**How Teen Sexual Behavior Responds to Sexually Transmitted Disease Risks**

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## Abstract

This paper examines how teen sexual behavior responds to associated disease infection risks using the biannual 1993–99 waves of the Youth Risk Behavior Surveys. We estimate the effect of state level rates of AIDS and other sexually transmitted diseases on sexual behavior with probit regressions for the decision to have sex during the previous three months along with ordinary least squares, Tobit, and negative binomial models for the number of sexual partners during that time. We divide the sample by gender and include individual controls for age, grade, and race, as well as state level per capita income and birth rates and indicators for state and year. The results show that AIDS and gonorrhea rates are significantly negatively related to the probability that male teens have sex. Conditional on having sex, however, males do not respond to changes in risk. Female sexual behavior also appears unresponsive to infection risks.

## 1. Introduction

Various statistics from the biannual 1991–99 Youth Risk Behavior Surveys (YRBS) of the Centers for Disease Control and Prevention (CDC) show that kids in the U.S. are initiating sexual activity at strikingly early ages. For instance, 38 percent of 9th graders and 65 percent of 12th graders reported having previously engaged in sexual intercourse. Furthermore, 37 percent of high school students reported having sex, and 10 percent reported having multiple sex partners, in the past three months. Compounding matters is that youth sex often occurs without protection from disease or pregnancy risk. Only 57 percent of sexually active students used a condom the last time they had sex, and 17 percent used no birth control at all. Moreover, sexual activity increased during the latter half of the decade. The proportion of students having ever had sex increased by 4.6 percent from 1995–99 among 9th graders and by 6.6 percent from 1997–99 for 12th graders. Similarly, the fraction of students who had sex in the past 3 months at least once and with multiple partners rose by 4.3 percent and 7.6 percent, respectively, from 1997–99.

Apart from any policy actions that might be taken to reverse high and increasing rates of youth sex, one might imagine that sexual behavior trends would be subject to a natural cycle of ebbs and flows. In particular, like contagious diseases, "outbreaks" of risky behaviors such as youth or unprotected sex should be self-limiting, in that they lead to adverse consequences, namely sexually transmitted disease (STD), that will influence future cohorts to alter their behaviors. This decrease in risky behavior, in this case through increased abstinence or use of protection during sex, in turn reduces future rates of sexually transmitted disease. Some evidence that teen sexual behavior is cyclical in this way already exists. From 1991 to 1999, rates of condom and birth control use by sexually active YRBS respondents rose from 48 percent to 61 percent and from 80 percent to 84 percent, respectively, while teen birthrates declined by

20 percent. More generally, by 1999 syphilis rates had fallen by three-fourths from their peak in 1990, and gonorrhea rates had fallen by two-thirds from a brief plateau in 1985.

Thus an important question is, does teen sexual behavior respond to the risk of STD infection? Microeconomic theory predicts that increases in infection risk are akin to increases in the full price of risky behavior and therefore lead to declines in such behavior. However, conventional wisdom holds that not only are risky behaviors inherently inelastic to changes in "price," but that furthermore teens are less concerned about the adverse consequences of their actions, and thus are less responsive to changes in the risks of such consequences, than adults. For instance, a recent U.S. News and World Report article argues that teens might not perceive sexual behavior risks as accurately as do adults, because "teens [are] too young to fathom the consequences, both emotional and physical, of their behavior" (Mulrine 2002). With regard to STD risks, this view is supported by evidence from Levine (2001), who uses YRBS data from 1991–97 to examine whether changes in "prices" affect sexual activity and birth control use. Among other price measures, he uses state AIDS incidence rates to proxy for the risk of infection with AIDS, since, holding all else constant, as AIDS rates increase the likelihood of contracting AIDS during sexual intercourse rises. His results fail to reveal an effect of AIDS prevalence on lifetime or current sexual activity or current birth control use other than a negative effect on the probability that high school girls have ever had sex.

In contrast, two other econometric studies have concluded that risky sexual behaviors by teens and young adults are inversely related to the risk of contracting AIDS, again using state AIDS rates to proxy for AIDS infection risk. Ahituv et al. (1996) uses National Longitudinal Survey of Youth data from 1984–90 to investigate the relationship between state AIDS prevalence and condom use by young adults. They find a strong positive relationship, and more generally that even after controlling for factors such as perceived health risks and more convenient contraceptive options like the pill, over half of the difference in increased condom use is explained by increased AIDS incidence. Altman-Palm and Tremblay (1998) study the effect of state-level AIDS prevalence on state teen pregnancy rates using state data from 1989 and 1992. They find that when the incidence of AIDS doubles, adolescent pregnancy and abortion rates significantly decline, but that small changes in AIDS rates do not affect pregnancy or abortion rates.

This paper examines the effect of state prevalence rates of AIDS and other STDs on teen sexual behavior using the biannual 1993–99 waves of the YRBS. It is similar to Levine (2001) but includes data from the 1999 survey, which was not yet released at the time of his study, and omits the 1991 survey because of a change in the CDC definition of AIDS that took effect in 1993 (as outlined below). It also looks at additional measures of sexual behavior, specifically the number of recent partners and condom use, that he did not examine. Moreover, it examines the impact not only of other STDs, but also of two other state level factors, per capita income and teen birth rates, for which he did not control.

