I DID WHAT LAST NIGHT?!

ADOLESCENT RISKY SEXUAL BEHAVIORS AND SUBSTANCE USE

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INTRODUCTION

Recent years have seen a widespread public concern with the practice of safe sex. While this concern has been brought on mainly by the AIDS epidemic, the benefits of safe sex include protection against other sexually transmitted diseases (STDs) and unwanted pregnancies. In particular, sexual risk-taking behavior, or unsafe sex, is a prevalent problem among teenagers. Broadly defined, sexual risk-taking behaviors include unprotected sex, unfamiliarity with the partner, and multiple partners. While the last two outcomes are not necessarily risky behaviors, they are included under the rubric of risky sexual behavior because when the partner is not well known and when there are multiple partners, it is more likely that the infection status of the partner is unknown. Knowledge of the infection status can lead to practices such as condom use or abstinence, which compensate for the risk of contracting an STD [Laumann et al., 1994].

Studying the sexual behavior of teenagers is important because when compared to older adults, teenagers and young adults are particularly at risk for contracting an STD or having an unwanted pregnancy. For example, among Americans, young women between the ages of 20 and 24 have the highest rate of unintended pregnancy, and teenage women between the ages of 15 and 19 have the second highest rate [Henshaw, 1998]. Incidence rates of chlamydia and gonorrhea—the two most common reportable STDs—are also high among American teenagers and young adults. In 2000, the chlamydia incidence rate was 258 per 100,000 population for persons of all ages, 1,373 for teenagers, and 1,404 for young adults [CDC, 2000]. The corresponding gonorrhea incidence rates were 132, 516, and 623, respectively. Approximately one-quarter of all new human immunodeficiency virus (HIV) infections in the United States occur among teenagers and young adults [CDC, 1997]. Thus, the focus on teenagers is significant

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since the health and development of teens are particularly affected by their sexual behavior.

An important question for policy purposes is to identify what induces teens to engage in unsafe sex. Two of the most commonly cited correlates of risky sexual behavior are alcohol and drug use. Numerous studies have shown a positive association between substance use and risky sexual practices (see Leigh and Stall [1993] and Donovan and McEwan [1995] for reviews of this literature). For example, studies such as Graves and Leigh [1995] show that young adults who drink heavily or use marijuana are more likely to be sexually active and to have multiple partners, and those who are heavy drinkers are also less likely to use condoms. Evidence also comes from Strunin and Hingson [1992] and Fergusson and Lynskey [1996], who show that alcohol use by teenagers is associated with unprotected intercourse. Rosenbaum and Kandel [1990] show that prior use of alcohol or illegal drugs increases the risk of initiating intercourse prior to age sixteen.

It is important to note that none of these studies establishes a causal relationship from drugs and alcohol use to risky sex, rather, these studies highlight an association. There are several competing explanations of the observed association, each with different implications for a possible causal relationship between substance use and sexual behaviors. Laumann et al. [1994] propose that alcohol and drugs may enhance sexual desire, and that substance use may result in impaired judgment and may increase the likelihood that condoms and other birth control methods are not used. This theory implies that alcohol and drug use cause risky sexual practices. In contrast, according to Jessor and Jessor's [1977] "problem behavior theory," the two outcomes are manifestations of a common personality trait. This suggests that risky sex and substance use are associated only because both are related to an unmeasured third variable, such as a thrill-seeking personality. Leigh and Stall [1993] find support for this theory by citing many studies that show that cigarette smoking is also highly correlated with risky sex. It is hard to argue that smoking is an indicator of temporary lapses in judgment, which is one argument for why alcohol use may cause risky sex. Finally, Cooper, Skinner, and George [1990] point out that a teenager who chooses to have many sexual partners may use drugs and alcohol to cope with society's negative view of such behavior. In effect, the teenager consumes these substances to lower the psychic costs of risky sex. In this scenario, the sexual behavior is the impetus for substance use, therefore, risky sex may cause the substance use. Reverse causality may also occur when a youth is introduced to or obtains drugs and alcohol from a sex partner. This is more likely the earlier the youth begins to have sex, the more sexual partners that he or she has, and the older his or her partners are. Note that these reverse causality arguments may not apply when considering substance use and safe sex practices (for example, birth control).

RELATED RESEARCH

The studies discussed above that show a relationship between substance use and risky sexual behaviors fail to provide evidence for or against causality. A number of researchers have tried to provide evidence by conducting event-level research, which involves an in-depth examination of the situational characteristics surrounding specific

sexual events. Specifically, these studies compare the likelihood of engaging in safe sex when alcohol or other substances have been used to the likelihood of engaging in safe sex when alcohol or other substances have not been used. Weinhardt and Carey [2000] provide a detailed review of this literature and find a lack of evidence that alcohol use causes unprotected sex. Many of the studies reviewed, however, pertain to college students and adults. Regarding adolescents, the authors note that, "Adolescents whose first experiences with sexual intercourse occur under the influence of alcohol are less likely to have planned for sexual activity and contraception and/or HIV-risk-reduction strategies are less likely to be used." [Weinhardt and Carey, 2000].

Insights from the economics literature may provide some clues as to the nature of the relationship between substance use and risky sexual behaviors through the use of statistical techniques that account for unmeasured factors that may otherwise bias estimates. One important paper from this literature is by Kaestner and Joyce [2001], who examine the effects of substance use on the probability of unintended pregnancy and contraception use. Using the 1984 and 1988 waves of the National Longitudinal Survey of Youth (NLSY), the authors try to establish causality from substance use to unintended pregnancy using instrumental variable and fixed effects techniques. They estimate the equations separately by race and find that, when the unmeasured individual traits are controlled for in the fixed effects models, alcohol use increases the likelihood of unintended pregnancy and lowers contraception use for whites, while drug use has no statistically significant effects. By contrast, substance use is statistically unrelated to unintended pregnancy for blacks and Hispanics. Estimates using instrumental variables were found to be unreliable because of the lack of powerful instruments in predicting drug and alcohol use.

Dee [2001] reaches an alternate conclusion in his study on changes in the minimum legal drinking age and childbearing among teens and young adults. Using a panel of state-level data across time, he finds evidence that reductions in alcohol consumption encouraged by higher drinking ages reduced the childbearing rates of blacks, while having an uncertain effect on childbearing rates of whites. The discrepancy in the conclusions between Dee's [2001] study and that of Kaestner and Joyce [2001] may arise because of differences in the outcomes studied (childbearing rates versus unintended pregnancies), time period under consideration (1977-92 versus 1984 and 1988), and unit of observation (state versus individual). It is clear, however, that the true impact of alcohol consumption and alcohol policies on teenage pregnancy is still unknown.

Chesson, Harrison, and Kassler [2000] use state-level beer and liquor taxes to help establish the direction of causality between alcohol consumption and sexually transmitted diseases. Using a panel of state STD rates over a 15-year period (1981-95), the authors examine the direct relationship between alcohol taxes and STD rates. They find that an increase in the beer tax or the liquor tax will reduce the rates of gonorrhea and syphilis. Since the only way the alcohol taxes should affect STD rates is through reduced consumption, the authors conclude that their results are consistent with a causal relationship from alcohol use to risky sexual behaviors, which in turn lead to the contraction of STDs.

