

The Impact of Government Policies and Neighborhood Characteristics on Teenage Sexual Activity and Contraceptive Use

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Although a great deal of research has examined the determinants of adolescent sexual activity and contraceptive use, most researchers have focused on adolescents' personal characteristics and family backgrounds, to the neglect of variables more easily manipulated by policymakers. In this study we examined the effects of government policies and neighborhood context on adolescent female sexual behavior with the goal of providing better information to participants in the policymaking process.

We used data from the National Survey of Family Growth (NSFG), Cycle V for women aged 15 through 19 to jointly estimate the determinants of being sexually active, and, conditional on being sexually active, of using contraceptives at last intercourse. Our primary focus was on government programs and laws that may alter the costs of being sexually active and of using contraceptives. Parental notification and consent laws, Medicaid funding for abortions, and the availability of family planning and abortion services all are potentially important determinants of teenage sexual behavior, yet we know very little about their effects. Only 1 other study has examined the relation of the cost of obtaining an abortion to sexual activity and contraceptive use¹ and just a few studies have examined the impact of family planning clinics on teenage sexual behavior.^{2,3} Surprisingly, the only evidence of a link between family planning availability and teenage contraceptive use comes from evaluations of particular school-based or community-based programs.⁴⁻⁶ No study utilizing national data has documented such a relationship.

We were also interested in the effects of neighborhood characteristics on teenage sexual behavior. Although a number of researchers have examined the role these characteristics play in the determination of

Objectives. This study sought to examine the effects of government policies and neighborhood characteristics on adolescent female sexual behavior to better inform future public policy decisions.

Methods. Using a bivariate probit model and National Survey of Family Growth data on women aged 15 through 19 years, we estimated the probabilities of their being sexually active and, if sexually active, of their using contraceptives.

Results. Variables measuring the cost of obtaining an abortion are not good predictors of sexual activity or contraceptive use. However, the relationship between family planning availability and contraceptive use is statistically significant at conventional levels.

Conclusions. Policymakers seem to have little leverage with regard to influencing the decision to become sexually active, although increased access to family planning services may encourage responsible contraceptive behavior. Neighborhood context is an important determinant of adolescent female sexual behavior. (*Am J Public Health.* 2002; 92:1773-1778)

teenage sexual activity,^{2,3,7-9} little work has been done on the relationship between neighborhood-level variables and teenage contraceptive use.² Additional information on this relationship could be of use in effectively targeting government programs and in shaping sex education curricula. Moreover, adequate controls for neighborhood context are an essential step to obtaining accurate estimates of the effects of personal characteristics, family background, and government policies.

Finally, state sex-education requirements are potentially important determinants of adolescent sexual behavior. A large number of researchers have investigated the effect of self-reported sex education on the initiation of intercourse and the use of contraceptives, but the results of these studies are mixed (especially with regard to contraceptive use) and there are a number of drawbacks to using self-reported sex education measures.¹⁰ We avoid the drawbacks associated with self-reports by using information on state statutes that mandate the teaching of sex education in public schools. This is the first study to examine the impact of such mandates on teenage sexual behavior.

METHODS

The Empirical Model

A bivariate probit model was used to examine the decision to become sexually active, and conditional on being sexually active, the decision to use birth control. This model allows for explicit correlation between these decisions and can be described as follows. Consider an individual making 2 potentially related decisions as described by equations 1 and 2 below:

- (1) $S_i^* = \beta'x_{si} + \epsilon_{si}, S_i = 1 \text{ if } S_i^* > 0,$
0 otherwise
- (2) $C_i^* = \beta'x_{ci} + \epsilon_{ci}, C_i = 1 \text{ if } C_i^* > 0,$
0 otherwise,

where equation 1 represents the decision to have intercourse and equation 2 represents the decision to use contraceptives. Assume that ϵ_{si} and ϵ_{ci} are normally distributed with means of 0 and standard deviations of 1, and that ρ is the correlation between these 2 error terms. We do not observe S_i^* and C_i^* , only the signs, coded as above. In addition, note that in this model we only observe C_i if $S_i = 1$. In other words, we only observed an individual using contraceptives who decided

to become sexually active. Maximum likelihood estimation of this model, referred to as a bivariate probit with correction for sample selection, is straightforward.¹¹