Each of these latter two variables, state teen birth rates and per capita income, is important to include because of its potential relationship with sexual behavior. Across states and years included in the YRBS, state AIDS rates are positively correlated with teen birth rates and negatively correlated with per capita income, even controlling for fixed state effects. Thus, if state teen birth rates and per capita income affect individual sexual behavior, excluding these variables from the analysis will produce omitted variable bias in the estimates of the impact of state AIDS and other STDs. Evidence from Ruhm (2000) that several risky behaviors, including smoking, obesity, physical inactivity, and unhealthy diets (as well as total mortality and most sources of fatalities), fluctuate procyclically suggests that state per capita income might positively affect teen sexual behavior. Similarly, evidence from Evans et al. (1992) of strong teen pregnancy peer group correlations suggests a positive relationship between teen sexual activity and state teen birth rates, since teen births indicate unprotected sex by teens.

The analysis uses probit regressions for the decision to have sex during the previous three months along with ordinary least squares, Tobit, and negative binomial models for the number of sexual partners during that time. We divide the sample by gender and include indicators of individual age, grade level, and race, as well as indicators of survey year and state of residence. The results show that AIDS and gonorrhea rates are significantly negatively related to the probability that male teens have sex. Conditional on having sex, however, males do not respond to changes in risk. Female sexual behavior also appears unresponsive to infection risks. For males, the probability of having sex is also positively related to the state teen birth rate and negatively related to state per capita income. The paper further addresses how various measures of self-esteem affect teen sexual behavior among males, generally showing that self-image is directly related to sexual activity.

## 2. Data

Sexual behavior data come from the Youth Risk Behavior Survey (YRBS), administered by the CDC nationally to high school students in each odd-numbered year from 1991–99. The purpose of the YRBS is to monitor behaviors of teens that are likely to influence their health. Along with behaviors involving substance use, diet, and physical activity, the survey focuses on "sexual behaviors that result in HIV infection, other sexually-transmitted diseases, and unintended pregnancies." It should be noted that because YRBS collects information only from teens enrolled in high school at the time of the survey, the data do not represent the teen population as a whole. In particular, since high school dropouts are by definition more risk seeking than their enrolled counterparts in at least one observed way, they might be more likely to engage in risky sexual behavior.

Most of our sexual behavior measures are constructed from a single YRBS question regarding the number of people with whom the respondent had sexual intercourse during the past three months. We not only analyze this variable itself, but also use this information to create indicators of whether students have had at least one partner and more than one partner in the previous three months. We also examine indicators of condom and birth control use based on separate questions asking whether a condom, and what specific type of birth control, was used the last time the respondent had sexual intercourse.

Analyses are performed separately by gender. Beyond that, most YRBS questions inquire about behaviors that would be endogenous if included as explanatory variables in the regressions. Thus, for most of the analysis, the only respondent characteristics included as controls are indicators for each grade from 10–12 (with $9^{th}$ grade omitted), each age from 15–18 (with age 14 omitted), and black, Hispanic, Asian, and other race/ethnicity (mutually exclusive, with white omitted). However, the latter part of the paper also includes various measures that serve as proxies for self-esteem, including indicators for whether respondents are trying to lose, gain, or maintain their weight (with not having a weight goal omitted), describe their weight as very underweight, slightly underweight, slightly overweight, or very overweight (with "about right" omitted), and played on a sports team in the past year, along with variables for the number of days in the past week that the respondent lifted weights and exercised for at least 20 minutes.

The remaining explanatory variables are state-level data from separate sources that are merged to YRBS responses according to state of residence and year of interview. The HIV/AIDS Surveillance Report (http://www.cdc.gov/hiv/stats/hasrlink.htm) provides annual AIDS incidence rates per 100,000 state residents. We multiply this variable by 100 (so that rates are per 1,000 residents) for expository purposes. Because the CDC altered its definition of AIDS in 1993 (to include cases that would not have previously been classified as AIDS), and no consistent time-series of state prevalence rates that includes years both before and after 1993 is available, we omit data from the 1991 YRBS and use only the 1993–99 surveys.

Birth rates among women aged 15–19 come from the National Vital Statistics Report (http://www.cdc.gov/nchs/products/pubs/pubd/nvsr/nvsr.htm). Our variable measures the number of live births per 100 state residents in this cohort. Data are also available on the analogous variable for women 15–17 year olds, but we do not consider this group separately because the results are very similar regardless of age group.

Rates of gonorrhea, syphilis (primary & secondary and all cases), and chlamydia rates per 100 state residents come from the annual Sexually Transmitted Disease Surveillance Reports of the CDC (http://www.cdc.gov/nchstp/dstd/Stats_Trends/Stats_and_Trends.htm). Details on symptoms and consequences of these STDs are available from these reports. An important difference between AIDS and these other STDs are that all of the latter are bacterial and thus can be cured with antibiotics.

State per capita income levels are reported by the Bureau of Economic Analysis (http://www.bea.doc.gov/). These are converted to 1999 dollars using the CPI for all urban consumers.