Rees, Argys, and Averett [2001] examine the effects of marijuana and alcohol use on the sexual practices of high school age teenagers in Wave 1 of the National Longitudinal

Study of Adolescent Health. Using bivariate probit and two-stage least square estimation to control for unobserved heterogeneity, they find little evidence to suggest that substance use has a causal impact on the probability of being sexually active and the probability of having sex without contraception. Specifically, they show that, for females, neither drunkenness nor marijuana use impacts the probability of having sex and using contraception. For males, drunkenness has no impact on the probability of having sex, but it may lead to a lower probability of using contraception. Marijuana use has no impact on sexual behaviors by males.

Sen [2002] examines the effects of any level of alcohol use and heavy alcohol use on the probabilities of having sex and having sex without contraception in the first round of the NLSY, 1997. Following Rees, Argys, and Averett [2001], Sen [2002] uses bivariate probit and two-stage least square estimation techniques and separates the sample by gender. Sen [2002] concludes that any alcohol use increases the probability of sexual intercourse and unprotected sex for both genders, while heavy alcohol use generally has no effect. This last result is consistent with the findings from Rees, Argys, and Averett [2001].

The studies by Rees, Argys, and Averett [2001] and Sen [2002] are similar in design to this paper in that instrumental variables are used to explore the nature of the relationship between substance use and risky youth sexual behaviors. These studies ignore the distinction between the decision to use birth control and the decision to have sex, however. Respondents who have unprotected sex are compared against both abstainers and sexually active youth who consistently use birth control. The resulting coefficients on substance use reflects both the decision to engage in sex and the decision of whether to use protection or not, making the distinct impact of consumption on birth control use unknown. In this paper, we correct for this problem by examining condom and birth control use only for the sexually active sample of teenagers.

This paper also improves on previous literature by presenting a comprehensive study of alcohol use, heavy alcohol use, and marijuana use on four different risky sexual practices among teens. The results of the instrumental variable estimation are validated by estimates of the reduced form equation, which relates substance use policies directly to the sexual practices, which no previous study has done. The set of policies used is unique and includes the tax on beer, the monetary price of marijuana, a measure of alcohol availability (the number of outlets licensed to sell alcohol), and statutory fines and jail terms for possession of small amounts of marijuana. While others have previously used the beer tax [Chesson, Harrison, and Kassler, 2000; Sen, 2002], no study has examined measures of alcohol availability or measures of the monetary and full price of marijuana. These variables are particularly relevant for policy analysis since previous research has shown that increases in alcohol and drug prices can lower consumption [Leung and Phelps, 1993; Grossman, Chaloupka, and Sirtalan, 1998; Grossman and Chaloupka, 1998; Saffer and Chaloupka, 1999; Pacula et al., 2001] and therefore may serve to be viable policy tools to alter risky teenage sexual behaviors.

METHODOLOGY

The above discussion on the possible ways drugs and alcohol might be related to sexual behaviors can be summarized in three ways: 1) drug and alcohol use causes unsafe sex; 2) unsafe sex causes drug and alcohol use; and 3) drug and alcohol use and unsafe sex are both caused by an unobserved third factor, such as a thrill-seeking personality. Taking into account these three cases gives the following equations:

(1) $$S_{it} = \alpha_0 + \alpha_1 A_{it} + \alpha_2 D_{it} + \alpha_3 \mathbf{X}_{it} + \alpha_4 u_i + \varepsilon_{it,}$$

(2) $$A_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 Pd_{jt} + \beta_3 Pa_{jt} + \beta_4 \mathbf{Y}_{it} + \beta_5 u_i + \omega_{it,}$$

(3) $$D_{it} = \delta_0 + \delta_1 S_{it} + \delta_2 Pa_{jt} + \delta_3 Pd_{jt} + \delta_4 \mathbf{Y}_{it} + \delta_5 u_i + \eta_{it,}$$

where S represents a measure of risky sexual behavior, A is a measure of alcohol use, D is a measure of drug use, Pa is the price of alcohol, Pd is the price of drugs, and $\mathbf{X}$ and $\mathbf{Y}$ represent observed individual characteristics which may affect sexual behavior ($\mathbf{X}$) and drug and alcohol use ($\mathbf{Y}$). The vectors $\mathbf{X}$ and $\mathbf{Y}$ may have many of the same elements in common. Unobserved, individual traits which do not vary over time are represented by u_i. The subscripts i, j, and t refer to individuals, geographic area, and time, respectively. The prices of drugs and alcohol appear in Equations (2) and (3) because drugs and alcohol may be complement goods [Saffer and Chaloupka, 1999; Pacula, 1998] or substitute goods [DiNardo and Lemieux, 2001; Chaloupka and Laixuthai, 1997].

Many of the studies discussed in the introduction have used ordinary least squares (OLS) to estimate Equation (1); however, this can lead to biased and inconsistent coefficients if reverse causality is present ($\beta_1 \neq 0$ and $\delta_1 \neq 0$) or the unmeasured individual-level factor is correlated with sexual behaviors and substance use ($\alpha_4 \neq 0$, $\beta_5 \neq 0$, and $\delta_5 \neq 0$). In either case, drug and alcohol use will be correlated with the error term in Equation (1) ($\alpha_4 u_i + \varepsilon_t$), thus estimates by OLS violate the requirement that the right-hand side variables be orthogonal to the error term.

In order to avoid the problems presented by OLS estimation, two-stage least squares (TSLS) is used to estimate Equation (1).[1] The TSLS technique requires at least one exogenous variable (instrument) that will predict drug and alcohol use but that is not correlated with the error term in the sexual behavior equation.[2] When estimating Equation (1) by TSLS, drug or alcohol consumption is first predicted with the instruments and then the predicted value is used as a regressor in Equation (1). The predicted value of consumption is purged of its correlation with the error term in the sexual behavior equation, leading to unbiased estimates of drug or alcohol use on risky sex.

A reduced form equation can be derived by substituting Equations (2) and (3) into Equation (1):

(4) $$S_{it} = \gamma_0 + \gamma_1 Pa_{jt} + \gamma_2 Pd_{jt} + \gamma_3 Y_{it} + \gamma_4 X_{it} + \gamma_5 u_i + \upsilon_{it}.$$

Estimating the reduced form equation shows the direct effect of changes in the prices of drugs and alcohol in reducing risky sexual behaviors. A statistically significant price coefficient implies that risky sex is a result of consumption since there is no intuitive

reason to believe that the prices of drugs and alcohol are determinants of risky sex, holding consumption constant. The reduced form estimation will therefore serve as a check on the validity of the results from the instrumental variable estimation.

DATA

Data on sexual risk-taking behaviors and related outcomes come from the 1991, 1993, 1995, 1997, and 1999 National School-Based Youth Risk Behavior Surveys (YRBS). These surveys contain nationally representative samples of high school students in grades 9-12. Four measures of sexual behaviors are considered, all of which refer to sexual practices in the past three months. This time period is chosen because it corresponds most closely to the available illegal drug and alcohol use questions. The first indicator refers to all respondents and is a dichotomous indicator for whether the respondent has had sex in the past three months. The other dependent variables are all limited to the sample of respondents reporting having sex in the past three months, and include the number of partners, a dichotomous indicator of whether a condom was used at last encounter, and a dichotomous indicator of whether any form of birth control was used to prevent pregnancy at last encounter. Respondents are assigned a value of "1" for the birth control question if condoms or birth control pills were used and are assigned a "0" otherwise. In 1999, use of Depo-Provera (an injected hormonal birth control) is also included as a method of birth control.

