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THE EFFECT OF A PEER'S TEEN PREGNANCY ON SEXUAL BEHAVIOR

Priyanka Anand
Lisa B. Kahn

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1050 Massachusetts Avenue
Cambridge, MA 02138
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ABSTRACT

In this paper, we examine whether a friend or older sibling's teen pregnancy impacts one's own sexual behavior. We exploit high-frequency data on sexual activity from the National Longitudinal Study of Adolescent to Adult Health and the sharp timing of the end of a peer's pregnancy to analyze the evolution of sexual behavior. We find that those who observe a peer's teen pregnancy change their sexual behavior after the event to put themselves at lower risk of their own teen pregnancy; specifically, they are less likely to have unprotected sex and have fewer sexual partners in the months following the end of the teen pregnancy. We find that females are more likely to change their sexual behavior after the end of a peer's teen pregnancy compared to males, and the effects are larger after observing a peer's teen pregnancy that results in a live birth. Our work suggests that connecting youth personally with the experiences of teen parents is a promising avenue for teen pregnancy prevention campaigns.

Priyanka Anand
George Mason University
Department of Health Administration and Policy
4400 University Drive, MS1J3
Fairfax, VA 22030
United States
panand4@gmu.edu

Lisa B. Kahn
Department of Economics
University of Rochester
280 Hutchison Rd
P.O. Box 270156
Rochester, NY 14627
and NBER
lisa.kahn@rochester.edu

I Introduction

The United States has the highest teen birth rate of any industrialized country in the world (United Nations, 2017) and early child-bearing is associated with negative long-term educational and economic consequences.[1] As such, there is substantial policy interest in understanding the causes of teen pregnancy and, more generally, adolescent sexual behavior. Previous work has investigated the relationship between demographics (such as race, religion, education, and income) and teen pregnancy, the impact of policies regarding access to abortion, sex education, and family planning services on sexual behavior, and the role of media influences on teen childbearing.[2] However, much less is known about the role of peer influence from teen pregnancy. In this paper, we explore whether sexual behavior is affected by observing the teen pregnancy of a peer, which we define as a friend or older sibling.

Little is known about the impact of a sibling or friend's teen pregnancy on one's own sexual behavior.[3] Teen pregnancy as an influence on a friend or sibling is particularly interesting because it may have large, visible consequences that are difficult for a teenager to fully imagine, ex ante. On the one hand, a teen might mimic a peer's sexual behavior if they admire the peer, desire the same attention or view the experience as legitimizing of teen pregnancy. On the other hand, directly observing a pregnancy, abortion or baby might

[1] These consequences are a source of long-standing debate. Early studies that primarily relied on cross-sectional OLS estimates found large negative effects of teen pregnancy on educational attainment, income, and marriage stability (Card, 1981; Card and Wise, 1978; Trussell, 1976; Waite and Moore, 1978). More recent papers point out the large selection bias preventing a causal interpretation of these correlations (Geronimus and Korenman, 1992; Hoffman, Foster and Furstenberg, 1993; Ashcraft, Fernandez-Val and Lang, 2013; Hotz, McElroy and Sanders, 2005). Though Fletcher and Wolfe (2009, 2012) upheld the negative educational and economic consequences of teen pregnancy even after controlling for family heterogeneity with their use of miscarriages as a control group, the literature on causal effects is inconclusive.

[2] For demographics, see Kearney and Levine (2010); An, Haveman and Wolfe (1993); for policy evaluation, see Lindo et al. (2020); Oettinger (1999); Packham (2017); Fischer, Royer and White (2018); Jones and Pineda-Torres (2022); for impacts of the media see Kearney and Levine (2015); Jaeger, Joyce and Kaestner (2020).

[3] Peers have been shown to play an important role in the risky behaviors of teenagers. For instance, younger siblings show correlated behaviors in terms of alcohol, marijuana and cigarette use to those of their older siblings (Altonji, Cattan and Ware, 2017; Ouyang, 2004) and there are strong correlations within peer groups of the initiation of sex, truancy, and marijuana and cigarette use (Card and Giuliano, 2013; Ajilore, 2015). Notably, Heissel (2017, 2021) shows that an older sibling's teen pregnancy has a negative impact on academic outcomes and exposure to the juvenile justice system.

make an individual more cautious, deterring one from engaging in sexual behaviors that put them at risk of their own teen pregnancy.[4] For siblings, changes in parenting style may also play a role, with parents either becoming more strict towards all offspring or instead focusing more attention on the sibling with the pregnancy.

Identifying the causal impact of a peer's teen pregnancy on sexual behavior is complicated by the fact that environmental factors contributing to teen pregnancies will be common across the peer groups. Thanks to the extremely rich National Longitudinal Study of Adolescent to Adult Health dataset (Harris, 2018), we can exactly pinpoint the timing and characteristics of all sexual relationships and pregnancies of respondents. We therefore exploit the sharp timing of a peer's teen pregnancy and analyze the evolution of an individual's sexual behavior before and after the event. We can also control for family background and neighborhood characteristics. Our approach identifies the causal impact of a peer's pregnancy on own sexual behavior if peer groups with pregnancies would have been on a similar age trajectory in terms of their sexual behavior, absent the peer pregnancy. Identification is threatened if, for example, groups with teen pregnancies would have accelerated their sexual activity during their teenage years, relative to groups without pregnancies, even absent the pregnancy. Naturally, we cannot fully rule this pattern out; however, we note that we see no evidence of differential pre-trends for those with peer pregnancies. Further, we find similar results when we use as a control group those who will eventually have a peer teen pregnancy but have not yet experienced one by a certain age. A remaining concern, of course, is that peer groups experience contemporaneous shocks driving the pregnancy and any changes in sexual behavior (Manski, 1993). However, we expect such a bias would go in the opposite direction of our findings.

Indeed, we find that those who observe a friend or older sibling's teen pregnancy are less likely to engage in sexual behavior that puts them at risk of their own teen pregnancy

[4]East et al. (2009) analyzes a survey of Latina girls whose older siblings have had teen pregnancies and finds that almost all report an increased motivation to avoid early parenting, though most do not perceive early parenting to be a hardship.

after the event compared to those who have not experienced a peer's teen pregnancy by that age. In particular, we find that respondents are less likely to have unprotected sex (primarily through their use of birth control, rather than through abstaining altogether) and have fewer sexual partners after observing a peer's teen pregnancy. These effects on sexual behavior are evident only after the peer's teen pregnancy.