**3. Methods**

The basic methodology of the paper is regression of a sexual behavior dependent variable, Y, on a vector of state level explanatory variables S, including prevalence rates of AIDS and other STDs, per capita income, teen birth rates, and indicators for state of residence, and a vector of individual indicators I for age, grade, race, and interview year:

$$Y = \hat{a}_0 + \hat{a}_1 S + \hat{a}_2 I + \mathring{a},$$

where å is a normally distributed error term. All regressions are estimated separately by gender, and using probability (sampling) weights. The specific regression techniques employed are probit, OLS, tobit and negative binomial, depending on the format of the dependent variable under consideration. For OLS models, $R^2$ statistics are reported. For other techniques, we report the pseudo $R^2$ statistic, which is equal to $1 - L_e/L_c$, where $L_e$ and $L_c$ are the log-likelihood functions for the estimated and a constant-only model, respectively. We estimate nine different regression models that vary according to dependent variable, sample, and regression technique, as the following chart outlines.

| Model | Dependent variable | Sample | Method |
|---|---|---|---|
| 1 | At least one partner | All respondents | Probit |
| 2 | More than one partner | All respondents | Probit |
| 3 | Number of partners | All respondents | OLS |
| 4 | Number of partners | All respondents | Tobit |
| 5 | Number of partners | All respondents | Negative binomial |
| 6 | More than one partner | Those who had sex | Probit |
| 7 | Number of partners | Those who had sex | OLS |
| 8 | Condom use | Those who had sex | Probit |
| 9 | Birth control use | Those who had sex | Probit |

For each gender, the samples used in models 1–5 include all respondents. The dependent variables in models 1 and 2 are binary indicators of having had sex with at least one partner and more than one partner, respectively, in the past three months. Since these variables are binary, we estimate these models using the probit regression technique. Probits are preferred to OLS in this scenario because probit predicted probabilities are restricted to values between zero and one. Since estimated probit coefficients are in standard normal terms and thus are not easy to interpret, we report coefficients and standard errors in terms of marginal effects on the change in probability of the dependent variable, which are calculated as derivatives with respect to continuous variables and as discrete changes from zero to one in indicator variables. Marginal effects are evaluated at the means of the explanatory variables.

The dependent variable in models 3, 4 and 5 is the number of partners. This variable is censored on both ends, with a lower limit of zero and an upper limit of six, the latter because the YRBS questionnaire lists “6 or more” as the maximum choice for number of partners. Model 3 treats the number of partners as a continuous variable, ignoring its censoring and integer nature, and estimates the regression using OLS.

Model 4 estimates a Tobit model that takes into account both censoring points. Tobit regression incorporates the possibility that individuals who choose “six or more” partners might have in fact had more than six partners, as well as the possibility that those who choose no partners might vary in their degree of resolve to not have sex, assuming that in theory the chosen number of partners could be less than zero. [The vast majority of censoring is at zero, so Tobit models produce nearly identical results regardless of whether they adjust for the upper limit, and models only adjusting for the upper limit produce results nearly identical to those of OLS.] Tobit coefficients (and standard errors) are reported because they are also the marginal effects for the unobserved latent number of partners variable that in reality extends below zero and above six. But the marginal effects for the observed censored number of partners variable, which equal the Tobit coefficient multiplied by the fraction of observations that are not censored, are also provided.

Model 5 makes use of the fact that the number of partners takes on non-negative integer values, and can thus be estimated using a count data model. The standard model of this type is a Poisson regression model, but we use a negative binomial model, which is similar but allows for the dependent variable to have a larger variance than mean. Negative binomial coefficients can be interpreted in the same way as log linear regression coefficients, and thus the marginal effects (evaluated at the mean) are simply the coefficients multiplied by the mean number of partners.

The samples for models 6–9 are restricted to respondents who have had sex in the past three months. Models 6 and 7 mimic models 2 and 3. Models 8 and 9 are probit regressions in which the dependent variables are indicators that the respondent used a condom and any birth control, respectively, during the last episode of intercourse.

Since our main explanatory variables are measured at the state level, our regressions include state (and year) indicators. The coefficients on the state-level variables are therefore identified by changes of these variables within states over time. As a result, we omit YRBS data from respondents in states that have only been sampled during one of the four surveys during 1993–99, though we check the sensitivity of our results to this restriction.

**4. Results**

Table 1 presents the descriptive statistics for males, who are the focus of the analysis based on the results to be presented later in this section. The top panel presents information on the dependent variables, first for all respondents, including those reporting no sexual contact in the past three months, and then a sample restricted to those reporting at least one partner in that time. There are 23,106 males in the sample, thirty-six percent of whom had at least one partner in the past three months. Of these, another 37 percent report having more than one partner. The average number of partners is less than one, but almost two for those who had at least one partner. Among males reporting sexual activity, roughly two in five did not use a condom the last time they had sex while one out of seven failed to use any type of birth control.

The middle panel displays summary statistics for the state-level explanatory variables. Each year about one out of every 19 women aged 15–19 gives birth and one in 4,000 individuals is diagnosed with AIDS. Among the other STDs, chlamydia is most prevalent, followed by gonorrhea and syphilis, with most syphilis cases being beyond the secondary stage. The bottom panel shows the percentage of the sample in each age (14 years old excluded), grade (freshmen excluded), and race (white excluded) category.

Tables 2–8 present regression results. Table 2 gives results for the state-level explanatory variables for various specifications of model 1, probit regressions for having at least one partner in the past three months, for males. Column 1 shows our baseline model, which includes all variables except non-AIDS STD prevalence. AIDS prevalence rates are significantly negatively related to having sex. One additional AIDS case per 10,000 residents – an AIDS rate increase of 0.1 – reduces the propensity to have sex by 3 percentage points. This translates to an elasticity of about –0.22: a 10 percent increase in the AIDS rate will decrease the probability of having sex by 2.2 percent. Teen birth rates are strongly positively associated with having sex. An additional teen birth per 100 teen women increases the propensity to have sex by 11 percentage points, which translates to an elasticity of 1.67. In contrast with the findings of Ruhm (2000), teen sex is counter cyclical, as per capita income has a significant negative effect. An additional 1,000 in per capita income reduces the propensity to have sex by 3.6 percentage points, translating to an elasticity of –2.57.