The rationale for using a bivariate probit model as opposed to estimating 2 separate equations is that the decisions to engage in sexual activity and to use contraceptives are undoubtedly linked, and ignoring this relationship can lead to biased parameter estimates. For instance, a woman's desire for children, which is presumably unobservable and therefore included in the error terms, might be correlated with both the decision to become sexually active and the decision of whether to use contraceptives. Joint estimation of outcomes explicitly takes into account this correlation.

To estimate a bivariate probit model it is necessary to posit an identifying restriction. Usually this means that there must be at least 1 variable in x_{3i} that is not included in x_{2i} ; however, the identification problem is not always easy to solve and researchers often are forced to rely on functional form. Here we relied on the number of years since menarche, a measure of physical maturity, to identify the bivariate probit.

The estimated coefficients from the bivariate probit are not directly interpretable in terms of probabilities, but the marginal effects for the sexual activity outcome (i.e., the impact of a unit change in an explanatory variable on the probability of being sexually active) are straightforward to calculate:

$$(3) \quad \partial \text{Prob}(P=1) / \partial x = \varphi(\beta'x)\beta,$$

where φ is the standard normal density and the variables in the vector x are held constant at their sample means. The marginal effects for the contraception outcome (i.e., the impact of a unit change in an explanatory variable on the probability of using contraceptives at last intercourse) are also calculated at the sample means according to the same formula, conditional on selection (i.e., conditional on the individual's being sexually active).

Data Sources and Measures

The primary data source for this project was the NSFG, Cycle V, together with a number of secondary data sources noted in the Acknowledgments. The NSFG is a nationally

representative survey, conducted by the Research Triangle Institute under contract with the National Center for Health Statistics (NCHS), of 10 847 females who were between the ages of 15 and 44 years in 1995. Details with regard to the interview procedures are available elsewhere.¹² Briefly, interviews took place during the first 10 months of 1995 and focused on issues of reproductive health, pregnancy, and childbearing. Detailed demographic and family information was collected, although information having to do with respondents' labor market outcomes and opportunities was not. Particularly sensitive questions were heard over headphones, and

the respondent entered her own answers into a notebook computer.

Because our focus was on teen behavior, we restricted our sample to unmarried women aged 15 through 19 years. Means for this sample of 1 280 individuals are presented in Table 1. Thirty-eight percent of respondents reported that they were sexually active, defined as having had intercourse in the 3 months before being interviewed. Of those who were sexually active, only 70.2% reported using contraceptives during their last sexual encounter. Given current concern about high teenage pregnancy and sexually transmitted disease (STD) rates, this figure

TABLE 1—Sample Means and Standard Deviations: Data From the 1995 Wave of the National Survey of Family Growth, Unmarried Women Aged 15–19 Years

Variable	Total Sample	Sexually Active ^a
Sexually active	.380	...
Used contraceptives702
Used condom292
Black	.200	.227
Hispanic	.141	.142
Years since menarche	4.70 (1.87)	5.347 (1.773)
Age, y	16.96 (1.43)	17.540 (1.320)
No-parent household	.029	.045
Single-parent household	.287	.337
Parents' education, y	13.67 (2.82)	13.314 (2.684)
Household income <\$20 000	.250	.316
Household income >\$70 000	.182	.149
Raised as Catholic	.273	.264
Raised with no religion	.131	.178
Urban	.840	.834
Midwest	.235	.229
Northeast	.194	.207
West	.217	.201
Percentage tract Black	18.29 (26.22)	18.93 (26.24)
Percentage tract Hispanic	8.90 (14.52)	9.29 (15.40)
Median income in tract (\$1000s)	32.576 (12.926)	31.186 (11.929)
County unemployment rate	6.55 (2.30)	6.62 (2.05)
Family planning clinics (per 10 000 women aged 15–44 years in county of residence)	1.34 (2.07)	1.38 (2.17)
Sex education requirement	.470	.464
Abortion provider in county of residence	.623	.616
Medicaid funding of abortions	.334	.331
Parental notification or consent law	.351	.362
Sample size	1280	487

Note. Standard deviations for continuous variables in parentheses.

