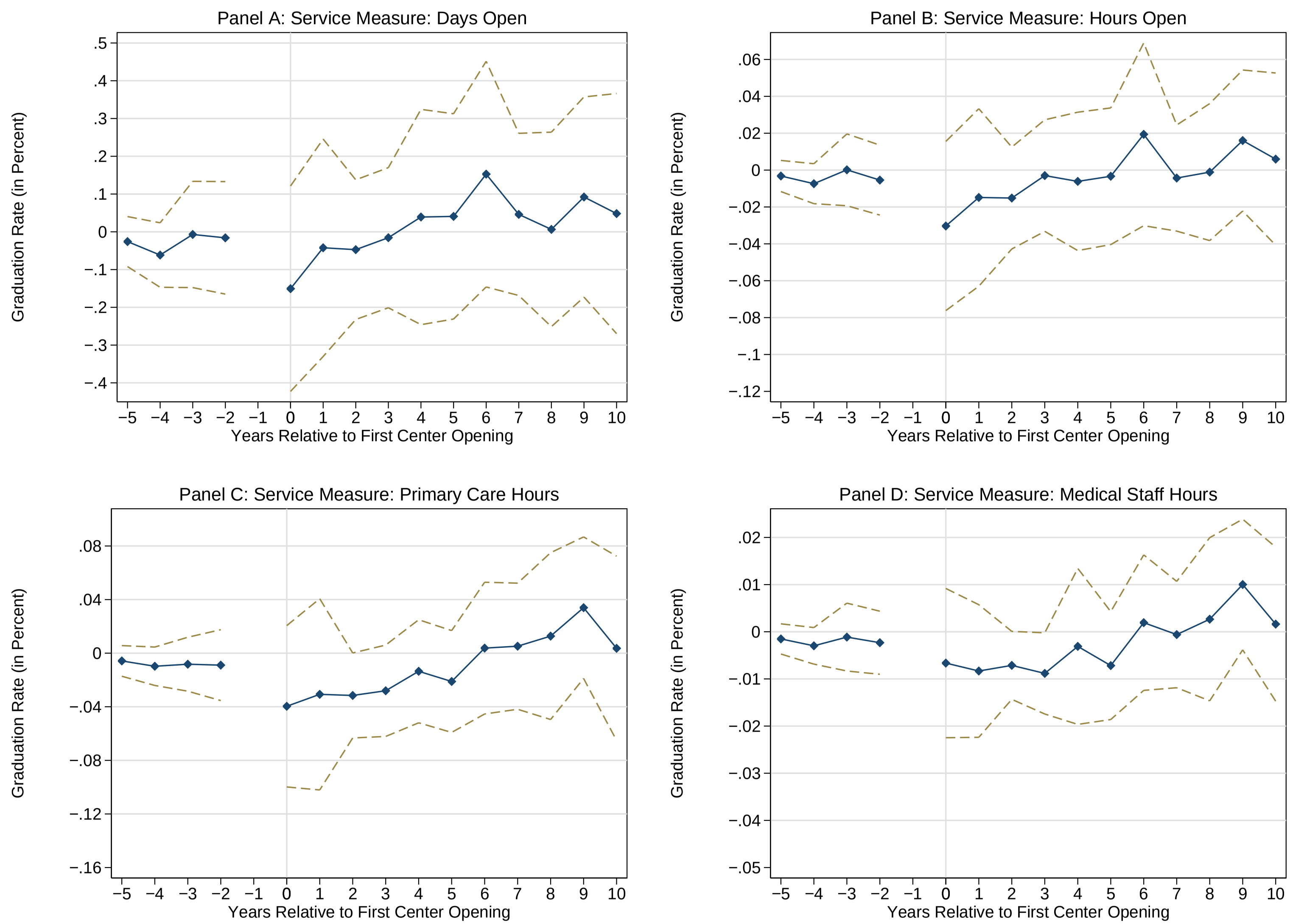
Authors' estimates of equation (2) as described in the text. Each point in the solid line shows the coefficient estimate on the service measure interacted with the relative time the first center opening in the school district. All estimates include school district and state-by-year fixed effects and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

Figure 12: Event Study Estimates of the Effect of SBHC Services on 11^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



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

Figure 13: Event Study Estimates of the Effect of SBHC Services on 12^{th} Grade High School Dropout Rates (in Percent) – Diploma Data