Columns 2–5 of Table 2 each include rates of one additional STD, while column 6 includes rates of all four non-AIDS STDs. The parameter estimates for the three state-level variables included in all columns are quite stable, though per capita income loses significance in column 5, and the AIDS rate standard error rises slightly in column 6. The only STD besides AIDS that significantly affects the probability of having sex is gonorrhea. In column 2, an increase in the gonorrhea rate of 0.1, or 1 person per 1,000, reduces the propensity to have sex by 5.3 percentage points, which equates to an elasticity of –0.21. Its coefficient in column 6 is similar. Since all other STDs are insignificant and their inclusion does not affect results for the other variables, we henceforth exclude them from the regressions and use the column 2 model in remaining models.

Table 3 shows the full results for models 1–5 for males, with the first column replicating the specification in column (2) of Table 2. The results for models 2–5 are similar to those for model 1. Regarding the state-level variables, effects on having more than one partner are weaker (except for per capita income) than they on having sex, but all are significant in the same direction. Moreover, since only 37 percent of sexually active males have had more than one partner, the smaller marginal effects translate to similar or, in the case of per capita income, larger elasticities. Significance levels for the OLS number of partners equation are similar to those in the at least one partner equation, with larger marginal effects again translating to larger elasticities based on the relative magnitudes of the dependent variable means. Tobit and negative binomial significance levels are also quite similar, with marginal effects that are slightly larger than OLS marginal effects. In sum, the effects of the four state-level variables on sexual behavior are insensitive to specification of the dependent variable and regression technique. Generally, the statistical significance is 99 percent for AIDS and birth rates, 95 percent for the gonorrhea rate, and 90 percent for per capita income.

As for the remaining variables, in all models sexual activity increases with age, is highest for freshmen (holding age constant), and increased in 1999 relative to earlier survey years. Whites are more sexually active than Asians but less active than blacks and Hispanics.

Models 1–5 in Table 3 include all males and focus on the decision whether, and with how many partners, to have sex. Models 6–9 focus on decisions, regarding how many partners with whom to have sex and whether and what type of birth control to use, conditional on already having decided to have sex, and thus restrict the sample to males who have had sex in the past three months. Unlike the earlier results, regression coefficients for the state-level explanatory variables in Table 4 are uniformly insignificant. Apparently, once males decide to have sex, STD risks, peer sexual activity, and economic conditions no longer affect sexual behavior decisions. Age, grade, and race maintain importance in the decision to have sex with multiple partners, and grade and race significantly determine the number of partners. Condom use decreases with age (holding grade level constant), but otherwise individual characteristics show little relationship with condom and birth control use decisions.

Table 5 shows the results for the state-level variables in all nine models for females, with the table transposed in the sense that models vary across rows while explanatory variables vary across columns. Except for a positive relationship between AIDS rates and use of any birth control, STD rates do not significantly affect female sexual behavior decisions. Other than a positive effect of per capita income on condom use, no other state level variables are significant in any of the regressions in the samples restricted to sexually active females. In the sample of all respondents, birth rates are significant, albeit with smaller magnitudes and significances than for males, and per capita income negatively affects the number of sex partners. Not surprisingly, Wald tests for joint significance of the four state-level variables are insignificant at the 90 percent level except for the two models, 4 and 5, in which both the birth rate and per capita income are significant and one of those is significant at the 95 percent level.

Since the state-level variables are largely insignificant for regressions with the sexually active male and both female samples, the remainder of the analysis concentrates on the sample of all male respondents. Table 6 illustrates the sensitivity of our results to excluding respondents whose state was only represented in one of the four surveys during 1993–99. The panel (a) sample includes all male survey respondents, while panel (b) restricts the sample to respondents from states that were sampled in all four of the surveys during the period. In each case AIDS rate results are slightly weaker than those presented in Table 3. The effects of the gonorrhea rate in panel (a) are quite similar to Table 3, but those in panel (b) are 40-50 percent larger in magnitude. In both panels, the results for the birth rate and per capita income are quite similar to those shown earlier. Overall, the results are not strongly influenced by our sample selection strategy.

To show how the fixed effects of state of residence vary, Table 7 ranks the largest and smallest state indicator coefficients for each model. These coefficients measure sexual behavior in each state, holding constant other observed factors, relative to that in Alabama, which is excluded because as the state in which Dr. Bishop attended graduate school it is surely unique. We consistently find that males living in New York and Massachusetts are the most sexually active, while those living in Arizona and Mississippi are the least. Relative to teens in Alabama, New Yorkers are 63 percentage points more likely to have had sex in the past three months and had from 2 to 5 more partners depending on the model, while Arizona teens are 12 percentage points less likely to have had sex and have from 0.3 to 1 fewer partners.

Table 8 introduces the set of self-esteem variables described in the data section to the models in Table 3 to measure how self-esteem variables affect teen male sexual behavior decisions. We expect males with higher self-esteem to be more sexually active, although the reverse might be predicted for females. Only about 19 percent of respondents are trying to maintain their weight, while 56 percent are trying to either gain or lose weight. The remaining 25 percent do not have a weight goal. Nonetheless, 73 percent of respondents consider themselves to be at about the right weight, with the majority of remaining students perceiving themselves to be overweight. The other three self-esteem variables address physical fitness. The average number of days spent lifting weights in the past week is 3.3; roughly 65 percent of respondents participated in a team sport; and the mean number of days spent exercising for 20 minutes or more in the past week is 4.2.