The existing literature on the impact of a peer's teen pregnancy on sexual behavior has focused on own teen pregnancy as an outcome. The findings have been mixed: some papers have found that a teen pregnancy in the family (Monstad, Propper and Salvanes, 2011) or among grademates in the same school (Fletcher and Yakusheva, 2016) positively impacts one's own probability of a teen pregnancy, suggesting that a desire to mimic the peer with the pregnancy will outweigh any deterrent effect for exposure to real consequneces, while others (Yakusheva and Fletcher, 2015; Kapinos and Yakusheva, 2016) have found that a friend's teen birth is associated with a reduction in the likelihood of own teen pregnancy.[5] These previous papers have attempted a range of clever identification strategies that are useful, but not without their own strong assumptions.[6] One of our contributions to the existing literature is an identification strategy that allows us to control for differences in the level of sexual activity across peer groups of the same age with and without teen pregnancies. Our paper also contributes to the existing literature by studying a range of sexual behavior measures, including sexual activity, number of partners, and birth control use. Focusing exclusively on teen pregnancy as an outcome, as the previous literature has done, may miss some of the nuance of effects on sexual behavior.

[5]Kuziemko (2006) focuses on adult sibling pairs and shows that individuals are more likely to have a child in the two years after one's sibling has a child.

[6]Yakusheva and Fletcher (2015) and Kapinos and Yakusheva (2016) use the absence of a miscarriage as an instrument for the probability of teen childbearing, arguing that conditional on pregnancy, miscarriage probability is random. This is a very nice approach that was first proposed by Hotz, Mullin and Sanders (1997) and Hotz, McElroy and Sanders (2005), but may suffer from differential measurement error to the extent that youth may only selectively recall (or even know about) peer's miscarriages. Fletcher and Yakusheva (2016) use the proportion of grademates whose mother had a teen pregnancy and the average age of menarche of grademates as instruments, neither of which fully rule out other environmental factors correlated with these instruments. Monstad, Propper and Salvanes (2011) use a change in compulsory school laws in Norway as a source of variation in teen pregnancy, but cannot fully isolate the teen pregnancy effect from the main effects of increased schooling.

We also explore impact heterogeneity in responses and find intuitive results. Effects are larger when the focal observation is female and when the peer with the teen pregnancy is female. We could reasonably expect larger impacts on girls because parents can provide them with long-acting reversable contraception and larger impacts when the peer is a teen mom since their experience and visibility may differ from that of a teen dad. In addition, effects are entirely accounted for by peer pregnancies that result in a live birth, which makes sense given that these would be the most visible. These intuitive patterns are reassuring; if omitted variables were driving our results, we might expect those to be fairly similar across live births as those that terminate early and across females and males.

The organization of the paper is as follows. Section 2 describes the data and provides some summary statistics. Section 3 presents the empirical strategy used to identify the effects of a peer's teen pregnancy on sexual behavior. Section 4 presents the empirical results and discussion. Section 5 concludes.

II Data

The dataset used in this paper is from the National Longitudinal Study of Adolescent to Adult Health (Add Health). The Add Health survey drew a sample of approximately 90,000 students in 144 schools across the United States to participate in a basic in-school survey and then selected nearly 21,000 of these students to participate in a series of five waves of in-home surveys conducted from 1994 to 2018. The in-home surveys contain detailed retrospective questions about sexual behavior in waves 1, 2, and 3 and a full pregnancy history with pregnancy end dates that were collected in waves 3 and 4. Importantly for this study, the Add Health survey includes information on the siblings and friends of respondents. Respondents were asked to name their top five male and top five female friends in three separate surveys (the wave 1 in-school and in-home surveys as well as the wave 2 in-home survey), resulting in up to 30 friend nominations. Siblings living in the same household as students selected

for the wave 1 in-home survey were oversampled. By wave 4, all survey respondents had completed their teenage years and were in their mid-twenties to mid-thirties. The ages, years, and sample sizes for the first four waves of the survey can be found in Appendix Table B1.

We obtain demographic and family background information for the survey respondents from wave 1. Key variables of interest for this study are whether respondents had a pregnancy or got their partner pregnant before the age of 20, the exact end date of the pregnancy, and the outcome of the pregnancy. For the pregnancy variables, we use information from waves 3 and 4, in which individuals are asked to create a roster of all pregnancies and the date each pregnancy ended (whether it was a live birth, abortion, or other outcome).[7] See appendix A for details on data construction.

We create an analytic sample of respondents who have at least one peer (defined as a friend, older sibling, or twin) also selected for the in-home survey and associate these focal observations with the earliest, if any, teen pregnancy among their peer group. We use the peer's own survey answers to determine their pregnancies, which limits peers to those who are observed in the wave 3 or 4 survey in order to have their complete pregnancy history.

Relationship rosters in waves 1 and 2 ask respondents about their sexual activity and consistent birth control use during each of their relationships in the last 18 months; we do not use the wave 3 relationship information because the birth control information is not asked consistently and the lookback period in wave 3 is sometimes longer than 18 months. We convert the wave 1 and 2 relationship information into an age-based panel of sexual behaviors. For each age window (which we define as a 3-month age bin), we define whether the individual was sexually active, and, conditional on sexual activity, whether the individ-

[7]The other waves of the survey contain information on pregnancies as well. In waves 1 and 2, individuals were asked whether each romantic relationship included a pregnancy; however, the date of the pregnancy is not recorded systematically. A pregnancy roster was collected in wave 5, but only for pregnancies that resulted in a live birth. Our preferred specification uses pregnancy information from waves 3 and 4, which is collected for both male and female respondents and should include all pregnancies experienced by the individual.

ual had unprotected sex and the number of sexual partners.[8] We also create a composite measure equaling one if the individual is having sex without using birth control and zero otherwise (including those who abstain), i.e., the propensity to have unprotected sex. The data appendix includes a detailed description of the variable creation.[9] Using the age-based panel, we can then analyze how these sexual behaviors evolve before and after a friend or sibling's teen pregnancy. Our event-study design thus relies on our ability to generate a panel of possibly time-varying behaviors. This is why we do not examine one's own teen pregnancy as an outcome, since it is an absorbing state.