^a Sexually active is defined as having had sexual intercourse in the 3 months before being interviewed.

suggests the importance of identifying policies and practices that effectively discourage unprotected sex.

Vectors x_{si} and x_{ci} in equations 1 and 2, respectively, included personal characteristics and family background measures such as age, race, religion, parental education, family structure, and income. To capture the effects of peer and neighborhood influences, the vectors also included 3 dichotomous measures of region, the county unemployment rate, and 3 contextual variables measured at the census tract level (percentage tract Black, percentage tract Hispanic, and median household income). Number of years since menarche was included only in vector x_{si} . In other words, we assumed that physical maturity affects the probability of being sexually active, but not the probability of using contraceptives given that an individual is sexually active.

Three variables measure the cost of obtaining an abortion. The first indicates the existence of an abortion provider in the county of residence; the second indicates whether the state of residence allowed Medicaid to fund “therapeutic” abortions; and the third indicates the presence of a parental notification or consent law in the state of residence. Our interest was in whether, as the potential cost of an abortion falls, teenagers respond by either becoming sexually active or by failing to use contraceptives.

The availability of family planning services was measured by the number of family planning clinics per 10 000 women aged 15 to 44 years in the county of residence. This measure is possibly a reflection of the demand for, as opposed to the supply of, family planning services; however, “[e]vidence of both a positive relationship between individual contraceptive use and area-level family planning availability and a negative relationship between individual pregnancy and area-level availability suggests that area-level characteristics are likely to be measuring the supply of contraceptives.”^{13(p877)} Evaluations of school- and community-based programs suggest that offering subsidized contraceptives and easier access to family planning information should be associated with a greater probability of using contraceptives at last intercourse.^{4–6}

Finally, vectors x_{si} and x_{ci} included a dichotomous variable equal to 1 if the state of

residence required the teaching of some form of sex, health, AIDS, or family education in public schools, and equal to 0 otherwise. We also experimented with 2 alternative measures of state requirements, one indicating the existence of a state statute mandating the teaching of AIDS education, the other indicating the existence of a state statute mandating the teaching of proper condom use.

RESULTS

Variables

Table 2 presents bivariate probit coefficient estimates, standard errors, and marginal effects for our basic model. The first 3 columns display estimates of the sexual activity equation (equation 1); the second set of columns display estimates of the contraceptive use equation (equation 2).

Personal characteristics and family background variables are generally poor predictors of contraceptive use at last intercourse; however, in confirmation of findings of previous studies, they seem to play important roles in the decision to become sexually active. For instance, an additional year of age is associated with an increase of .098 in the probability of a respondent’s being sexually active. Living with one parent, as opposed to two parents, is associated with an increase of .133 in the probability of being sexually active, and being raised in a nonreligious household is associated with an increase of .129 in this probability. Years since menarche, the variable which identifies our model, is also positively related to being sexually active: each additional year since the age of menarche is associated with a .024 increase in the probability of having had intercourse in the 3 months before the interview date.

Interestingly, the coefficients of household income, parental education, race, and ethnicity are not statistically significant at conventional levels in either equation. Nevertheless, these factors are obviously correlated with neighborhood characteristics, and specifications without neighborhood-level variables on the right-hand side of the equation produced stronger personal and family background effects.