Model 1 shows that gainers are about 7 percentage points more likely, underweight students are 7 percentage points less likely, and very overweight students are about 13 percentage points less likely to have at least one partner. An extra day of imitating Brad Salin increases the likelihood of having sex by one percentage point, but other physical fitness variables do not appear to have a significant impact on the sex decision. The results for the other four models are similar except that being very overweight is not again significant. The Tobit and negative binomial models produce nearly identical results, with magnitudes of significant coefficients in the latter being about one-half of the former. Overall, those attempting to gain weight and spending more days lifting weights are more sexually active, supporting our self-esteem hypothesis if weight gainers and lifters have higher self-esteem than others. Similarly, those who consider themselves underweight, which might be a sign of lower self-esteem for males, are less sexually active.

**5. Conclusion**

For male high school students, AIDS and gonorrhea rates appear to have significant negative effects on the decisions of whether and with how many partners to have sex. This supports the hypothesis that AIDS and gonorrhea rates reflect perceived risks of infection with those diseases along with the theory that teen behavior responds to the risks associated with sex. Moreover, male teen sexual activity is correlated with peer sexual activity, as reflected by teen birth rates, and is counter cyclical.

However, once the decision has been made to have sex, male teens fail to respond to any of these state-level variables. It is possible that teen males are more responsive to the risks associated with sexual behavior prior to having sex for the first time. They could be wary of the "unknown." Once the decision to have sex has been made, though, they break through this barrier and become less fearful of the possible negative results. Those that do not see immediate negative repercussions begin to feel invincible and think that "it won't happen to me." Or, those who select themselves to have sex might be the ones who have sufficiently little risk aversion to not be affected by disease risk. In addition, female sexual behavior is unresponsive to perceived risks, peer behavior, and economic conditions.

The male results differ from those of Levine (2001). One reason might be the difference in sample period, as his data included the 1991 YRBS but not the 1999 survey. Another might be that because of this, he had to impute AIDS rates for part of his sample period in order to generate a series that used a consistent AIDS definition. A third, and perhaps more likely, reason for the difference is our inclusion of the two additional state-level variables, in particular the teen birth rate. Although not shown, AIDS rates lose their significance when the birth rate is not included. A possible explanation for this is that AIDS rates proxy not only perceived risk but also peer sexual behavior, so that in theory the effect of AIDS rates on sexual behavior is indeterminate. Inclusion of the birth rate might isolate the risk component of the AIDS rate by separately controlling for the peer sexual behavior correlation.

These results also differ from those of Ahituv et al. (1996), who find a strong AIDS rate effect on condom use. The reason for this might be that their sample was much older, ranging in age from 19 to 33. For that cohort, which has much higher rates of sexual activity than 14–18 year olds, protection against STDs might be the only margin along which individuals are likely to respond to infection risks. Another reason might be the difference in the sample periods.

An implication of these results is that programs that reduce rates of AIDS and other STDs will have the unintended effect of increasing male teen sexual activity by reducing its riskiness. Another is that programs that reduce teen sex might have a multiplier effect through peer sexual behavior correlations.

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**Table 1**
**Summary Statistics for Males**

| | Mean | Standard Deviation |
|---|---|---|
| **Sexual Behavior in Past Three Months** | | |
| *All Respondents (n = 23, 106)* | | |
| At least one partner | .363 | .481 |
| More than one partner | .133 | .340 |
| Number of partners | .670 | 1.246 |
| *Sexually Active Respondents (n = 9,724)* | | |
| More than one partner | .367 | .482 |
| Number of partners | 1.846 | 1.451 |
| Condom used last time | .629 | .483 |
| Birth control used last time | .839 | .367 |
| **State-level Explanatory Variables** | | |
| Per capita income (in 10,000s) | 2.602 | 2.687 |
| Birth rate for 15-19 year olds (per 100) | 5.400 | 1.270 |
| AIDS rate (per 1,000) | .260 | .196 |
| Gonorrhea (per 100) | .143 | .087 |
| Syphilis (per 100) | .022 | .019 |
| Primary / Secondary Syphilis (per 100) | .005 | .007 |
| Chlamydia (per 100) | .219 | .075 |
| **Individual Explanatory Variables** | | |
| *Age* | | |
| 15 | .215 | .411 |
| 16 | .269 | .444 |
| 17 | .265 | .441 |
| 18 | .162 | .369 |
| *Grade* | | |
| 10 | .243 | .429 |
| 11 | .260 | .438 |
| 12 | .256 | .436 |
| *Race* | | |
| Black | .137 | .344 |
| Hispanic | .100 | .300 |
| Asian | .033 | .179 |
| Other | .081 | .273 |

Note: Summary statistics are weighted using YRBS sampling weights. All sexual behavior variables except number of partners and all individual explanatory variables are binary indicators. Explanatory variable summary statistics are for all respondents. Sample sizes are 9,626 for condom use and 9,490 for birth control use.

**Table 2**
**Probits for Having At Least One Sex Partner – Males**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| AIDS Rate | -.304[a] | -.296[a] | -.304[a] | -.305[a] | -.326[a] | -.318[b] |
| | (.111) | (.111) | (.113) | (.111) | (.120) | (.138) |
| Birth Rate | .112[a] | .110[a] | .112[a] | .112[a] | .112[a] | .113[a] |
| | (.030) | (.030) | (.030) | (.030) | (.032) | (.032) |
| Per Capita Income | -.359[c] | -.360[c] | -.359[c] | -.360[c] | -.323 | -.357[c] |
| | (.202) | (.202) | (.205) | (.205) | (.207) | (.214) |
| Gonorrhea Rate | | -.527[b] | | | | -.496[b] |
| | | (.235) | | | | (.232) |
| Primary & Secondary | | | -.012 | | | .756 |
| Syphilis Rate | | | (1.142) | | | (3.908) |
| Overall Syphilis Rate | | | | .027 | | .235 |
| | | | | (.566) | | (1.907) |
| Chalamydia Rate | | | | | -.015 | .022 |
| | | | | | (.158) | (.177) |
| Sample Size | 23,106 | 23,106 | 23,106 | 23,106 | 22,332 | 22,332 |

Note: Coefficients are marginal effects on the probability of reporting at least one sex partner in the past three months. Standard errors are in parentheses. Superscripts [c], [b], and [a] indicate significance at the 90, 95, and 99 percent levels, respectively. Regressions use sampling weights and include indicators for age, grade, race, state, and year.