Our sample contains 7,885 observations, 1,332 (17%) of which had an older sibling (including twins) or friend with a teen pregnancy, 63% of which resulted in a live birth.[10] These teen pregnancy rates are lower than the corresponding measures reported in other papers because we must limit our attention to the 50 percent of peer pregnancies that occurred before the outcome behavior variables were measured in the wave 2 survey.[11]

Table 1 shows summary statistics for the sample based on the peer's teen pregnancy status.[12] The time-varying characteristics (such as household income, receipt of food stamps,

[8]We define the number of partners in a given time window using the start and end dates of sexual relationships. We define having unprotected sex as reporting not always using birth control in all sexual relationships in a given time window. We do not use the relationship information from wave 3 due to inconsistencies in how the birth control information is asked – respondents are asked if they used birth control the first and last time they were sexually active within a relationship, but not if they ever had unprotected sex during the relationship.

[9]One concern may be that respondents are not reliably reporting their sexual behavior and birth control use for reasons that may include fear of reprisal, desire to project an adult image, or recall bias. To reduce the influence of the interviewer or parental presence on responses, many of the sensitive AddHealth questions were asked through earphones and respondents directly entered their responses into a laptop computer (Sieving, Beuhring and Resnick, 2001). Regarding recall bias, Sieving et al. (2005) compared survey responses two weeks apart regarding the sexual behavior and contraception use in the last three and six months by adolescent girls and found substantial consistency for up to 6-months. These results suggest that adolescent girls can reliably report sexual behavior over a 6-month period, although it is important to note that the recall period we examine in this study could be up to 18 months long.

[10]We restrict attention to older siblings and twins because these seem the most logical flow of influence. For the friends analysis, we focus on teen pregnancies that occurred after the friend nomination to ensure the pair was friends when the teen pregnancy occurred.

[11]Yakusheva and Fletcher (2015) find that 34% of females have a friend with a pregnancy before age 20 as reported in wave 3 of the AddHealth survey, and Kearney and Levine (2012) report that 20% of women in the National Survey of Family Growth have given birth by the time they are twenty.

[12]Peer characteristics refer to the peer with the earliest teen pregnancy and are missing for those with no peer teen pregnancy because most have multiple peers.

and household composition) are from the wave 1 survey, which is the closest wave to when most of the peer's teen pregnancies occurred. We find that those who observe a peer's teen pregnancy look disadvantaged relative to those that do not have a teen pregnancy. Their families earn roughly $10,000 less per year, are almost twice as likely to receive food stamps, are more likely to be Black and are less likely to live with a father in the household. All of these differences are statistically significant at the 1%-level. They also have different geographies, on average: those with a peer teen pregnancy are are less (more) likely to be living in the Northeast (South), and more likely to be living in a rural area.

Table 1 also shows that 69% of the peer teen pregnancies occur to a female peer. One concern is that boys may be unaware of a pregnancy or unwilling to acknowledge their role as the father and thus underreport their instances of teen pregnancies. However, teen girls tend to have older partners who might not themselves be teenagers. We have explored these two channels using only information from mothers on the age of their partners and find that the greater fraction of females among teen pregnancies is largely a result of age gaps in relationships.[13]

Panel B of table 1 shows baseline sexual behaviors across the two groups. We report the mean values of the dependent variables nine months before the end of a peer's teen pregnancy for those whose peer had a teen pregnancy and nine months before the average age at a peer's teen pregnancy for those whose peers did not have one. We find that those who experience a peer teen pregnancy were more likely to have unprotected sex, stemming primarily from lower use of birth control. There is no difference in sexual activity or the number of partners, conditional on sexual activity.

These differences in family background and baseline sexual activity highlight the importance of controlling for observed and unobserved factors correlated with peer pregnancies

[13]We calculate the rate at which teen pregnancies would occur among boys if we relied soley on information reported by girls regarding the age of their partners (see Appendix Table B2). We find that if we only used information provided by the mother, we would have a sample where girls had the majority of teen pregnancies – though 61%, not the 69% based on the self-reported data. See also Fletcher and Wolfe (2012) who provide evidence from various data sources (including the Add Health data) that the fertility information reported by men is not systematically biased across race and family background characteristics.

Table 1: Summary statistics of respondent characteristics, by peer's pregnancy status

	No Pregnancy	Pregnancy
Panel A:	Household characteristics	
Female	0.51	0.58***
Peer is sibling		0.35
Peer is female		0.69
Same gender as peer		0.61
Live birth		0.61
Age difference		0.54
White	0.64	0.48***
Non-white	0.36	0.51***
Hispanic	0.11	0.12
Asian	0.04	0.03***
Black	0.16	0.30***
Other	0.05	0.06**
Urban	0.27	0.22***
Suburban	0.53	0.46***
Rural	0.18	0.30***
West	0.17	0.16
Midwest	0.26	0.23**
South	0.38	0.48***
Northeast	0.17	0.11***
Household income (wave 1)	40.11	29.50***
Food stamps (wave 1)	0.09	0.16***
Lives with mother (wave 1)	0.92	0.87***
Lives with father (wave 1)	0.72	0.59***
Panel B:	Sexual behavior variables before peer pregnancy	
Unprotected sex	0.11	0.13**
Sexually active	0.24	0.26
# of partners cond. on sex	1.32	1.30
No protection cond. on sex	0.45	0.52**
Observations	6,553	1,332

Notes: Statistical significance relative to the "No Pregnancy" group indicated with *** at the .01 level, ** at the 0.05 level, and * at the 0.10 level. Household income is measured in thousands. Sexual behavior is measured 9 months before the peer's teen pregnancy ended or 9 months before the average age at a peer's teen pregnancy for those who did not have a peer with a teen pregnancy.

that affect the sexual behavior. As we detail next, our difference-in-differences and event study methodologies control for any age-invariant differences between those with and without a peer pregnancy. We also explore robustness to allowing for different age trends based on observables and conduct a robustness check that limits the control group to those who have not yet experienced a peer's teen pregnancy by a particular age (but eventually do).