Table 1 shows the means and standard deviations for the four dependent variables and all of the independent variables. Thirty-four percent of males and 37 percent of females report having sex in the past three months. Conditional on having sex in the past three months, the average number of partners is 1.79 for males and 1.29 for females. Sixty-nine percent of males and 64 percent of females who have had a sexual encounter in the past three months report using some form of birth control at last encounter, while 61 percent of sexually active males and 47 percent of sexually active females report condom use at last encounter.

Three measures of alcohol and drug consumption are used. The first is the number of days in the past 30 days on which the respondent had five or more drinks of alcohol in a row within a couple of hours (termed binge drinking); the second is the number of days in the past 30 days on which the respondent had at least one drink of alcohol; and the third is the number of times in the past 30 days the respondent used marijuana.

The socioeconomic and demographic characteristics of the respondents are very limited in that only age, gender, and race are consistently reported in all surveys. These variables are included in each model along with a dichotomous indicator for whether the respondent has been educated about AIDS at school. Next, two variables are included that indicate whether or not the respondent's age is greater than that of the majority of the class and whether or not the respondent's age is less than that of the majority of the class. The former will help identify students who have repeated grades while the later will identify students who have skipped grades.

TABLE 1
Weighted Means [Standard Deviations]

	Males, Full Sample (N=27,567)	Males, Sexually Active (N=10,944)	Females, Full Sample (N=30,096)	Females, Sexually Active (N=11,675)
Had sex	0.34 [0.48]	—	0.37 [0.48]	—
Number of partners	—	1.79 [1.40]	—	1.29 [0.77]
Use birth control	—	0.69 [0.46]	—	0.64 [0.48]
Use condom	—	0.61 [0.49]	—	0.47 [0.50]
Number of days drink	3.34 [5.75]	5.85 [7.34]	2.34 [4.36]	3.72 [5.43]
Number of days binge	1.68 [3.62]	3.10 [4.79]	0.99 [2.52]	1.72 [3.33]
Number of times use marijuana	3.62 [9.59]	7.06 [12.83]	1.84 [6.38]	3.55 [8.78]
Beer tax	0.55 [0.15]	0.56 [0.16]	0.55 [0.15]	0.56 [0.16]
Alcohol Outlets	2.23 [0.89]	2.26 [0.94]	2.22 [0.89]	2.22 [0.96]
Marijuana price	945.78 [281.70]	942.6 [268.5]	930.2 [280.2]	935.69 [274.04]
Jail	0.19 [0.22]	0.21 [0.22]	0.19 [0.22]	0.2 [0.2]
Fine (in $1,000s)	1.09 [6.34]	1.02 [6.00]	1.06 [6.22]	0.92 [5.55]
Black	0.10 [0.3]	0.20 [0.40]	0.14 [0.35]	0.19 [0.39]
Other race	0.19 [0.39]	0.18 [0.39]	0.20 [0.40]	0.18 [0.38]
Age	16.19 [1.21]	16.54 [1.14]	16.10 [1.21]	16.49 [1.11]
Age greater than grade	0.06 [0.25]	0.09 [0.29]	0.04 [0.19]	0.05 [0.22]
Age less than grade	0.003 [0.05]	0.002 [0.04]	0.003 [0.05]	0.003 [0.05]
Seat belt	3.58 [1.28]	3.18 [1.33]	3.86 [1.13]	3.59 [1.20]
Sports	1.60 [1.55]	1.65 [1.60]	1.01 [1.31]	0.84 [1.21]
Number of days smoked	5.30 [10.34]	9.10 [12.54]	5.17 [10.15]	9.07 [12.50]
AIDS education	0.93 [0.26]	0.91 [0.28]	0.93 [0.26]	0.92 [0.27]
State real income	156.53 [19.21]	155.03 [19.35]	156.48 [19.16]	154.84 [18.89]
State unemployment	5.71 [1.60]	5.75 [1.64]	5.69 [1.60]	5.70 [1.60]
Protestant	21.89 [9.52]	22.37 [9.50]	22.06 [9.85]	22.78 [9.95]
Catholic	19.96 [12.03]	19.27 [12.17]	19.77 [12.14]	18.81 [12.31]
Southern Baptist	5.46 [7.67]	6.34 [8.27]	5.70 [7.93]	6.69 [8.63]
Mormon	0.88 [0.94]	0.80 [0.86]	0.88 [0.92]	0.83 [0.87]
1993	0.23 [0.42]	0.25 [0.43]	0.24 [0.42]	0.23 [0.42]
1995	0.15 [0.36]	0.15 [0.36]	0.15 [0.36]	0.16 [0.37]
1997	0.24 [0.43]	0.23 [0.42]	0.22 [0.41]	0.21 [0.41]
1999	0.20 [0.40]	0.20 [0.40]	0.22 [0.41]	0.21 [0.41]
North East	0.22 [0.41]	0.21 [0.41]	0.22 [0.41]	0.20 [0.40]
Midwest	0.27 [0.45]	0.28 [0.45]	0.26 [0.44]	0.26 [0.44]
South	0.28 [0.45]	0.33 [0.47]	0.28 [0.45]	0.33 [0.47]
First time	—	0.10 [0.30]	—	0.13 [0.34]

One of the drawbacks of the YRBS is the lack of a rich set of variables representing individual and family characteristics. To make up for this, some additional measures that may help control for the respondent's personality or propensity towards risk are included in all models. The first is how often the respondent usually wears a seat belt when he or she is a passenger in a car (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, 5 = always). Second, we include the number of sports teams on which the respondent plays, which may reflect the respondent's attachment to and involvement in school and the community. The number of days in the past 30 days on which the respondent smoked is also included to represent unmeasured personality traits since there is no reason to believe that smoking is directly correlated with risky sexual practices.[3] Next, when condom use and birth control use are considered, we

include an indicator for whether or not the sexual encounter in question is the respondent's first time. This indicator takes on a value of "1" if the respondent's current age is equal to the reported age at first encounter, the respondent has had only one lifetime partner, and has had only one partner in the past three months. Otherwise, a "0" is assigned. A respondent who has had repeated encounters with the same partner in the past three months may be designated as a first timer; however, the number of encounters is not reported in the YRBS.

Finally, all models include dummy variables for the survey year, variables representing the religious composition of the state, state real per capita income, the state unemployment rate, and dummy variables indicating the region in which the respondent resides.[4] The survey year dummy variables are included to capture secular trends in the outcomes, while the state and region variables are intended to proxy unobserved attitudes towards risky behaviors that may be shared by respondents living in the same state.

Instruments

Variables measuring the full price of alcohol and marijuana serve as instruments that are used to predict consumption but not sexual behavior. The full price includes the monetary price of purchasing the good plus factors that may increase the total costs of obtaining the substance, such as time and travel costs, or expected penalties for illegal possession. The prices are theoretically valid instruments because there is no reason to believe that the prices of drugs and alcohol are predictors of risky sexual behaviors, holding consumption constant. Prices should, however, predict consumption. Previous research has shown that consumption of these goods is negatively related to their prices [Leung and Phelps, 1993; Grossman, Chaloupka, and Sirtalan, 1998; Grossman and Chaloupka, 1998; Saffer and Chaloupka, 1999; Pacula et al., 2001].