**Table 3**
**Sexual Behavior Regressions for Males (n = 23,106)**

| Method | **At least one partner** Probit | **More than one partner** Probit | **Number of partners** OLS | **Number of partners** Tobit | **Number of partners** Neg. Binomial |
|---|---|---|---|---|---|
| AIDS Rate | -.296[a] | -.121[c] | -.752[a] | -2.121[a] | -1.044[a] |
| | (.111) | (.068) | (.268) | (.699) | (.378) |
| | | | | *-.817* | *-.699* |
| Gonorrhea Rate | -.527[b] | -.245[c] | -1.043[c] | -3.454[b] | -1.687[b] |
| | (.235) | (.137) | (.591) | (1.470) | (.787) |
| | | | | *-1.33* | *-1.130* |
| Birth Rate | .110[a] | .044[b] | .260[a] | .838[a] | .429[a] |
| | (.030) | (.019) | (.070) | (.197) | (.104) |
| | | | | *.322* | *.287* |
| Per Capita Income | -.360[c] | -.283[b] | -.800[c] | -2.534[c] | -1.374[c] |
| | (.202) | (.125) | (.485) | (1.346) | (.753) |
| | | | | *-.976* | *-.920* |
| Age 15 | .108[a] | .093[a] | .216[a] | .783[a] | .418[a] |
| | (.028) | (.022) | (.055) | (.196) | (.122) |
| 16 | .207[a] | .152[a] | .439[a] | 1.480[a] | .759[a] |
| | (.032) | (.027) | (.077) | (.234) | (.140) |
| 17 | .284[a] | .169[a] | .539[a] | 1.890[a] | .894[a] |
| | (.035) | (.031) | (.085) | (.253) | (.149) |
| 18 | .351[a] | .236[a] | .714[a] | 2.300[a] | 1.100[a] |
| | (.038) | (.041) | (.095) | (.274) | (.158) |
| Grade 10 | -.040[c] | -.041[a] | -.132[b] | -.371[b] | -.226[b] |
| | (.020) | (.012) | (.057) | (.159) | (.090) |
| 11 | -.050[c] | -.052[a] | -.222[a] | -.522[a] | -.324[a] |
| | (.025) | (.013) | (.072) | (.189) | (.105) |
| 12 | -.007 | -.066[a] | -.233[a] | -.383[c] | -.292[b] |
| | (.030) | (.015) | (.081) | (.210) | (.115) |
| Black | .286[a] | .253[a] | .933[a] | 2.060[a] | 1.010[a] |
| | (.016) | (.016) | (.056) | (.112) | (.053) |
| Hispanic | .088[a] | .078[a] | .224[a] | .653[a] | .386[a] |
| | (.016) | (.013) | (.039) | (.108) | (.063) |
| Asian | -.134[a] | -.012 | -.163[a] | -.925[a] | -.424[a] |
| | (.024) | (.020) | (.047) | (.216) | (.142) |
| Other | .077[b] | .101[a] | .240[a] | .620[a] | .370[a] |
| | (.029) | (.022) | (.060) | (.174) | (.087) |
| 1995 | -.023 | .002 | -.001 | -.028 | .051 |
| | (.023) | (.014) | (.055) | (.151) | (.084) |
| 1997 | -.006 | .011 | .013 | .078 | .099 |
| | (.040) | (.024) | (.088) | (.259) | (.145) |
| 1999 | .111[c] | .085[b] | .269[c] | .907[b] | .530[b] |
| | (.066) | (.047) | (.147) | (.411) | (.225) |
| (Pseudo) $R^2$ | .0734 | .0879 | .0921 | .0404 | .0380 |

Note: Probit coefficients are marginal effects. Standard errors are in parentheses. Marginal effects are in italics for Tobit and negative binomial regressions. Tobit marginal effects equal the product of the coefficient with the ratio of the numbers of uncensored (8,901) and total observations. Negative binomial marginal effects equal the product of the coefficient with the mean number of partners. Regressions use sampling weights and include state indicators.