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

Table 1: Percent of Health Centers Providing Different Contraceptive Services

Contraception Type	Prescribed & Dispensed On Site	Prescribed On Site	Referrals Only	No Provision
Condoms (Male)	30.1	4.1	27.5	43.4
Condoms (Female)	20.2	5.8	30.6	38.3
Dental Dams	13.2	6.0	30.12	50.7
Diaphragm	6.9	8.3	38.0	46.8
Birth Control Pills	21.0	14.7	28.5	35.8
Birth Control Shot (Depo-Provera)	24.4	7.3	30.5	37.8
Implant	4.6	6.2	44.8	44.4
Patch	13.9	11.9	33.2	41.0
Ring (NuvaRing)	15.6	11.6	31.9	40.9
Emergency Contraception	19.0	10.4	28.8	41.8
IUD	4.1	6.3	47.1	42.5
Spermicides	9.9	11.2	32.5	46.4

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

Table 2: Descriptive Statistics of Analysis Variables

Variable	Mean	SD
Days Open	0.209	0.891
Days Open (for centers)	3.657	5.509
Hours Open	1.373	5.704
Hours Open (for centers)	6.109	10.763
Primary Care Staff Hours	1.044	4.849
Primary Care Staff Hours (for centers)	5.344	9.870
Medical Staff Hours	4.566	17.829
Medical Staff Hours (for centers)	20.217	33.036
Birth Rate ≤15	0.558	1.026
Birth Rate 16-19	45.645	23.971
10^{th} Grade Dropout Rate	0.224	0.122
11^{th} Grade Dropout Rate	0.155	0.098
12^{th} Grade Dropout Rate	0.093	0.088
Female 14-17 Dropout Rate	0.128	0.272
Male 14-17 Dropout Rate	0.129	0.271
Female 18-19 Dropout Rate	0.317	0.325
Male 18-19 Dropout Rate	0.319	0.315

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. 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. 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.

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

Treatment Measure	≤15 (i)	16-19 (ii)
Days Open*Post	-0.058	-2.474**
	(0.059)	(1.194)
Hours Open*Post	-0.009	-0.464**
	(0.013)	(0.221)
Primary Care Staff Hours*Post	-0.024	-0.706**
	(0.017)	(0.290)
Medical Staff Hours*Post	-0.005	-0.155**
	(0.004)	(0.079)

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. All estimates include county and state-by-year fixed effects and are weighted by the high school aged population in the county. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

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

	≤15			16-19		
Treatment Measure	Birth Control (i)	Birth Control Dispensed (ii)	No Birth Control (iii)	Birth Control (iv)	Birth Control Dispensed (v)	No Birth Control (vi)
Days Open*Post	-0.055	-0.083	0.034	-2.441**	-1.973**	-2.343
	(0.059)	(0.052)	(0.143)	(1.179)	(0.935)	(2.856)
Hours Open*Post	-0.009	-0.016	0.006	-0.474**	-0.414*	-0.155
	(0.013)	(0.012)	(0.023)	(0.226)	(0.182)	(0.290)
Primary Care Staff Hours*Post	-0.025	-0.025*	0.032	-0.702**	-0.624**	0.234
	(0.016)	(0.015)	(0.046)	(0.288)	(0.228)	(0.558)
Medical Staff Hours*Post	-0.005	-0.004	0.004	-0.154**	-0.116**	-0.047
	(0.004)	(0.003)	(0.009)	(0.079)	(0.053)	(0.074)

Notes: Authors' estimates of equation (1) as described in the text. Each cell comes from a separate regression. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. All estimates include county and state-by-year fixed effects are weighted by the high school aged population in the county. Standard errors clustered at the county level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 5: The Effect of SBHC Services on Birth Rates (per 1000 women) by Birth Control Status and Race

	≤15		16-19	
Panel A: White				
Treatment Measure	Birth Control (i)	No Birth Control (ii)	Birth Control (iii)	No Birth Control (iv)
Days Open*Post	-0.080	-0.055	-2.852**	-3.165
	(0.054)	(0.110)	(1.371)	(2.757)
Hours Open*Post	-0.016	-0.006	-0.566**	-0.261
	(0.011)	(0.013)	(0.256)	(0.251)
Primary Care Staff Hours*Post	-0.026*	0.007	-0.829**	-0.180
	(0.015)	(0.032)	(0.336)	(0.586)
Medical Staff Hours*Post	-0.006	-0.0006	-0.169*	-0.069
	(0.004)	(0.005)	(0.090)	(0.067)
Panel B: Black				
Treatment Measure	Birth Control (i)	No Birth Control (ii)	Birth Control (iii)	No Birth Control (iv)
Days Open*Post	-0.063	0.147	-1.829	1.499
	(0.093)	(0.363)	(1.527)	(5.386)
Hours Open*Post	-0.011	0.027	-0.445*	-0.055
	(0.018)	(0.053)	(0.265)	(0.561)
Primary Care Staff Hours*Post	-0.022	-0.006	-0.719**	0.657
	(0.022)	(0.039)	(0.328)	(1.066)
Medical Staff Hours*Post	-0.007	-0.001	-0.157**	0.254
	(0.006)	(0.016)	(0.072)	(0.262)
Panel C: Hispanic				
Treatment Measure	Birth Control (i)	No Birth Control (ii)	Birth Control (iii)	No Birth Control (iv)
Days Open*Post	-0.221**	-0.185	-2.514	1.575
	(0.102)	(0.487)	(2.507)	(7.313)
Hours Open*Post	-0.039**	0.011	-0.439	0.617
	(0.015)	(0.059)	(0.404)	(0.730)
Primary Care Staff Hours*Post	-0.066**	-0.004	-1.038*	0.557
	(0.023)	(0.044)	(0.665)	(0.460)
Medical Staff Hours*Post	-0.016**	-0.002	-0.193	0.068
	(0.004)	(0.024)	(0.149)	(0.226)