This pattern of results indicates the importance of controlling for neighborhood environ-

ment, and in fact Table 2 clearly indicates the existence of strong neighborhood influences. Median family income in the census tract is negatively related to the probability of being sexually active and positively related to the use of contraceptives. A 1-standard-deviation increase in median family income (an increase of approximately \$13 000 for the full sample) is associated with a decrease of .039 in the probability of having had intercourse in the past 3 months and an increase of .065 in the probability of having used contraceptives at last intercourse.

We also found some evidence of a negative relationship between the percentage of the tract that is Black and the probability of being sexually active, a result in keeping with previous research.² A percentage point increase in this variable is associated with a .002 decrease in the probability of being sexually active, although it should be noted that this relationship is significant at the .1, but not the .05 level ($P=.057$).

Neither region of the country nor living in an urban area seem to have independent effects on sexual behavior, controlling for neighborhood effects. The coefficient of the unemployment rate variable, which can be thought of as a measure of the opportunity cost to becoming pregnant, is not statistically significant in either equation.

Regarding the policy variables, our estimates provide little evidence that the cost of obtaining an abortion affects sexual behavior, nor is there evidence that the availability of family planning services is related to sexual activity. There is, however, some support for the hypothesis that female adolescent contraceptive behavior is sensitive to the availability of family planning services. Specifically, the presence of an additional family planning clinic per 10 000 women in the county of residence is associated with a .019 increase in the probability of using contraceptives at last intercourse. Although the relationship between contraceptive use and family planning availability is significant only at the .1 level ($P=.062$), our results may suggest that an increase in the supply of family planning services encourages the adoption of contraceptives without leading to increased sexual activity.

Our estimates provide no evidence whatsoever that requiring public schools to provide

TABLE 2—Bivariate Probit Coefficients and Marginal Effects: Determinants of Sexual Activity and Contraceptive Use Among Women Aged 15–19 Years, 1995 National Survey of Family Growth (NSFG).

Variable	Sexual Activity			Contraceptive Use		
	Coefficient	SE	Marginal Effect	Coefficient	SE	Marginal Effect
Constant	-4.470	.620	...	2.153	2.151	...
Black	.162	.141	.061	.073	.232	.017
Hispanic	-.032	.143	-.012	-.208	.219	-.050
Age	.261***	.037	.098	-.087	.112	-.021
Years since menarche	.065**	.027	.024
No-parent household	.548**	.236	.205	-.057	.336	-.014
Single-parent household	.301***	.089	.113	-.045	.162	-.011
Parents' education	-.027	.015	-.010	.013	.024	.003
Household income < \$20 000	.130	.094	.048	-.113	.138	-.027
Household income > \$70 000	-.002	.108	-.001	-.160	.177	-.038
Raised as Catholic	-.010	.096	-.003	-.085	.146	-.020
Raised with no religion	.344***	.132	.129	-.282	.192	-.067
Urban	-.061	.125	-.023	.052	.187	.012
Northeast	.045	.128	.017	.145	.190	.034
Midwest	-.036	.112	-.014	-.004	.172	-.001
West	-.169	.133	-.063	-.132	.228	-.031
Percentage tract Black	-.004*	.002	-.002	-.001	.004	-.0002
Percentage tract Hispanic	.001	.004	.0002	.003	.005	.001
Median income in tract (\$1000s)	-.008**	.004	-.003	.020***	.006	.005
County unemployment rate	-.007	.018	-.003	-.049	.037	-.012
Family planning clinics (per 10 000 women aged 15–44 years) in county of residence	-.010	.018	-.004	.079*	.042	.019
Sex education requirement	.001	.085	.0005	-.115	.131	-.027
Abortion provider in county of residence	.032	.103	.012	-.045	.148	-.010
Medicaid funding of abortions	.051	.110	.019	-.073	.166	-.017
Parental notification or consent law	.043	.101	.016	.026	.163	.006
Correlation coefficient (SE)						-.663 (.762)
Log-likelihood						-1029.102
Sample size						1 280