**Table 4**
**Sexual Behavior Regressions for Males Reporting At Least One Partner**

| Method | More than one partner Probit | Number of partners OLS | Condom used last time Probit | Birth control used last time Probit |
|---|---|---|---|---|
| AIDS Rate | -.091 | -.660 | .045 | .017 |
| | (.174) | (.488) | (.179) | (.125) |
| Gonorrhea | .263 | .516 | -.166 | -.032 |
| | (.333) | (.955) | (.341) | (.243) |
| Birth Rate | .010 | .188 | -.055 | .016 |
| | (.048) | (.133) | (.049) | (.033) |
| Per Capita Income | .513 | .729 | .260 | .153 |
| | (.313) | (.931) | (.321) | (.218) |
| Age 15 | .135[a] | .154 | -.086 | .008 |
| | (.052) | (.161) | (.054) | (.032) |
| 16 | .167[a] | .289 | -.120[b] | -.004 |
| | (.057) | (.187) | (.058) | (.035) |
| 17 | .133[b] | .208 | -.118[c] | .002 |
| | (.061) | (.197) | (.062) | (.039) |
| 18 | .177[a] | .345[c] | -.136[b] | .002 |
| | (.067) | (.209) | (.067) | (.043) |
| Grade 10 | -.090[a] | -.214[c] | .034 | .004 |
| | (.033) | (.121) | (.035) | (.024) |
| 11 | -.115[a] | -.364[a] | .028 | .010 |
| | (.038) | (.138) | (.041) | (.027) |
| 12 | -.186[a] | -.525[a] | -.035 | .031 |
| | (.042) | (.151) | (.048) | (.032) |
| Black | .286[a] | .796[a] | .098[a] | .011 |
| | (.023) | (.076) | (.022) | (.017) |
| Hispanic | .116[a] | .235[a] | -.016 | -.092[a] |
| | (.028) | (.077) | (.027) | (.022) |
| Asian | .133[a] | .124 | -.003 | -.084[b] |
| | (.066) | (.153) | (.060) | (.049) |
| Other | .179[a] | .306[a] | .009 | .012 |
| | (.043) | (.111) | (.042) | (.028) |
| 1995 | .020 | .122 | .011 | .001 |
| | (.037) | (.103) | (.036) | (.025) |
| 1997 | .026 | .093 | .034 | .021 |
| | (.061) | (.165) | (.061) | (.043) |
| 1999 | .105 | .279 | .067 | -.008 |
| | (.098) | (.265) | (.095) | (.069) |
| (Pseudo) $R^2$ | .0656 | .0776 | .0204 | .0224 |
| Sample Size | 9,724 | 9,724 | 9,626 | 9,490 |

Note: Probit coefficients are marginal effects. Standard errors are in parentheses. Superscripts [c], [b], and [a] indicate significance at the 90, 95, and 99 percent levels, respectively. Regressions use sampling weights and include state indicators.

**Table 5**
**Sexual Behavior Regressions for Females**

| | Method | Mean | Birth Rate | AIDS Rate | Gonorrhea Rate | Per Capita Income | Joint Test |
|---|---|---|---|---|---|---|---|
| **All Respondents (n = 24,444)** | | | | | | | |
| At least one partner | Probit | .376 | .059[c] | -.129 | .053 | -.301 | 7.32 |
| | | (.484) | (.031) | (.122) | (.225) | (.205) | [.120] |
| More than one partner | Probit | .070 | .013 | -.018 | -.029 | -.111 | 3.34 |
| | | (.255) | (.014) | (.051) | (.103) | (.102) | [.502] |
| Number of partners | OLS | .492 | .080[c] | -.176 | .026 | -.575[c] | 1.91 |
| | | (.892) | (.047) | (.191) | (.372) | (.308) | [.106] |
| Number of partners | Tobit | .492 | .266[b] | -.538 | -.022 | -1.577[c] | 9.80 |
| | | (.892) | (.129) | (.494) | (.902) | (.827) | [.044] |
| Number of partners | Negative Binomial | .492 | .194[c] | -.330 | -.086 | -1.343[b] | 10.01 |
| | | (.892) | (.104) | (.386) | (.685) | (.657) | [.040] |
| **Sexually Active Respondents (n = 9,538)** | | | | | | | |
| More than one partner | Probit | .186 | .000 | .021 | .084 | .153 | .670 |
| | | (.389) | (.037) | (.135) | (.261) | (.262) | [.955] |
| Number of partners | OLS | 1.309 | .021 | -.014 | -.098 | -.552 | .40 |
| | | (.813) | (.086) | (.334) | (.593) | (.522) | [.805] |
| Condom used last time | Probit | .486 | -.002 | .119 | -.441 | .582[c] | 5.480 |
| | | (.499) | (.052) | (.194) | (.350) | (.340) | [.241] |
| Birth control used last time | Probit | .794 | -.042 | .221[c] | .147 | .373 | 4.63 |
| | | (.404) | (.039) | (.130) | (.247) | (.243) | [.327] |

Note: Parentheses contain standard deviations for means and standard errors for coefficients. Probit coefficients are marginal effects. Superscripts [c], [b], and [a] indicate significance at the 90, 95, and 99 percent levels, respectively. P-values are in brackets. Joint tests are tests for the joint significance of the four variables listed here. These are F-tests for OLS regressions and likelihood ratio tests for all other models. The sample size is 9,464 for condom use and 9,349 for birth control use. Regressions use sampling weights and include indicators for age, grade, race, year, and state.

**Table 6**
**Sexual Behavior Regressions for Males**

**(a) All states included (n = 27,085)**

| Method | **At least one partner** Probit | **More than one partner** Probit | **Number of partners** OLS | **Number of partners** Tobit | **Number of partners** Negative Binomial |
|---|---|---|---|---|---|
| AIDS Rate | -.229[b] | -.098 | -.647[b] | -1.780[b] | -.973[b] |
| | (.105) | (.065) | (.256) | (.687) | (.376) |
| Gonorrhea | -.525[b] | -.221 | -.993[c] | -3.381[b] | -1.563[c] |
| | (.235) | (.135) | (.589) | (1.496) | (.805) |
| Birth Rate | .103[a] | .044[b] | .247[a] | .809[a] | .429[a] |
| | (.028) | (.017) | (.065) | (.190) | (.105) |
| Per Capita | -.346[c] | -.224[c] | -.670 | -2.264[c] | -1.071 |
| Income | (.197) | (.120) | (.475) | (1.328) | (.739) |