Five variables will be used as instruments: The real state-level excise tax on a gallon of beer, the real price of a pound of marijuana, the per capita number of outlets licensed to sell alcohol in each state, and the midpoint of the minimum and maximum statutory fines and jail terms (in years) for possession of small amounts of marijuana. Beer taxes come from the Beer Institute's *Brewer's Almanac*, the number of outlets licensed to sell alcohol comes from Jobson's *Liquor Handbook*, marijuana prices come from the Drug Enforcement Agency, and fines and jail terms are from state statutes, collected by the lawyers and policy analysts for the ImpacTeen Illicit Drug Team.

RESULTS

Table 2 shows means of substance use by sexual behavior status. In all cases, respondents who engage in sex and in risky sexual practices have higher rates of drinking and drug use. For example, 50 percent of males who have had sex in the past three months also binge drink, while only 23 percent of sexually inactive males binge drink. The corresponding numbers for females are 34 percent and 17 percent. For sexually active respondents, Table 2 shows that, compared to males who have had only one partner in the past three months, males who have had more than one partner binge more frequently (3.86 versus 2.16 days), drink on more days (7.52 versus

4.34 days), and use marijuana more frequently (9.40 versus 4.60 times). Similar trends hold for sexually active females. Teens of both genders who do not use condoms or birth control also drink and use marijuana more than those who do use protection.

TABLE 2
Sexual Behaviors and Substance Use

	All Respondents		Sexually Active Respondents					
	Did not have sex in past 3 mos.	Had sex in past 3 mos.	1 partner in past 3 mos.	More than 1 partner in past 3 mos.	Used birth control	Did not use birth control	Used a condom	Did not use a condom
MALES								
Proportion binge	0.23	0.50	0.46	0.56	0.48	0.54	0.47	0.55
Proportion drink	0.40	0.69	0.64	0.75	0.68	0.71	0.67	0.72
Proportion use marijuana	0.14	0.39	0.32	0.49	0.38	0.42	0.37	0.42
Number of days binge	0.87	2.85	2.16	3.86	2.53	3.50	2.45	3.48
Number of days drink	1.98	5.63	4.34	7.52	5.13	6.61	5.03	6.59
Number of times used marijuana	1.59	6.55	4.60	9.40	5.93	7.59	5.84	7.54
FEMALES								
Proportion binge	0.17	0.34	0.30	0.50	0.33	0.36	0.31	0.36
Proportion drink	0.36	0.59	0.55	0.76	0.59	0.60	0.57	0.61
Proportion use marijuana	0.09	0.27	0.23	0.45	0.26	0.29	0.25	0.29
Number of days binge	0.51	1.34	1.07	2.53	1.23	1.49	1.15	1.50
Number of days drink	1.47	3.26	2.74	5.54	3.10	3.49	2.97	3.51
Number of times used marijuana	0.71	2.94	2.36	5.52	2.71	3.23	2.54	3.28

Note: For each substance, all means and proportions are statistically different between respondents who do engage in the risky sexual behaviors and those do not engage in the behaviors, with the exception of birth control use by the proportion of females who drink.

TABLE 3
Had Sex in the Past 3 Months

	MALES (N=27,567)				FEMALES (N=30,096)			
	OLS (1)	TSLS (2)	First Stage (3)	Reduced Form (4)	OLS (5)	TSLS (6)	First Stage (7)	Reduced Form (8)
Binge	0.023	−0.022			0.020	−0.139		
	(24.71)	(−0.71)			(14.09)	(−1.47)		
Beer tax			−0.647	0.037			0.001	0.057
			(−2.04)	(1.16)			(0.01)	(1.49)
Alcohol Outlets			0.087	−0.0001			0.042	−0.002
			(1.81)	(−0.03)			(1.96)	(−0.36)
Marijuana Price			−0.0004	3.7E−06			−0.0002	0.0001
			(−2.42)	(0.14)			(−1.99)	(2.10)
Jail			0.274	−0.001			0.043	−0.015
			(1.20)	(−0.04)			(0.40)	(−0.46)
Fine			−0.005	0.001			0.0004	0.0004
			(−1.12)	(1.12)			(0.14)	(0.56)
Black	0.304	0.271	−0.678	0.285	0.182	0.119	−0.387	0.169
	(29.76)	(11.27)	(−8.81)	(26.85)	(17.07)	(2.94)	(−8.71)	(15.47)