III Empirical Strategy

We estimate difference-in-differences and event study models as follows:

$$\mathrm{Y}_{ia} = \alpha_i + \gamma_a + \beta(\mathrm{PeerPreg}_i * \mathrm{Post}_a) + \varepsilon_{ia} \tag{1}$$

$$Y_{ia} = \alpha_i + \gamma_a + \sum_{\tau} \beta^{\tau}(\mathrm{PeerPreg}_i * [\mathbb{I}(a = \tau)]) + \varepsilon_{ia} \tag{2}$$

Y_{ia} is a measure of sexual behavior for respondent i during a 3-month age bin, a. $\mathrm{PeerPreg}_i$ is an indicator for respondent i having a peer who had a teen pregnancy and Post_a is an indicator for age bin a being after the peer's teen pregnancy ended. The end date of the pregnancy is the only date regarding the pregnancy that we can measure consistently. This classic double fixed effects model includes individual fixed effects (α_i) and 3-month age bin fixed effects (γ_a). Our focal analysis window is from 18 months before to 12 months after the end date of a peer's teen pregnancy, or, from age 11.75 to 20.5 for those without a peer pregnancy (corresponding to the full time window that observations experience a peer teen pregnancy in our sample).[14] We cluster standard errors by individual to take into account correlated observations for the same person across different ages. We also explore a robustness check that clusters by neighborhood (defined as a census tract) to account for correlations for individuals who live in the same geographic area.

[14]The panel of observations may be unbalanced if sexual behavior information is missing for the age bin (typically due to survey timing). We restrict the analysis to respondents observed in at least two age bins and also explore robustness to a balanced panel.

The coefficient, β, in equation 1 gives the average change in an outcome after, compared to before, a peer's teen pregnancy, relative to other respondents at the same age. Peer effects analyses typically suffer from three threats to internal validity: (1) sorting, (2) common shocks, and (3) reflection (Manski, 1993). Individual fixed effects control for sorting, i.e., that individuals with similar sexual behaviors are more likely to become friends, as long as such sorting is time invariant. Reflection, that peers influence each other simultaneously, is less of a concern for our key coefficient of interest (the changes in behavior *after* a peer pregnancy) given that we estimate the impact of a peer's pregnancy on *future* behaviors. We also explore a robustness where we drop focal observations who themselves had a teen pregnancy before their peer's. Common shocks are a concern that is difficult for us to rule out, though, as we will discuss below, we would expect this bias to go against our findings that teenagers with a peer pregnancy tend to become safer in their own sexual behaviors.

Thus we can interpret the coefficient as causal as long as the parallel trends assumption holds: the age profile of sexual behavior in the control group serves as an appropriate counterfactual for those who experienced a peer's teen pregnancy. The event-study specification (equation 2) helps provide intuition for the parallel trends assumption and allows us to explore dynamics, of interest in their own right. The event time dummies, $[\mathbb{I}(a = \tau)]$), equal one if age a is τ months before or after the age when they experienced the peer's teen pregnancy. We set 9 months before the end date of the pregnancy as the omitted category.

Recent econometrics literature has revealed that variation in treatment timing combined with heterogeneous treatment effects can bias difference-in-differences and event study estimates due to the use of already-treated units as "forbidden comparisons" (Goodman-Bacon, 2021). Our study has variation in treatment timing given that respondents were different ages when their peers experienced their teen pregnancy. We address this concern by using two alternative estimators: (1) the Sun and Abraham (2021) correction that limits the control group to those who are never treated and (2) the Callaway and Sant'Anna (2021) correction that excludes those who never observed a peer's teen pregnancy and uses not-yet-

treated respondents as the comparison group. In addition to resolving the issue of forbidden comparisons, this second estimator also serves to address the concern that respondents who never observed a peer's teen pregnancy may have a different age trajectory in their sexual behavior than those who did observe a peer's teen pregnancy by using the sexual behavior of those who have not-yet observed their peer's teen pregnancy as a counterfactual.

IV Results

Table 2 shows the estimates from the difference-in-differences specification in equation 1. Column 1 includes individual fixed effects; column 2 uses the Sun and Abraham (2021) correction, limiting the comparison group to those who are never treated; column 3 includes neighborhood-specific and race-specific age trends; column 4 applies the Callaway and Sant'Anna (2021) approach using only observations that will eventually be treated in the control group. Results are quite robust across all specifications.

For the likelihood of having unprotected sex, we find a peer's teen pregnancy is associated with a 2.3 to 4.6 percentage point decrease after a peer's teen pregnancy. Since the baseline rates of unprotected sex are low (13% for those who will eventually have a peer teen pregnancy), these reflect large percent changes: the lower bound estimates are equivalent to a 18% decrease and the upper bound estimates are as large as a 35% decrease. All estimates are statistically significant at the 1% level.

For the other outcomes, the point estimates indicate decreases in the rate of unprotected sex and number of partners (both conditional on sex) after an older sibling or friend's teen pregnancy. It is possible that parents respond to the teen pregnancy of one of their children by giving birth control resources to their other children. The reduction in the number of partners is statistically significant across all specifications except for the Callaway and Sant'Anna specification, which is positive but not statistically significant. The lack of precision in the Callaway and Sant'Anna estimate is likely due to the small sample size after

Table 2: Impacts of Peer Pregnancy on Sexual Behavior: Difference-in-differences Estimates

	(1)	(2)	(3)	(4)
Unprotected sex				
Peer teen preg * After	–0.025***	–0.023***	–0.035***	–0.046***
	[0.009]	[0.009]	[0.009]	[0.014]
N	84,789	84,789	84,789	8,474
Sexually active				
Peer teen preg * After	–0.003	–0.001	–0.013	–0.015
	[0.012]	[0.012]	[0.013]	[0.017]
N	84,789	84,789	84,789	8,474
No protection cond. on sex				
Peer teen preg * After	–0.091***	–0.098***	–0.106***	–0.121***
	[0.033]	[0.029]	[0.008]	[0.041]
N	11,944	11,944	11,944	1,757
# of partners cond. on sex				
Peer teen preg * After	–0.116**	–0.101**	–0.061***	0.044
	[0.057]	[0.050]	[0.012]	[0.072]
N	11,944	11,944	11,944	1,757
Sun and Abraham		X	X	
Heterogenous trends			X	
Callaway and Sant'Anna				X