**(b) Only states sampled all 4 years included (n = 17,560)**

| Method | **At least one partner** Probit | **More than one partner** Probit | **Number of Partners** OLS | **Number of partners** Tobit | **Number of partners** Negative Binomial |
|---|---|---|---|---|---|
| AIDS Rate | -.239[b] | -.104 | -.644[b] | -1.711[b] | -.835[b] |
| | (.118) | (.071) | (.283) | (.723) | (.396) |
| Gonorrhea | -.785[b] | -.330[b] | -1.573[b] | -4.911[b] | -2.507[b] |
| | (.312) | (.181) | (.775) | (1.914) | (1.027) |
| Birth Rate | .113[a] | .043[b] | .281[a] | .878[a] | .468[a] |
| | (.033) | (.021) | (.076) | (.212) | (.119) |
| Per Capita | -.376 | -.356[b] | -.820 | -2.339 | -1.140 |
| Income | (.246) | (.149) | (.561) | (1.535) | (.852) |

Note: Probit coefficients are marginal effects. Standard errors are in parentheses. Superscripts [c], [b], and [a] indicate significance at the 90, 95, and 99 percent levels, respectively. Regressions use sampling weights and include age, grade, race, year, and state indicators.

**Table 7**
**Largest and Smallest Estimated State Effects Relative to Alabama**
**(n = 23,106)**

| **At least one partner** Probit | | **More than one partner** Probit | | **Number of partners** OLS | | **Number of partners** Tobit | | **Number of partners** Negative Binomial | |
|---|---|---|---|---|---|---|---|---|---|
| *Largest* | | *Largest* | | *Largest* | | *Largest* | | *Largest* | |
| New York | .629 | New York | .677 | New York | 1.713 | New York | 5.392 | New York | 2.767 |
| Massachusetts | .573 | Massachusetts | .632 | Massachusetts | 1.540 | Massachusetts | 4.876 | Massachusetts | 2.609 |
| Pennsylvania | .413 | Illinois | .384 | Pennsylvania | 1.023 | Pennsylvania | 3.159 | Pennsylvania | 1.661 |
| Michigan | .384 | Pennsylvania | .380 | Illinois | .818 | Michigan | 2.765 | Illinois | 1.442 |
| *Smallest* | | *Smallest* | | *Smallest* | | *Smallest* | | *Smallest* | |
| Texas | .021 | Tennessee | .056 | Louisiana | -.024 | Texas | -.251 | Texas | -.145 |
| Arkansas | .038 | Alabama | .000 | Arkansas | -.099 | Arkansas | -.348 | Arkansas | -.148 |
| Mississippi | -.074 | Louisiana | -.008 | Mississippi | -.243 | Mississippi | -.781 | Mississippi | -.497 |
| Arizona | -.121 | Mississippi | -.065 | Arizona | -.308 | Arizona | -.969 | Arizona | -.501 |

Note: These are the coefficients on the state indicators from the Table 3 regressions.

**Table 8**
**Sexual Behavior Regressions for Males: Self Esteem Variables (n = 22,673)**

| | **Mean** | **At least one partner** | **More than one partner** | **Number of partners** | **Number of partners** | **Number of partners** |
|---|---|---|---|---|---|---|
| Method | | Probit | Probit | OLS | Tobit | Negative Binomial |
| *Attempting to:* | | | | | | |
| Gain Weight | .326 | .071[a] | .024[b] | .100[b] | .390[a] | .168[a] |
| | (.469) | (.017) | (.011) | (.040) | (.113) | (.064) |
| Maintain Weight | .191 | .017 | -.008 | -.010 | .048 | -.019 |
| | (.393) | (.018) | (.010) | (.040) | (.117) | (.067) |
| Lose Weight | .237 | -.010 | -.016 | -.104[b] | -.182 | -.130 |
| | (.425) | (.020) | (.013) | (.052) | (.145) | (.082) |
| *Self Evaluation:* | | | | | | |
| Very Underweight | .022 | -.066 | -.016 | -.073 | -.309 | -.049 |
| | (.146) | (.041) | (.023) | (.100) | (.294) | (.172) |
| Underweight | .021 | -.069[a] | -.016 | -.115[a] | -.423[a] | -.210[a] |
| | (146) | (.016) | (.009) | (.036) | (.108) | (.060) |
| Overweight | .203 | -.023 | .003 | -.115 | -.064 | -.003 |
| | (.402) | (.018) | (.013) | (.036) | (.131) | (.074) |
| Very Overweight | .025 | -.130[a] | .011 | .020 | -.253 | .169 |
| | (.157) | (.035) | (.030) | (.047) | (.402) | (.219) |
| Number of days lifted | 3.311 | .011[a] | .006[a] | .096[a] | .080[a] | .040[a] |
| weights in past week | (2.505) | (.002) | (.001) | (.149) | (.018) | (.010) |
| Team sport member | .651 | -.006 | -.010 | -.034 | -.092 | -.070 |
| | (.477) | (.013) | (.009) | (.032) | (.089) | (.049) |
| No. of days exercised | 4.183 | -.004 | -.001 | -.012 | -.032 | -.016 |
| 20 min. in past week | (2.404) | (.003) | (.001) | (.007) | (.020) | (.011) |

Note: The specifications are identical to those in Table 3 with these variables added. Probit coefficients are marginal effects. Parentheses contain standard deviations for means and standard errors for coefficients. Superscripts [c], [b], and [a] indicate significance at the 90, 95, and 99 percent levels, respectively.