TABLE 3—*Continued*
Had Sex in the Past 3 Months

	MALES (N=27,567)				FEMALES (N=30,096)			
	OLS	TSLS	First Stage	Reduced Form	OLS	TSLS	First Stage	Reduced Form
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Other race	0.060	0.065	0.033	0.064	0.003	−0.009	−0.095	0.008
	(5.76)	(5.35)	(0.43)	(5.64)	(0.26)	(−0.62)	(−1.93)	(0.75)
Age	0.071	0.085	0.300	0.078	0.089	0.101	0.075	0.091
	(30.65)	(8.35)	(14.05)	(33.01)	(35.60)	(13.32)	(6.88)	(36.55)
Age greater than grade	0.002	−0.004	−0.119	−0.001	−0.041	−0.045	−0.025	−0.040
	(0.21)	(−0.33)	(−1.28)	(−0.09)	(−3.32)	(−2.41)	(−0.31)	(−3.25)
Age less than grade	0.132	0.143	0.246	0.138	0.064	0.111	0.293	0.071
	(3.08)	(3.07)	(0.85)	(3.10)	(1.74)	(1.71)	(1.15)	(1.91)
Seat belt	−0.041	−0.061	−0.443	−0.051	−0.036	−0.064	−0.178	−0.040
	(−13.96)	(−4.32)	(−16.15)	(−16.06)	(−11.22)	(−3.87)	(−10.84)	(−12.08)
Sports	0.029	0.035	0.143	0.032	−0.006	0.008	0.088	−0.004
	(14.25)	(7.28)	(9.09)	(15.95)	(−2.67)	(0.96)	(7.24)	(−1.79)
Number of days smoked	0.009	0.015	0.136	0.012	0.011	0.027	0.099	0.013
	(25.28)	(3.39)	(22.21)	(33.96)	(28.46)	(2.84)	(25.27)	(32.44)
AIDS education	−0.020	−0.037	−0.364	−0.029	0.005	−0.003	−0.048	0.004
	(−1.92)	(−2.41)	(−4.43)	(−2.77)	(0.46)	(−0.24)	(−0.85)	(0.38)
State real income	0.0002	0.00004	−0.004	0.0001	0.0004	−0.00002	−0.002	0.0002
	(0.79)	(0.11)	(−1.14)	(0.43)	(0.91)	(−0.05)	(−1.43)	(0.65)
State unemployment	0.004	0.006	0.028	0.006	0.006	0.008	0.008	0.008
	(1.09)	(1.44)	(0.78)	(1.58)	(1.28)	(1.28)	(0.35)	(1.80)
Protestant	−0.001	−0.002	−0.006	−0.001	−0.001	−0.001	0.0001	−0.0003
	(−3.94)	(−3.47)	(−1.58)	(−3.05)	(−1.21)	(−1.01)	(0.03)	(−0.80)
Catholic	−0.002	−0.001	0.012	−0.001	−0.003	−0.002	0.011	−0.002
	(−2.55)	(−0.92)	(1.43)	(−1.25)	(−4.50)	(−1.10)	(2.71)	(−3.07)
Southern Baptist	0.003	0.004	0.026	0.003	0.001	0.003	0.015	0.001
	(3.60)	(3.07)	(2.76)	(3.42)	(0.55)	(1.46)	(3.47)	(0.54)
Mormon	−0.011	−0.014	−0.127	−0.016	−0.012	−0.007	0.001	−0.005
	(−1.53)	(−1.67)	(−1.46)	(−1.59)	(−1.01)	(−0.54)	(0.02)	(−0.32)
1993	0.002	−0.0001	0.028	−0.0004	−0.005	−0.013	−0.020	−0.012
	(0.10)	(−0.01)	(0.25)	(−0.03)	(−0.30)	(−0.60)	(−0.35)	(−0.74)
1995	−0.023	−0.026	−0.065	−0.022	0.014	0.024	0.079	0.017
	(−1.29)	(−1.49)	(−0.46)	(−1.27)	(0.77)	(1.02)	(1.10)	(0.91)
1997	−0.031	−0.026	0.078	−0.026	−0.007	−0.005	0.015	0.000
	(−1.72)	(−1.35)	(0.49)	(−1.47)	(−0.34)	(−0.17)	(0.19)	(−0.02)
1999	−0.009	0.005	0.114	0.003	−0.010	0.020	0.129	0.016
	(−0.43)	(0.19)	(0.57)	(0.15)	(−0.47)	(0.62)	(1.48)	(0.68)
North East	0.030	−0.005	−0.683	0.003	0.058	−0.019	−0.451	0.026
	(1.63)	(−0.14)	(−2.94)	(0.10)	(1.83)	(−0.30)	(−3.91)	(0.70)
Midwest	−0.001	−0.018	−0.439	−0.013	0.002	−0.023	−0.161	−0.006
	(−0.07)	(−0.69)	(−1.84)	(−0.46)	(0.07)	(−0.53)	(−1.43)	(−0.17)
South	−0.030	−0.041	−0.494	−0.038	−0.014	−0.056	−0.355	−0.005
	(−1.47)	(−1.60)	(−2.09)	(−1.57)	(−0.53)	(−1.28)	(−3.17)	(−0.18)
R^2	0.22	0.12	0.20	0.19	0.16	0.11	0.17	0.15
F on instruments			2.560				2.150	
			[0.031]				[0.064]	
Overidentification test		3.268				9.651		
		[0.514]				[0.047]		
Hausman test		2.038				2.844		
		[0.153]				[0.092]		

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year.

Table 3 shows the impact of binge drinking on the likelihood of having sex in a multivariate analysis. In this table and the tables that follow, the results are presented separately by gender. The t-ratios in brackets are calculated based on standard errors that are clustered by state and year [Huber, 1967].

The OLS results in column 1 of Table 3 show that for males, binge drinking is positively associated with having sex. However, this result is not upheld in the TSLS and the reduced form estimations. The TSLS coefficient on binge drinking is negative and statistically insignificant (column 2). A number of tests point to the efficacy of the TSLS procedure. First, an overidentification test indicates that the exclusion restrictions are valid. Second, the alcohol policies in the first stage (column 3) are statistically significant predictors of binge drinking and demonstrate the expected sign. Here, higher beer taxes will lower binge drinking, and more outlets licensed to sell alcohol will raise binge drinking. The coefficient on the price of marijuana is negative and significant providing some evidence that marijuana and alcohol are complement goods; however, the penalties for marijuana possession are not statistically significant predictors of binge drinking. The partial F-statistic associated with the excluded instruments is 2.56, which is low, but is statistically significant. Note that Bound, Jaeger, and Baker [1995] show that as the F-statistic on the instruments gets smaller, the bias in the TSLS estimates approaches that of OLS, casting some doubt on the TSLS estimate. Indeed, the Hausman test for the consistency of OLS is not rejected, thus drawing into question the reliability of the TSLS estimate.[5] Therefore, the coefficients in the reduced form model in column 4 become important as they provide an alternative approach in which to test for the possible positive impact of drinking on sex. Here, none of the coefficients on the instruments predict the likelihood of having sex, providing further evidence that for males, binge drinking is not a predictor of having sex.[6]

The results for females are presented in columns 5-8 of Table 3. The OLS coefficient is positive and statistically significant while the TSLS coefficient is negative and insignificant. The reliability of this insignificant TSLS coefficient (column 6) is questionable as the F-statistic on the instruments is low and the Hausman test is rejected only at the 10 percent level. However, the coefficients on the beer tax and alcohol outlets in the reduced form confirm the finding of no impact of binge drinking on the probability of having sex in the TSLS model. Note that the coefficient on the price of marijuana is negative and significant in the first stage regression, and positive and significant in the reduced form. There is, therefore, some evidence that marijuana and alcohol are complement goods, and that lowering the price of marijuana will raise the consumption of alcohol or marijuana and lower the probability of females having sex. One possible explanation for these results is that for females, excessive drug and alcohol consumption may inhibit sexual desire rather than promote it. Alternatively, males may be unwilling to "take advantage" of a female who is under the influence.

Table 4 shows the impact of binge drinking on the number of partners conditional on having had sex in the past three months. For both genders, the OLS results show that binge drinking is associated with having more partners, while the TSLS and reduced form estimates do not uphold this result. The insignificant TSLS coefficients suggest that binge drinking does not impact the number of partners. For males, the low F-statistics on the instruments makes the validity of the TSLS estimate questionable; however, the overidentification restrictions are valid and the Hausman test rejects