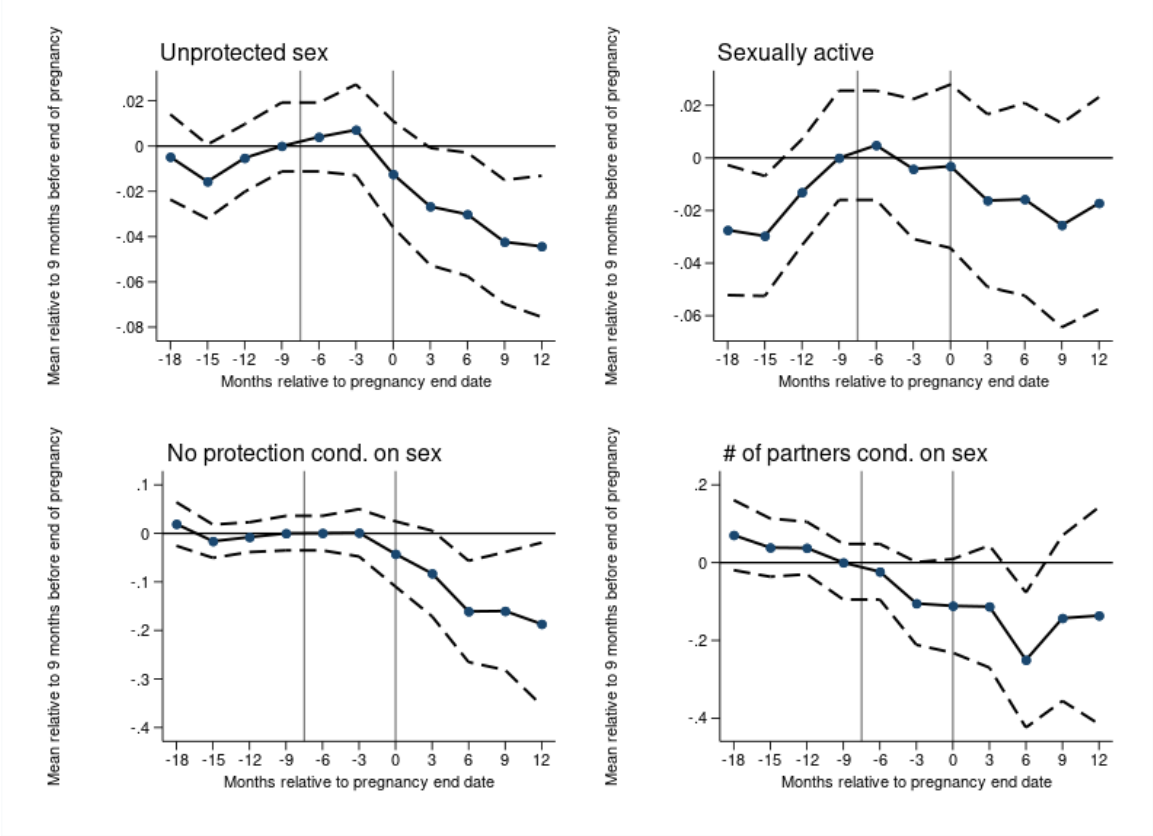
Source: Add Health Data
Notes: *** denotes the estimate is statistically significant from zero at the .01 level, ** at the 0.05 level, and * at the 0.10 level. We summarize regression estimates from equation 1. All specifications include individual and age group fixed effects. Sun and Abraham restricts the control group to those who were never treated; heterogeneous trends include neighborhood-specific and race-specific linear age trends; Callaway and Sant'Anna restrict to only observations that were ever treated.

making the necessary sample restrictions for this method. Because the results are generally robust across all specifications (with only one exception), we use the individual fixed effects model in column (1) as our preferred specification for the remainder of the analyses.

Figure 1 shows our main event study estimates from equation 2. The event study regressions mirror our preferred specification in column (1) of Table 2 that uses individual fixed effects. The rightmost vertical line represents the end of the peer's teen pregnancy. The other line is roughly the earliest the respondent could have learned about the peer pregnancy (7.5 months prior to the end date) – though for pregnancies that did not result in a live birth, the window would be substantially smaller. The figures show that respondents are less likely to have unprotected sex after a friend or older sibling's teen pregnancy. The change is observed at the end date of the peer's pregnancy and widens in magnitude from there. A year after a peer teen pregnancy ended, respondents are 4 percentage points less likely to have unprotected sex, relative to their baseline rate at 9 months before the peer's pregnancy ended. The pre-period estimates show a small increase in the rates of having unprotected sex for those who will observe a peer teen pregnancy, which is a trend that goes in the opposite direction of the large decrease in the rates of having unprotected sex we observe after the peer's teen pregnancy. Even excluding this period of peak activity, the decrease in unprotected sex is still substantial – roughly 3 percentage points – when compared to the earlier time periods. The other panels of the figure reveal a relative increase in sexual activity for the treatment group in the period leading up to the peer pregnancy, but no difference in the rate of unprotected sex, conditional on activity, or number of partners.

The pre-trend in sexual activity begins around the time of pregnancy initiation for peers with a teen pregnancy. It is possible that an omitted variable caused both the respondent and their peer to exhibit behaviors more likely to result in pregnancies around that time. However, the peer pregnancy then reverses the trend. The estimates of sexual activity are noisy, such that we cannot rule out no pre-trend and no impacts. The effect on birth control use is much more precise, with a 19 percentage point decrease in the likelihood of having

Figure 1: Impacts of Peer Pregnancy on Sexual Behavior: Event study coefficients



Source: Add Health data.
Notes: We plot regression estimates from equation 2 and their 95 percent confidence interval (dashed lines). The dependent variable "sexually active" equals one if the responded is sexually active in the indicated time window and is zero if they abstained. The dependent variable "no protection cond. on sex" equals one if the responded is sexually active and had unprotected sex in the indicated time window and is zero if they used protection. The dependent variable "# of partners cond. on sex" is the number of sexual partners the respondent had (if sexually active) in the indicated time window.The vertical lines represent just after nine months before (month -9) and the end of the peer's teen pregnancy (month 0). Regressions include individual and age group fixed effects.

unprotected sex conditional on sexual activity relative to their baseline rate 9 months before the end of the peer's teen pregnancy.

We next explore heterogeneity in responsiveness by gender and race of the focal observation. Table 3, columns (1) and (2) show the results for female and male respondents, respectively, and we find that the effects are driven solely by females. This result seems sensible. We may expect to see larger impacts on girls because parents can provide them with long-acting reversable contraception. Girls may also imagine that they would bear the brunt of any negative consequences of the teen pregnancy if fathers tend to be less involved and may face less responsibility. The remaining columns split the sample into white, Black and Hispanic respondents. We find the most consistently statistically significant effects among the white population, although there is an increase in birth control use among the Black population. The lack of significant results among the non-white population may be attributed to their smaller sample size.