Notes: Authors' estimates of equation (1). Each cell comes from a separate regression. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. All estimates include county and state-by-year fixed effects and 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 High School Dropout Rates (in Percent) – Diploma Data

Treatment Measure	10^{th} Grade (i)	11^{th} Grade (ii)	12^{th} Grade (iii)
Days Open*Post	0.045	-0.257**	0.010
	(0.074)	(0.109)	(0.076)
Hours Open*Post	0.004	-0.037**	-0.002
	(0.010)	(0.014)	(0.012)
Primary Care Staff Hours*Post	-0.003	-0.035**	-0.004
	(0.013)	(0.014)	(0.016)
Medical Staff Hours*Post	-0.001	-0.014**	-0.002
	(0.003)	(0.004)	(0.004)

Notes: Authors' estimates of equation (1) using NCES CCD high school diploma data from 1998-2010. Each cell comes from a separate regression. The 10^{th} Grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 10^{th} grade enrollment in year $t-2$. The 11^{th} Grade dropout rate equals 1 minus the ratio of diplomas awarded in year t and the 11^{th} grade enrollment in year $t-1$, and the 12^{th} grade dropout rate is calculated as 1 minus the ratio of diplomas awarded in year t and the 12^{th} grade enrollment in year t. All estimates include school district and state-by-year fixed effects as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. Estimates are weighted by the high school aged population in the school district. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: The Effect of SBHC Services on High School Dropout Rates by Birth Control Status (in Percent) – Diploma Data

		10^{th} Grade			11^{th} Grade			12^{th} Grade	
Treatment Measure	Birth Control (i)	Birth Control Dispensed (ii)	No Birth Control (iii)	Birth Control (iv)	Birth Control Dispensed (v)	No Birth Control (vi)	Birth Control (vii)	Birth Control Dispensed (viii)	No Birth Control (ix)
Days Open*Post	0.006	-0.031	0.206**	-0.312**	-0.332**	0.094	-0.002	-0.081	0.038
	(0.081)	(0.104)	(0.109)	(0.123)	(0.176)	(0.118)	(0.082)	(0.114)	(0.131)
Hours Open*Post	0.0004	-0.011	0.008	-0.041**	-0.045**	-0.015	-0.003	-0.021	-0.005
	(0.011)	(0.015)	(0.023)	(0.016)	(0.024)	(0.016)	(0.012)	(0.018)	(0.019)
Primary Care Staff Hours*Post	-0.007	-0.023	0.053	-0.039**	-0.039*	0.005	-0.004	-0.027	-0.002
	(0.014)	(0.020)	(0.056)	(0.015)	(0.021)	(0.030)	(0.016)	(0.022)	(0.029)
Medical Staff Hours*Post	-0.002	-0.005	0.009	-0.015**	-0.014*	-0.005	-0.002	-0.008*	-0.001
	(0.003)	(0.004)	(0.010)	(0.005)	(0.007)	(0.007)	(0.004)	(0.005)	(0.007)

Notes: Authors' estimates of equation (1) using NCES CCD high school diploma data from 1998-2010. Each cell comes from a separate regression. All estimates include school district and state-by-year fixed effects. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. The "No Birth Control" results show estimates using the set of centers that do not provide any contraceptive services. 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 as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. Estimates are weighted by the high school aged population in the school district. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 8: The Effect of SBHC Services on High School Dropout Rates (in percent) – Census Data