*Statistically significant at .1 level; **statistically significant at .05 level; *** statistically significant at .01 level (2-tailed test). Models include controls for missing county and tract variables.

sex, AIDS, or health education affects either teenage sexual activity or contraceptive use. Experiments with the 2 alternative measures of state educational requirements produced similar results. Neither the existence of a state statute requiring AIDS education nor the existence of a state statute requiring the teaching of proper condom use proved to be related to sexual activity or the use of birth control. These findings contradict recent research indicating that sex education encourages teens to become sexually active¹⁴ and suggest that state mandates with regard to classroom content do little to encourage the

adoption of more responsible contraceptive behavior.

Adding State and County Controls

Researchers working on issues related to public policy, fertility, and marriage are typically concerned with the potential biases introduced by unobservable factors correlated with the policies under investigation.¹⁵ Here too, unobservable factors may be important. For instance, the positive relationship between the availability of family planning services and contraceptive use may not be causal, but instead be due to norms of behav-

ior in counties in which there is easy access to family planning services.

Our approach to this problem is to augment our regression analysis with a number of additional controls, such as median household income at the county level, proportion of the county population with college degrees, proportion of the county population living in a rural environment, and proportion of the county population living in an urban environment. These controls are intended to capture social and behavioral norms potentially correlated with sexual behavior and the policy variables of interest in our study. We also in-

cluded the AIDS death rate in the county of residence as well as the number of syphilis and gonorrhea cases, respectively, per 100 000 population in the state of residence. These latter controls can be thought of as measuring an additional potential cost of becoming sexually active or not using a condom, and, in fact, there is some evidence that individuals respond to changes in this cost.^{1,16}

Coefficient estimates of this augmented regression model were very similar to those reported in Table 2. The presence of an additional family planning clinic per 10 000 women in the county of residence was still associated with a .019 increase ($P=.075$) in the probability of using contraceptives at last intercourse, whereas the coefficients of the other policy variables in the model remained statistically insignificant. The neighborhood effects and the effects of personal and family background characteristics remained essentially unchanged. Perhaps because they were measured at the state level, neither the syphilis nor the gonorrhea rates were statistically significant predictors of sexual behavior, although the AIDS death rate, which was measured at the county level, was insignificant as well.

DISCUSSION

Sex outside of marriage has become the norm for teens rather than the exception. This phenomenon has prompted a flood of research on the determinants of teenage sexual activity, but the focus has been on factors that are of little value from a policymaker's perspective. Although researchers have found that age, physical maturity, race, family structure, and socioeconomic status are important determinants of when an individual becomes sexually active,^{2,3,17–21} we know little about how adolescents respond to government programs and policies that potentially alter the costs of being sexually active and/or using contraceptives. By examining the role of policy incentives, we hoped to gain additional insight into how teenagers make decisions with regard to sexual activity and contraceptive use.

In recent years, Federal funding for the provision of family planning services has increased substantially.²² Concern is growing among politicians and the public, however,

that subsidy of birth control and provision of greater access to family planning information could encourage adolescents to become sexually active at an earlier age. Our results suggest that this concern is misplaced.

We found that the availability of family planning services, as measured by the number of clinics per 10 000 women in the county of residence, had no discernible effect on the probability that adolescent females are sexually active. In contrast, we found some evidence that family planning availability is linked to more responsible contraceptive behavior. Specifically, a 1-unit increase in our availability measure was associated with an increase of .019 in the probability of using some form of birth control at last intercourse, although it should be noted that this relationship was significant only at the .1 level. Because adolescents are especially dependent on publicly funded family planning providers,²³ further research in this area clearly is needed to inform current efforts at restructuring these programs.