Next, we estimate heterogeneity as a function of characteristics of the peer with the teen pregnancy. We estimate versions of equation 1 but allow for additional interactions with the diff-in-diff variable.[15] In Table 4, we find larger reductions in the likelihood of having unprotected sex for observations where the peer with the pregnancy is female, though the difference is not statistically significant. This effect makes sense, though, since the experience and visibility of a teen mom may differ from that of a teen dad.[16] Effects are also larger when the peer is the same gender as the focal observation, which is consistent with same-gendered peers being closer, though again the differential is not significant. Effects are significantly different and larger in magnitude for peer pregnancies that result in a live birth. This result is reassuring since live births would be much more salient than peer pregnancies that

[15]These peer characteristics are not defined for the control group since many respondents have multiple peers, whereas for peers with a teen pregnancy these characteristics correspond to the peer with the earliest pregnancy. We therefore cannot control for a main effect for having a peer with a given characteristics.

[16]Research has found that younger sisters spend more time taking care of the baby after a sibling's teen pregnancy (Heissel, 2021), which may result in a larger impact on perceptions about the costs of teen childbearing and reduce their available time for risky sexual behavior. Past literature has also found that among siblings, gender composition plays a role in the educational achievement (Conley, 2000; Kaestner, 1997; Butcher and Case, 1994) and alcohol and marijuana use Ouyang (2004).

Table 3: Impacts of Peer Teen Pregnancy on Sexual Behavior, by subgroup

	Female	Male	White	Black	Hispanic
Unprotected sex					
Peer teen preg * After	–0.041***	–0.000	–0.026**	–0.020	0.006
	[0.013]	[0.013]	[0.013]	[0.017]	[0.026]
N	44,661	40,128	52,610	15,148	9,248
Sexually active					
Peer teen preg * After	–0.013	0.010	–0.001	–0.000	0.021
	[0.016]	[0.019]	[0.018]	[0.025]	[0.029]
N	44,661	40,128	52,610	15,148	9,248
No protection cond. on sex					
Peer teen preg * After	–0.136***	0.021	–0.073*	–0.132**	–0.023
	[0.039]	[0.059]	[0.044]	[0.061]	[0.115]
N	7,195	4,747	7,073	2,589	1,264
# of partners cond. on sex					
Peer teen preg * After	–0.155**	0.024	–0.124*	–0.081	–0.158
	[0.060]	[0.124]	[0.071]	[0.124]	[0.132]
N	7,195	4,747	7,073	2,589	1,264

Source: Addhealth Data

Notes: *** denotes the difference is statistically significant from zero at the .01 level, ** at the 0.05 level, and * at the 0.10 level. We estimate equation 1 for the subgroup indicated with the column heading. See table 2 for the estimated impacts for the entire sample.

Table 4: Impacts of Peer Pregnancy on Unprotected Sex, by Peer Characteristics

Dependent Variable	Unprotected Sex				
	Peer female	Same gender	Live birth	Age difference	Sibling teen preg
Peer teen preg * After [DD]	–0.008	–0.012	–0.004	–0.025***	–0.020*
	[0.015]	[0.014]	[0.014]	[0.009]	[0.011]
DD * female	–0.025				
	[0.018]				
DD * same gender		–0.021			
		[0.018]			
DD * live birth			–0.033*		
			[0.018]		
DD * age diff				0.006	
				[0.005]	
DD * peer is sibling					–0.018
					[0.021]
N	84,789	84,789	84,789	84,789	84,789

Source: Addhealth Data
Notes: *** denotes the difference is statistically significant from zero at the .01 level, ** at the 0.05 level, and * at the 0.10 level. We estimate equation 1 but allow for an additional interaction between the difference-in-difference variable and a peer characteristic. These peer characteristics are defined only for those with a peer teen pregnancy and correspond to the characteristic of the peer with the earliest teen pregnancy. The control group is often associated with multiple peer observations so there is no main effect for having a peer with a given characteristic. Age difference between peers is demeaned.

terminated early. We see no difference across peers with larger age differences.[17] But we do see that siblings experience about twice the response of those whose peer with the pregnancy was a friend. Again, this result is reasonable since siblings could potentially spend much more time together than friend groups.

Finally, we explore a number of robustness checks. First, Appendix Figure B1 shows results from event studies where we restrict the sample to balanced panels. As noted, respondents may have missing observations for certain age bins due to the timing of the surveys. Reassuringly results are similar in the balanced panel, although the estimates are noisier

[17] A much younger sibling may not be as aware of the consequences of the older sibling's teen pregnancy as a younger sibling who is closer in age. Indeed, Monstad, Propper and Salvanes (2011) find teen births are more highly correlated when siblings are closer in age for families in Norway. However, in our sample, friend peers are typically very close in age.

Table 5: Impacts of Peer Teen Pregnancy on Sexual Behavior, Robustness Checks

	Main results	Including wave 3	No prior teen preg	Cluster SE by neigh.
Unprotected sex				
Peer teen preg * After	–0.025***		–0.017*	–0.025***
	[0.009]		[0.009]	[0.009]
N	84,789		83,993	84,789
Sexually active				
Peer teen preg * After	–0.003	–0.003	0.004	–0.003
	[0.012]	[0.007]	[0.013]	[0.013]
N	84,789	172878	83,993	84,789
No protection cond. on sex				
Peer teen preg * After	–0.091***		–0.097**	–0.091***
	[0.033]		[0.040]	[0.030]
N	11,944		11,585	11,944
# of partners cond. on sex				
Peer teen preg * After	–0.116**	–0.040**	–0.134**	–0.116**
	[0.057]	[0.019]	[0.068]	[0.055]
N	11,944	48,324	11,585	11,944

Source: Add Health Data
Notes: *** denotes the difference is statistically significant from zero at the .01 level, ** at the 0.05 level, and * at the 0.10 level

due to the smaller sample size. Second, Table 5 summarizes additional checks. Column (1) replicates our preferred diff-in-diff specifications. Column (2) reports results including information from wave 3 for the variables that we can measure consistently (which unfortunately does not include birth control usage). Column (3) drops observations who themselves had a teen pregnancy before their peer's because we are especially worried here about the reflection problem. Column (4) clusters the standard errors by neighborhood instead of by individual to capture any correlations among people who live in the same neighborhood. Reassuringly the sign and magnitude of the results are quite similar across all specifications.