TABLE 4
Number of Partners in Past 3 Months—Sexually Active Respondents

	MALES (N=10,944)				FEMALES (N=11,675)			
	OLS	TSLS	First Stage	Reduced Form	OLS	TSLS	First Stage	Reduced Form
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Binge	0.078	−0.120			0.050	0.068		
	(18.20)	(−1.23)			(10.45)	(0.89)		
Beer tax			−0.978	0.220			−0.239	0.061
			(−1.76)	(1.82)			(−0.95)	(1.00)
Alcohol Outlets			0.157	−0.025			0.096	0.005
			(2.09)	(−1.37)			(2.66)	(0.48)
Marijuana Price			−0.0005	−0.00001			−0.0003	−0.0001
			(−1.40)	(−0.18)			(−1.86)	(−1.47)
Jail			0.560	−0.056			0.278	−0.098
			(1.51)	(−0.49)			(1.53)	(−1.82)
Fine			−0.010	−0.001			−0.004	−0.0003
			(−1.03)	(−0.43)			(−0.74)	(−0.18)
Black	1.001	0.705	−1.433	0.880	0.202	0.215	−0.704	0.169
	(25.97)	(4.67)	(−10.53)	(20.58)	(9.32)	(3.84)	(−8.27)	(8.01)
Other race	0.297	0.325	0.062	0.317	0.056	0.059	−0.236	0.042
	(6.74)	(6.58)	(0.42)	(7.43)	(2.11)	(2.25)	(−2.46)	(1.49)
Age	−0.045	−0.008	0.185	−0.030	−0.025	−0.024	−0.014	−0.026
	(−3.21)	(−0.33)	(4.32)	(−2.06)	(−3.64)	(−3.66)	(−0.64)	(−3.69)
Age greater than grade	0.262	0.252	−0.047	0.257	0.017	0.016	0.058	0.019
	(4.96)	(3.90)	(−0.31)	(4.59)	(0.54)	(0.49)	(0.38)	(0.60)
Age less than grade	0.588	0.669	0.369	0.621	−0.045	−0.061	0.906	−0.002
	(1.98)	(2.19)	(0.51)	(2.10)	(−0.25)	(−0.32)	(1.08)	(−0.01)
Seat belt	−0.079	−0.187	−0.554	−0.121	−0.021	−0.018	−0.218	−0.033
	(−6.29)	(−3.53)	(−11.05)	(−9.16)	(−3.97)	(−1.04)	(−7.45)	(−5.67)
Sports	0.047	0.078	0.156	0.059	0.003	0.00003	0.144	0.010
	(4.23)	(4.08)	(4.98)	(5.07)	(0.38)	(0.00)	(5.06)	(1.43)
Number of days smoked	0.012	0.037	0.129	0.022	0.007	0.005	0.091	0.011
	(7.26)	(2.92)	(18.85)	(12.92)	(8.11)	(0.72)	(18.80)	(12.02)
AIDS education	−0.241	−0.376	−0.659	−0.298	−0.018	−0.015	−0.163	−0.028
	(−4.53)	(−3.77)	(−3.90)	(−5.07)	(−0.82)	(−0.53)	(−1.52)	(−1.19)
State real income	0.003	0.002	−0.006	0.002	0.0003	0.0004	−0.004	0.001
	(2.90)	(1.12)	(−1.20)	(1.87)	(0.59)	(0.66)	(−1.51)	(0.89)
State unemployment	0.037	0.046	0.007	0.045	0.014	0.014	−0.008	0.013
	(2.61)	(2.23)	(0.10)	(2.78)	(1.92)	(1.82)	(−0.20)	(1.66)
Protestant	−0.001	−0.002	−0.006	−0.001	−0.001	−0.001	0.001	−0.001
	(−0.71)	(−0.75)	(−0.85)	(−0.44)	(−1.67)	(−1.70)	(0.26)	(−1.50)
Catholic	−0.004	0.001	0.021	−0.001	−0.003	−0.004	0.017	−0.003
	(−1.64)	(0.37)	(1.60)	(−0.46)	(−2.99)	(−2.31)	(2.53)	(−2.32)
Southern Baptist	0.001	0.005	0.034	−0.001	−0.001	−0.002	0.021	−0.001
	(0.25)	(1.07)	(1.87)	(−0.27)	(−0.90)	(−0.83)	(2.80)	(−0.48)
Mormon	0.020	0.005	−0.184	0.045	0.024	0.025	−0.080	0.036
	(0.60)	(0.11)	(−0.91)	(0.82)	(1.32)	(1.35)	(−0.74)	(1.71)
1993	−0.058	−0.035	0.197	−0.052	−0.018	−0.017	0.007	−0.013
	(−1.01)	(−0.62)	(1.16)	(−1.06)	(−0.68)	(−0.65)	(0.07)	(−0.47)
1995	−0.024	−0.049	−0.163	−0.018	0.022	0.020	0.120	0.039
	(−0.47)	(−0.83)	(−0.74)	(−0.38)	(0.81)	(0.71)	(1.05)	(1.35)
1997	−0.116	−0.074	0.147	−0.082	−0.021	−0.022	0.052	−0.011
	(−1.95)	(−0.91)	(0.56)	(−1.36)	(−0.68)	(−0.68)	(0.37)	(−0.38)
1999	−0.095	−0.023	0.139	−0.043	0.009	0.004	0.152	0.0001
	(−1.45)	(−0.25)	(0.46)	(−0.61)	(0.28)	(0.11)	(1.03)	(0.00)

TABLE 4—*Continued*
Number of Partners in Past 3 Months—Sexually Active Respondents

	MALES (N=10,944)				FEMALES (N=11,675)			
	OLS	TSLS	First Stage	Reduced Form	OLS	TSLS	First Stage	Reduced Form
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
North East	0.109	–0.166	–1.359	0.049	0.047	0.066	–1.060	0.044
	(1.46)	(–0.91)	(–2.78)	(0.42)	(1.15)	(0.76)	(–4.32)	(0.93)
Midwest	0.094	–0.025	–0.864	0.125	0.063	0.072	–0.618	0.107
	(1.02)	(–0.17)	(–1.81)	(0.89)	(1.40)	(1.37)	(–2.61)	(1.84)
South	0.013	–0.070	–0.889	0.059	0.038	0.049	–0.862	0.045
	(0.15)	(–0.53)	(–1.88)	(0.46)	(0.90)	(0.81)	(–3.56)	(0.87)
R^2	0.15	0.09	0.18	0.10	0.07	0.07	0.16	0.04
F on instruments			1.800				2.710	
			[0.031]				[0.023]	
Overidentification test		1.247				9.545		
		[0.870]				[0.049]		
Hausman test		4.126				0.055		
		[0.042]				[0.815]		

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year.

the consistency of OLS. For females, the F-statistic is low, but is statistically significant, whereas the overidentification restrictions may not be valid and the Hausman test cannot reject OLS. Despite these questionable TSLS results, the reduced form tells a similar story. Here, neither higher beer taxes nor fewer alcohol outlets will lower the number of partners for either gender (indeed, the coefficient on the beer tax is positive and significant at the 10 percent level for males). Raising the marijuana price will have no impact on lowering the number of partners, although longer jail terms for marijuana possession may lower the number of partners for females.

TABLE 5
Birth Control Use—Sexually Active Respondents

	MALES (N=10,645)				FEMALES (N=11,434)			
	OLS	TSLS	First Stage	Reduced Form	OLS	TSLS	First Stage	Reduced Form
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Binge	–0.006	–0.102			–0.005	–0.139		
	(–5.09)	(–2.77)			(–3.06)	(–2.63)		
Beer tax			–0.964	0.125			–0.244	0.053
			(–1.71)	(2.91)			(–0.99)	(1.48)
Alcohol Outlets			0.147	–0.008			0.095	–0.006
			(1.90)	(–1.24)			(2.68)	(–1.13)
Marijuana Price			–0.001	0.0001			–0.0004	0.0001
			(–1.49)	(2.77)			(–2.15)	(3.23)
Jail			0.552	–0.042			0.328	–0.028
			(1.46)	(–1.40)			(1.84)	(–1.03)
Fine			–0.013	0.0004			–0.005	0.001
			(–1.36)	(0.48)			(–1.10)	(1.47)
Black	–0.016	–0.173	–1.578	–0.012	–0.035	–0.140	–0.752	–0.037
	(–1.15)	(–2.86)	(–11.33)	(–0.90)	(–3.05)	(–3.16)	(–8.84)	(–3.12)
Other race	–0.120	–0.112	0.006	–0.109	–0.169	–0.195	–0.243	–0.158
	(–7.94)	(–5.50)	(0.04)	(–6.96)	(–12.25)	(–9.49)	(–2.65)	(–11.70)