Sex education instruction is another potentially important determinant of teenage sexual behavior. A number of researchers have investigated the effects of self-reported sex education on the initiation of intercourse and the use of contraceptives. The results from these studies have been mixed (especially with regard to contraceptive use), but, as noted in a review of the literature, because sex or AIDS instruction is often “integrated into a variety of other topics and may vary greatly in length, content, and quality, respondents often had to use their own criteria to determine whether they had, in fact, received sufficient instruction to say that they had been exposed to a program. This undoubtedly added considerable measurement error and possibly bias to [a] seemingly simple question.”^{10 (p342)}

We avoided the problems inherent to using self-reports by utilizing a dichotomous variable equal to 1 if the state of residence required some form of sex, health, AIDS or family education in public schools, and equal to 0 otherwise. We also experimented with 2 alternative measures of state requirements, one that indicates the existence of a state statute mandating the teaching of AIDS education, the other that indicates the existence

of a state statute mandating the teaching of proper condom use.

Estimates of the impact of requiring that sex education be taught in public schools were consistently insignificant. Although these results run counter to claims that the teaching of sex education encourages teens to become sexually active, they suggest that broad state mandates with regard to classroom content are not an effective means by which to encourage the adoption of “safe sex” practices. To investigate the possibility that state requirements do not directly translate into classroom practices, we estimated a specification in which state requirements were replaced by a dichotomous variable indicating whether an individual reported having received sex education instruction. This variable performed no better than state requirements as a predictor of sexual behavior.

For many young women, unprotected intercourse results in a pregnancy terminated by an abortion.²⁴ We employed 3 variables to measure the cost of this method of pregnancy resolution. None were statistically significant determinants of sexual activity or of contraceptive use. This pattern of results may indicate that female adolescents are unaware of the factors that affect the cost of obtaining an abortion and also highlights the limited impact of government policies on sexual behavior—especially compared with the impact of neighborhood context, which was found to be an important determinant of behavior.

Neighborhood-level variables were constructed using information from the respondent's census tract (containing approximately 4 000 individuals), a common level of analysis. Our results provided some evidence that teenage women living in tracts with a high proportion of Blacks may have a lower probability of being sexually active. In addition, we found that median household income measured at the census tract level was negatively related to the probability that an individual was sexually active, and positively related to the probability that birth control was used at last intercourse. Although a study by Brewster et al. found that neighborhood employment opportunities for females and the proportion of females divorced or separated were statistically significant determinants of teen contraceptive use,² this basic relationship be-

tween neighborhood household income levels and contraceptive behavior has not been documented by other researchers.

There are a number of possible mechanisms through which neighborhood context could affect behavior. For instance, a child growing up in a “bad” neighborhood could be directly influenced by the behaviors, aspirations, and actions of her peers. Alternatively, adult norms of behavior in the neighborhood could play a role, or it might be argued that institutional factors such as investments in schools, police behavior, or even job opportunities are being captured through neighborhood composition.²⁵

Whatever the mechanism, neighborhood context seems to be a more important determinant of adolescent female sexual behavior than the direct incentives created through government policies, in terms of both statistical significance and magnitude. Although we found some evidence that contraceptive use is influenced by the availability of family planning services, none of our other policy variables were in any way related to observed sexual behavior. This pattern of results suggests that policies that mold communities and neighborhoods will be more successful, or at least more influential, than policies aimed at changing the cost of family planning and abortion services. ■

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Contributors

S.L. Averett, D.I. Rees and L.M. Argys all contributed equally to the writing of this article and to the study design and data analysis, and conducted the data analysis together at the National Center for Health Statistics (NCHS).

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The National Survey of Family Growth collected extremely sensitive information from its respondents. To ensure that the identity of these respondents is kept se-

cret, no information with regard to state or county of residence is available to researchers. However, a large number of tract-, county-, and state-level variables are present in the data, and with the help of Linda Piccinino at the NCHS we were able to incorporate additional information. The original sources of these variables are the Alan Guttmacher Institute; the Bureau of Health Professionals, Office of Data Analysis and Management; the Centers for Disease Control and Prevention; J.F. Mertz, C.A. Jackson, and J.A. Klerman; T.N. Steinberg; and the US Bureau of the Census.

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