V Discussion and conclusions

In this paper, we seek to understand the impact of a peer's teen pregnancy on one's own sexual behavior. The Add Health data allows us to analyze the behavior of the respondent just after the teen pregnancy of a friend or older sibling in terms of their sexual activity, number of partners, use of birth control, and overall sexual behavior. We find that sexual behavior is impacted by exposure to a peer's teen pregnancy. In particular, we find that respondents who observe a peer's teen pregnancy are less likely to engage in unprotected sex, primarily through use of birth control, and are also more likely to have fewer sexual partners. These responses are primarily driven by females response to a peer's teen pregnancy rather than males and by peer teen pregnancies that result in a live birth. We cannot completely rule out that diverging trends drive our results to some extent. However, the lack of pre-trends in our event studies, the consistency of our results when using only not-yet treated observations as controls or when including neighborhood- and race-specific trends, and the fact that our results are concentrated among observations with live births, are all reassuring.

There are several likely explanations for why we observe a change in sexual behavior following a peer's teen pregnancy, particularly for females. Those who observe an older sibling's teen pregnancy (especially younger sisters) may be providing caregiving for the baby, which leaves less time to engage in risky sexual behavior. This is consistent with the findings of Heissel (2021), who found that younger sisters of those with a teen pregnancy spend up to 1.9 more hours per day on childcare and more than an hour less per day with friends than other females. Parents may also become more strict with the younger siblings after a peer's teen pregnancy and/or take their daughters to get long-acting reversible contraception as opposed to relying on their sons to make decisions at the moment of the sexual encounter.

These findings are relevant for policy makers who would like to reduce pregnancy among teenagers through informational programs. For example, the U.S. federal government established the Personal Responsibility Education Program (PREP) as part of the Affordable Care Act to provide funding for educational programs on both abstinence and contracep-

tion to prevent teen pregnancy and sexually transmitted infections. Our findings show that youth tend to be influenced by the actions of their friends and older siblings, and as a result, highlighting the experiences of teen pregnancy in teen pregnancy prevention programs may reduce risky sexual behavior. However, the effectiveness of such a campaign depends on whether the change in sexual behavior that we observe is driven by learning new information through their peer's teen pregnancy or by the fact that the peer's teen pregnancy hits close to home. If teens simply lack information about the consequences of teen pregnancy, providing this information in teen pregnancy prevention programs would be sufficient. However, it is more likely that the observed changes in sexual behavior in response to a peer's teen pregnancy are due to the closeness of the relationship with the peer. In this case, a teen pregnancy campaign would be most effective if it personally connects teens to the experience of teen pregnancy. For example, teen pregnancy prevention programs may increase their use of networks and platforms for people to share their experiences with teen pregnancy so that teens feel more connected to the stories. Alternatively, the programs could rely more heavily on community-based information, such as local statistics and anecdotes, as opposed to nationwide information which may not be as relevant. Our work has shown that teens update their sexual behavior when they observe a teen pregnancy up close, which should be considered by policymakers when developing effective teen pregnancy prevention programs.

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A Data Appendix

We create an analytic sample of respondents who have at least one friend or older sibling (including twins) also selected for the in-home survey and associate those focal observations with the earliest, if any, teen pregnancy among their peer group. We start by identifying Add Health respondents who have an older sibling or twin. The restricted-use Add Health data provides information on 3,139 sibling pairs. We lose 17 pairs because they do not have information on the date of birth of at least one sibling. Our unit of analysis is the younger sibling, and we give each twin in a pair their own observation. Including each twin pair increases our sample to 3,909 sibling pairs. We then lose 360 pairs because the sibling was not in the wave 3 or 4 survey to provide pregnancy information, resulting in 3,549 sibling pairs. However, 293 of these younger siblings are paired with multiple older siblings. We reshape the data so that each younger sibling only appears in the data once, with information about all of their older siblings contained in that observation. This results in a sample of 3,279 younger siblings. Finally, we lose 319 younger siblings because they do not have outcome data for at least two age bins in the analysis window around their older sibling's teen pregnancy. The final sample size is 2,960 respondents who have an older sibling or twin.

We then identify Add Health respondents who nominate at least one friend who was selected for the in-home survey. Of the 12,103 respondents in the wave I in-home sample, 10,952 nominated at least one friend. 4,233 were excluded because they either did not have at least one friend who participated in the in-home surveys or their friend did not remain in the sample until waves 3 or 4 when the pregnancy information was collected. 1,218 did not have outcome data for at least two age bins in the analysis window around their friend's teen pregnancy. The final sample size is 5,495 respondents who have at least one friend nomination.

Finally, we merge together the friend and sibling pairs samples to create our analytic sample of respondents who have either a friend or older sibling/twin who participated in

the in-homes surveys and remained in the sample until waves 3 or 4. There were 5,036 respondents who had at least one friend who fit these criteria, 2,393 respondents who had at least one sibling, and 456 respondents who had a friend and a sibling. The low rate of overlap between the friend and sibling sample is because of the low likelihood that a nominated friend would be selected to participate in the Add Health in-home survey (of the approximately 90,000 participants in the in-school survey, only 20,745 were selected to participate in the in-home survey). The final sample size for the analytic sample is 7,885 respondents.

Our key dependent variables for the analyses are whether the individual was sexually active, the number of sexual partners the individual has conditional on sexual activity, whether the individual ever had unprotected sex conditional on sexual activity, and whether the individual ever had unprotected sex unconditional on sexual activity (that is, equals one if they did not use birth control when they were sexually active and equals zero if they either always used birth control or were abstinent). Each of these variables was measured in three-month age-bin intervals leading up to and following the peer's teen pregnancy. These variables were created from the relationship rosters completed by respondents during waves 1 and 2 of the survey, in which respondents are asked to identify retrospectively up to three romantic relationships that occurred during the 18 months prior to the interview. For each romantic relationship, respondents were asked retrospectively whether they were sexually active in that relationship and the first and most recent date of sexual intercourse. Respondents were also asked retrospectively in waves 1 and 2 whether they used any type of birth control every time they had sex in each romantic relationship they identified. In wave 3, respondents were asked about their romantic relationships since the summer of 1995 and whether they used birth control the first and most recent time of sexual intercourse in each romantic relationship they identified (not every time they had sexual intercourse, like was asked in waves 1 and 2); because of this difference in the birth control question in wave 3 compared to waves 1 and 2 and due to the long retrospective period, we do not use the wave 3 information. As a robustness check, we estimate our analyses incorporating the wave 3

information when creating the sexual activity and number of partners outcomes to see how it affects our results.