	14-17 Year Old			18-19 Year Olds		
	All	Female	Male	All	Female	Male
Treatment Measure	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Days Open*Post	-0.015	-0.022	-0.003	-0.129*	-0.291**	-0.009
	(0.020)	(0.024)	(0.025)	(0.072)	(0.104)	(0.099)
Hours Open*Post	-0.003	-0.004	-0.001	-0.018*	-0.032**	-0.004
	(0.003)	(0.003)	(0.003)	(0.010)	(0.015)	(0.014)
Primary Care Staff Hours*Post	-0.004	-0.003	-0.003	-0.014	-0.023	-0.003
	(0.003)	(0.004)	(0.003)	(0.011)	(0.015)	(0.014)
Medical Staff Hours*Post	-0.0012*	-0.002*	-0.001	-0.004	-0.007*	-0.002
	(0.0007)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)

Notes: Authors' estimates of equation (1) 1990 and 2000 Census data as well as 2005-2011 ACS data. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district who does not report attending school and who do not have a high school degree. All estimates include school district and state-by-year fixed effects as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. All estimates are weighted by the high school aged population in the school district. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 9: The Effect of SBHC Services on High School Dropout Rates by Birth Control Status Using Census Data – Females by Birth Control Status

	14-17 Year Olds		18-19 Year Olds	
Treatment Measure	Birth Control (i)	Birth Control Dispensed (ii)	Birth Control (iii)	Birth Control Dispensed (iv)
Days Open*Post	-0.007	0.005	-0.216*	-0.258*
	(0.028)	(0.004)	(0.113)	(0.140)
Hours Open*Post	0.002	0.005	-0.018	-0.017
	(0.004)	(0.005)	(0.016)	(0.020)
Primary Care Staff Hours*Post	-0.002	-0.002	-0.016	-0.021
	(0.005)	(0.006)	(0.018)	(0.022)
Medical Staff Hours*Post	-0.001	0.0001	-0.005	-0.004
	(0.001)	(0.001)	(0.005)	(0.006)

Notes: Authors' estimates of equation (1) using 1990 and 2000 Census data as well as 2005-2011 ACS data. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district who does not report attending school and who do not have a high school degree. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. All estimates include school district and state-by-year fixed effects as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. All estimates 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 10: The Effect of SBHC Services on High School Dropout Rates by Birth Control Status Using Census Data – Estimates Using Large Counties

	14-17 Year Olds			18-19 Year Olds		
Treatment Measure	Male (i)	Female (ii)	Female Birth Control (iii)	Male (iv)	Female (v)	Female Birth Control (vi)
Days Open*Post	0.027	0.044	0.054	0.325*	-0.500**	-0.412**
	(0.050)	(0.056)	(0.060)	(0.196)	(0.247)	(0.248)
Hours Open*Post	0.006	0.006	0.008	0.045	-0.071*	-0.058
	(0.007)	(0.008)	(0.009)	(0.030)	(0.037)	(0.038)
Primary Care Staff Hours*Post	0.008	0.005	0.006	0.055	-0.046	-0.072
	(0.012)	(0.012)	(0.012)	(0.050)	(0.057)	(0.058)
Medical Staff Hours*Post	-0.001	0.001	0.001	0.011	-0.020*	-0.019*
	(0.002)	(0.003)	(0.004)	(0.008)	(0.011)	(0.011)

Notes: Authors' estimates of equation (1) using 1990 and 2000 Census data as well as 2005-2011 ACS data. The sample is comprised of the large counties that constitute the birth rate analysis sample. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district who do not report attending school and who do not have a high school degree. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. All estimates include school district and state-by-year fixed effects as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. All estimates 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 11: The Effect of SBHC Services on Teen Birth Rates, Using Initial Service Levels

	≤15 Year Olds		16-19 Year Olds	
		Birth		Birth
	All	Control	All	Control
Treatment Measure	(i)	(ii)	(iii)	(iv)
Days Open*Post	-0.170	-0.169	-4.695	-4.725
	(0.160)	(0.159)	(3.529)	(3.534)
Hours Open*Post	-0.008	-0.009	-0.405*	-0.404*
	(0.013)	(0.013)	(0.204)	(0.202)
Primary Care Staff Hours*Post	-0.044	-0.045	-1.208*	-1.234*
	(0.029)	(0.029)	(0.041)	(0.646)
Medical Staff Hours*Post	-0.010	-0.010	-0.144	-0.144
	(0.010)	(0.010)	(0.297)	(0.301)

Notes: Authors' estimates of equation (1) using 1990 and 2000 Census data as well as 2005-2011 ACS data. Each cell comes from a separate regression. The dropout rates measure the proportion of each age group living in the district who do not report attending school and who do not have a high school degree. The "Birth Control" estimates include all centers that provide any contraceptive services, including referrals. The "Birth Control Dispensed" estimates include only those centers that dispense or prescribe birth control on-site. All estimates include school district and state-by-year fixed effects as well as controls for parental education, income, student race/ethnicity, and free/reduced price lunch status. All estimates are weighted by the high school aged population in the school district or county. Standard errors clustered at the school district level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.