TABLE 5—*Continued*
Birth Control Use—Sexually Active Respondents

	MALES (N=10,645)				FEMALES (N=11,434)			
	OLS (1)	TSLS (2)	First Stage (3)	Reduced Form (4)	OLS (5)	TSLS (6)	First Stage (7)	Reduced Form (8
Age	−0.009	0.005	0.142	−0.010	0.003	−0.004	−0.050	0.004
	(−2.13)	(0.60)	(3.37)	(−2.32)	(0.64)	(−0.65)	(−2.15)	(0.81)
Age greater than grade	−0.005	−0.012	−0.064	−0.005	−0.015	−0.009	0.044	−0.015
	(−0.38)	(−0.58)	(−0.40)	(−0.39)	(−0.85)	(−0.33)	(0.31)	(−0.82)
Age less than grade	−0.194	−0.159	0.322	−0.192	0.216	0.249	0.252	0.220
	(−2.65)	(−1.62)	(0.45)	(−2.63)	(2.45)	(2.98)	(0.48)	(2.43)
Seat belt	0.026	−0.024	−0.531	0.030	0.036	0.008	−0.213	0.038
	(6.05)	(−1.21)	(−10.68)	(7.11)	(8.46)	(0.65)	(−7.33)	(8.85)
Sports	0.016	0.031	0.156	0.015	0.020	0.039	0.143	0.019
	(5.94)	(4.34)	(4.86)	(5.65)	(4.83)	(3.71)	(5.11)	(4.76)
Number of days smoked	−0.001	0.011	0.128	−0.002	−0.001	0.011	0.089	−0.002
	(−3.35)	(2.35)	(19.02)	(−5.15)	(−2.21)	(2.26)	(18.30)	(−3.49)
AIDS education	0.065	0.002	−0.634	0.067	0.054	0.031	−0.159	0.055
	(3.97)	(0.04)	(−3.70)	(4.12)	(3.52)	(1.60)	(−1.56)	(3.62)
State real income	−0.001	−0.001	−0.007	−0.001	−0.0002	−0.001	−0.004	−0.0002
	(−1.25)	(−1.91)	(−1.35)	(−1.35)	(−0.33)	(−0.95)	(−1.43)	(−0.47)
State unemployment	−0.001	0.003	−0.002	0.004	−0.012	−0.011	−0.010	−0.009
	(−0.12)	(0.36)	(−0.03)	(0.72)	(−2.63)	(−1.67)	(−0.25)	(−2.10)
Protestant	0.001	0.001	−0.005	0.001	0.001	0.001	0.001	0.001
	(1.27)	(0.97)	(−0.73)	(2.20)	(1.59)	(1.31)	(0.27)	(2.08)
Catholic	−0.001	0.002	0.021	0.0002	−0.002	0.001	0.018	−0.001
	(−0.87)	(1.16)	(1.60)	(0.15)	(−1.79)	(0.31)	(2.72)	(−0.93)
Southern Baptist	−0.001	0.0003	0.030	−0.003	−0.001	0.002	0.022	−0.001
	(−1.20)	(0.18)	(1.64)	(−1.82)	(−0.80)	(0.89)	(2.82)	(−1.09)
Mormon	−0.021	−0.030	−0.175	−0.002	−0.039	−0.041	−0.068	−0.032
	(−1.85)	(−1.64)	(−0.85)	(−0.17)	(−4.28)	(−2.88)	(−0.62)	(−2.75)
1993	0.047	0.061	0.232	0.036	0.044	0.041	0.018	0.035
	(2.91)	(2.47)	(1.34)	(2.15)	(2.60)	(2.01)	(0.18)	(2.03)
1995	0.038	0.027	−0.144	0.044	0.015	0.029	0.112	0.014
	(2.04)	(1.08)	(−0.64)	(2.63)	(0.81)	(1.13)	(0.97)	(0.82)
1997	0.062	0.084	0.173	0.073	0.026	0.033	0.037	0.032
	(3.24)	(2.59)	(0.64)	(3.63)	(1.80)	(1.44)	(0.26)	(2.21)
1999	0.100	0.134	0.123	0.133	0.060	0.090	0.115	0.091
	(4.64)	(3.72)	(0.40)	(5.74)	(3.40)	(3.32)	(0.76)	(4.68)
North East	−0.012	−0.149	−1.347	−0.017	-0.011	−0.154	−1.035	−0.041
	(−0.32)	(−1.94)	(−2.68)	(−0.39)	(−0.33)	(−2.20)	(−4.25)	(−1.05)
Midwest	−0.005	−0.064	−0.831	0.016	−0.028	−0.093	−0.606	−0.036
	(−0.16)	(−1.12)	(−1.71)	(0.42)	(−0.95)	(−2.01)	(−2.56)	(−1.05)
South	−0.060	−0.100	−0.851	−0.014	−0.101	−0.178	−0.836	−0.076
	(−1.85)	(−1.82)	(−1.76)	(−0.40)	(−3.85)	(−3.85)	(−3.42)	(−3.02)
First Time	−0.033	−0.161	−1.340	−0.024	0.052	−0.007	−0.452	0.055
	(−2.01)	(−3.07)	(−11.61)	(−1.44)	(3.49)	(−0.25)	(−6.84)	(3.64)
R²	0.04	0.02	0.19	0.04	0.05	0.03	0.17	0.05
F on instruments			1.730				3.28	
			[0.134]				[0.008]	
Overidentification test		2.854				3.255		
		[0.583]				[0.516]		
Hausman test		6.783				6.431		
		[0.009]				[0.011		

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year.