A respondent is considered sexually active during a three-month age bin if the dates of sexual activity within any relationship reported in waves 1 or 2 overlap with the start and end date of the three-month age bin. The number of sexual partners during the three-month age bin is the number of relationships for which the dates of sexual activity overlapped with the three-month age bin. We avoid double counting relationships by dropping relationships that were ongoing at the time of the interview and reported in later waves with the same start date. Finally, the respondent is considered having unprotected sex conditional on sexual activity during the three-month age bin if they reported that they did not always use birth control in all sexual relationships reported in waves 1 or 2 that occurred during the three-month age bin. Our measure of having unprotected sex (not conditional on sexual activity) equals 1 if the respondent says they are sexually active during the three-month age bin but did not use birth control every time they had sex; it equals 0 if they are not sexually active during the three-month age bin or used birth control every time they had sex in all their relationships during that time.

All of our dependent variables are missing for 1) age bins that occur during a year in which the respondent reported a relationship but did not report the exact months the relationship started or ended, 2) age bins prior to 18 months before the wave 1 interview, and 3) age bins when the respondent has not yet reached that age by the wave 2 interview date.

B Appendix tables and figures

Table B1: Add Health sample size and ages

	Wave 1	Wave 2	Wave 3	Wave 4
Year	1994-95	1996	2001-02	2008-09
Age Range	11-21	12-22	18-26	24-32
Observations	20,745	14,738	15,197	15,701
Core observations	12,105	9,140	9,130	9,522

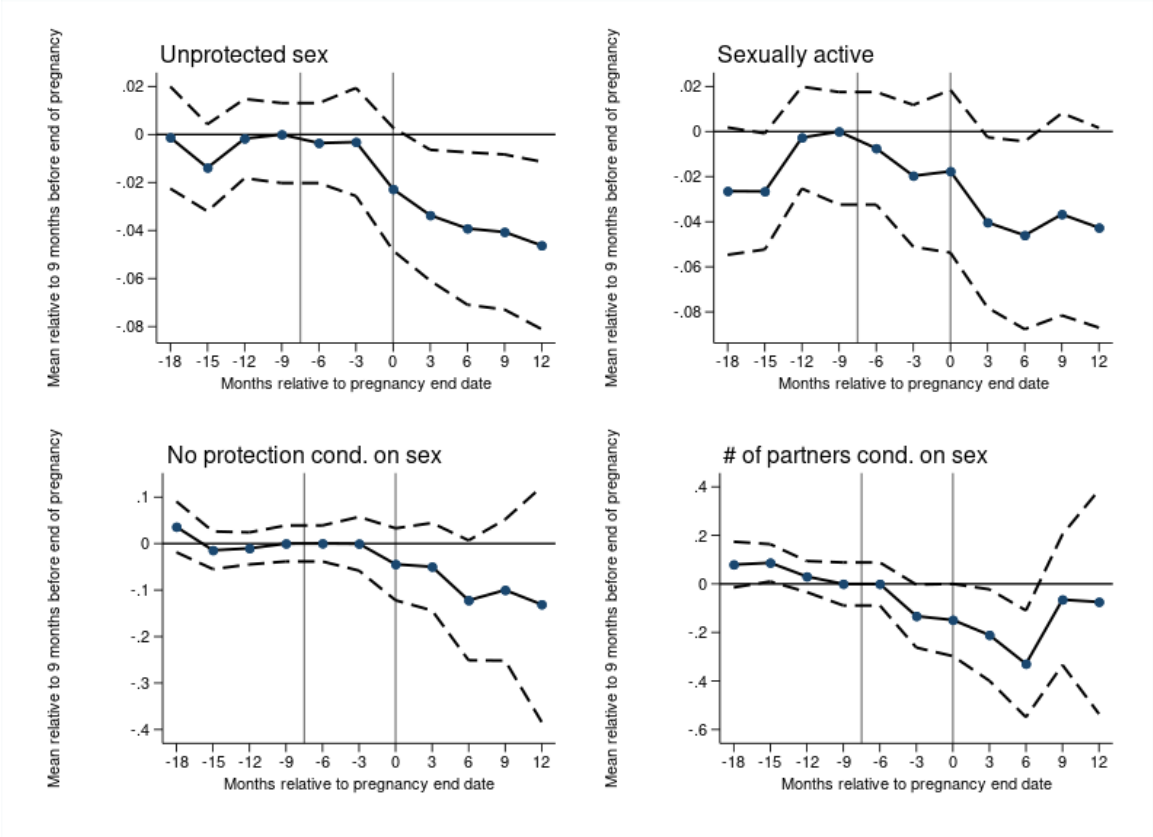
Notes: The Add Health survey drew a sample of students in 144 schools across the United States to participate in an in-school survey, and selected a subset of those students (the core sample) to participate in a series of five in-home waves conducted from 1994 to 2018; additional respondents were oversampled for the in-home interviews that included students who were Black, Cuban, Puerto Rican, or Chinese, students with physical disabilities, and siblings of the core sample. We use the first four waves of data for this study because all respondents had reached adulthood by wave 4.

Table B2: Using reporting by the mother on partner age to calculate the number of pregnancies by age

	Dad age		Total girl
Mom age	teen	20+	teen pregs
teen	1045	1097	2142
20+	350	10316	
Total boy teen pregs	1395		

This table shows the number of pregnancies reported in wave 4 by all females in the sampled population; we do not limit this to those in the sibling, friend or core sample. We find that out of the 3537 total teen pregnancies (1395 + 2142), 61% are to females.

Figure B1: Event study coefficients using a balanced panel



Source: Add Health data.
Notes: We plot regression estimates from equation 2 and their 95 percent confidence interval (dashed lines). The dependent variable "sexually active" equals one if the responded is sexually active in the indicated time window and is zero if they abstained. The dependent variable "no protection cond. on sex" equals one if the responded is sexually active and had unprotected sex in the indicated time window and is zero if they used protection. The dependent variable "# of partners cond. on sex" is the number of sexual partners the respondent had (if sexually active) in the indicated time window. The vertical lines represent just after nine months before (month -9) and the end of the peer's teen pregnancy (month 0). Regressions include individual and age group fixed effects and are corrected for staggered treatment windows using the approach of Sun and Abraham. The sample is limited to those respondents with a balanced panel.