TABLE 6
Condom Use—Sexually Active Respondents

	MALES (N=10,760)				FEMALES (N=11,553)			
	OLS (1)	TSLS (2)	First Stage (3)	Reduced Form (4)	OLS (5)	TSLS (6)	First Stage (7)	Reduced Form (8)
Binge	−0.006 (−5.66)	−0.053 (−1.63)			−0.003 (−2.11)	−0.133 (−2.54)		
Beer tax			−0.994 (−1.76)	0.076 (1.70)			−0.241 (−0.98)	0.049 (1.42)
Alcohol Outlets			0.145 (1.89)	0.0002 (0.03)			0.096 (2.69)	−0.009 (−1.45)
Marijuana Price			−0.001 (−1.55)	0.00005 (1.53)			−0.0004 (−2.06)	0.0001 (2.43)
Jail			0.547 (1.44)	−0.015 (−0.45)			0.321 (1.79)	−0.014 (−0.49)
Fine			−0.012 (−1.21)	0.001 (0.92)			−0.006 (−1.16)	0.002 (1.79)
Black	0.049 (3.23)	−0.030 (−0.56)	−1.603 (−11.64)	0.055 (3.76)	0.076 (5.91)	−0.025 (−0.56)	−0.745 (−8.73)	0.072 (5.64)
Other race	−0.059 (−3.99)	−0.056 (−3.81)	−0.010 (−0.07)	−0.053 (−3.48)	−0.058 (−4.47)	−0.084 (−3.97)	−0.238 (−2.49)	−0.050 (−3.87)
Age	−0.034 (−8.64)	−0.028 (−4.47)	0.141 (3.40)	−0.035 (−8.86)	−0.034 (−8.31)	−0.040 (−6.98)	−0.046 (−2.08)	−0.033 (−8.17)
Age greater than grade	0.005 (0.41)	0.002 (0.10)	−0.079 (−0.49)	0.006 (0.42)	0.013 (0.68)	0.019 (0.70)	0.049 (0.35)	0.013 (0.73)
Age less than grade	−0.244 (−3.17)	−0.224 (−2.68)	0.392 (0.54)	−0.243 (−3.16)	0.181 (1.78)	0.297 (1.92)	0.909 (1.08)	0.181 (1.77)
Seat belt	0.028 (6.91)	0.003 (0.16)	−0.540 (−10.75)	0.032 (7.89)	0.037 (8.88)	0.010 (0.78)	−0.213 (−7.36)	0.038 (9.41)
Sports	0.018 (6.93)	0.026 (4.06)	0.155 (4.82)	0.018 (6.53)	0.031 (6.97)	0.051 (4.80)	0.150 (5.13)	0.031 (6.88)
Number of days smoked	−0.001 (−3.39)	0.004 (1.11)	0.126 (18.74)	−0.002 (−5.10)	−0.002 (−3.79)	0.010 (2.09)	0.089 (18.33)	−0.002 (−4.57)
AIDS education	0.052 (2.97)	0.023 (0.79)	−0.598 (−3.52)	0.056 (3.20)	0.041 (2.60)	0.021 (0.93)	−0.149 (−1.47)	0.042 (2.67)
State real income	−0.0002 (−0.04)	−0.0003 (−0.62)	−0.006 (−1.13)	−0.0004 (−0.07)	−0.00002 (−0.04)	−0.0004 (−0.83)	−0.003 (−1.33)	−0.0001 (−0.25)
State unemployment	0.007 (1.21)	0.009 (1.60)	0.010 (0.14)	0.009 (1.61)	−0.005 (−1.01)	−0.004 (−0.67)	−0.013 (−0.32)	−0.002 (−0.36)
Protestant	0.001 (1.05)	0.0005 (0.86)	−0.006 (−0.86)	0.001 (1.72)	−0.00004 (−0.09)	0.00003 (0.06)	0.001 (0.22)	0.0001 (0.29)
Catholic	0.001 (0.57)	0.002 (1.44)	0.020 (1.51)	0.001 (1.10)	−0.002 (−1.75)	0.001 (0.55)	0.017 (2.59)	−0.001 (−0.76)
Southern Baptist	−0.0002 (−0.16)	0.001 (0.56)	0.033 (1.82)	−0.001 (−0.41)	−0.001 (−0.59)	0.002 (0.96)	0.022 (2.95)	−0.001 (−0.91)
Mormon	−0.010 (−0.81)	−0.013 (−0.91)	−0.152 (−0.74)	−0.005 (−0.32)	−0.019 (−1.66)	−0.023 (−1.44)	−0.082 (−0.75)	−0.020 (−1.34)
1993	0.066 (3.30)	0.073 (3.06)	0.223 (1.29)	0.059 (2.80)	0.079 (5.68)	0.074 (3.66)	0.003 (0.03)	0.071 (4.52)
1995	0.074 (3.52)	0.068 (2.84)	−0.156 (−0.69)	0.078 (3.61)	0.086 (5.23)	0.098 (4.05)	0.100 (0.86)	0.085 (5.34)
1997	0.105 (4.19)	0.116 (3.72)	0.176 (0.66)	0.110 (4.20)	0.110 (6.56)	0.116 (4.66)	0.029 (0.21)	0.113 (6.32)
1999	0.132 (5.05)	0.151 (4.60)	0.145 (0.46)	0.152 (5.19)	0.108 (4.80)	0.136 (4.28)	0.102 (0.69)	0.135 (5.64)

TABLE 6—*Continued*
Condom Use—Sexually Active Respondents

	MALES (N=10,760)				FEMALES (N=11,553)			
	OLS (1)	TSLS (2)	First Stage (3)	Reduced Form (4)	OLS (5)	TSLS (6)	First Stage (7)	Reduced Form (8)
North East	−0.009	−0.072	−1.263	−0.024	0.052	−0.091	−1.069	0.019
	(−0.20)	(−1.11)	(−2.54)	(−0.48)	(1.63)	(−1.37)	(−4.34)	(0.45)
Midwest	0.030	0.003	−0.787	0.029	0.049	−0.016	−0.623	0.036
	(0.89)	(0.07)	(−1.63)	(0.69)	(2.00)	(−0.41)	(−2.60)	(0.98)
South	−0.009	−0.027	−0.818	0.004	−0.020	−0.100	−0.871	−0.005
	(−0.25)	(−0.64)	(−1.70)	(0.09)	(−0.84)	(−2.16)	(−3.56)	(−0.17)
First Time	−0.018	−0.082	−1.343	−0.009	0.115	0.062	−0.450	0.116
	(−1.05)	(−1.71)	(−11.76)	(−0.53)	(7.66)	(2.01)	(−6.95)	(7.69)
R^2	0.05	0.04	0.19	0.04	0.06	0.04	0.17	0.06
F on instruments			1.750				3.190	
			[0.129]				[0.010]	
Overidentification test		3.095				2.685		
		[0.542]				[0.612]		
Hausman test		2.093				6.148		
		[0.148]				[0.013]		

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year.

Tables 5 and 6 contain the results of the impact of binge drinking on birth control use and condom use, respectively. Unlike with the probability of having sex or the number of partners, binge drinking does appear to impact the use of birth control and condoms. For both genders, the OLS and TSLS coefficients on binge drinking are negative and statistically significant. As seen previously, the TSLS models suffer from low F-statistics on the instruments in the first stage, although the overidentification restrictions are valid, and the Hausman test is rejected in all cases except for condom use by males. In the reduced form, higher beer taxes will raise the probability of using any birth control and condoms for males. Higher marijuana prices will also increase the use of birth control among sexually active males. For females, higher beer taxes have no impact, although higher marijuana prices will lead to more use of birth control and condoms.

Table 7 shows the results when the number of days in the past 30 days on which the respondent had at least one drink of alcohol is the measure of substance use. Coefficients from the OLS, TSLS and first stage regressions are shown. The reduced form estimates do not change from those in Tables 3-6 and therefore are not repeated. The results for drinking any positive quantities are very similar to those for binge drinking. In the OLS models, drinking is positively related to the probability of having sex and having multiple partners for both males and females, and is negatively related to birth control use by both genders and condom use by males. As with binge drinking, the TSLS coefficients show that drinking lowers birth control use for both genders and condom use as reported by females. Drinking does not raise the probability of having had sex or multiple partners for both genders.

TABLE 7
Drinking and Sexual Behaviors

| | MALES | | | FEMALES | | |
	OLS (1)	TSLS (2)	First Stage (3)	OLS (4)	TSLS (5)	First Stage (6)
HAD SEX						
Drink	0.016	−0.008		0.014	−0.078	
	(28.06)	(−0.41)		(18.49)	(−1.79)	
Beer tax			−0.817			−0.167
			(−1.69)			(−0.59)
Alcohol outlets			0.157			0.072
			(2.13)			(1.58)
Marijuana price			−0.001			−0.0003
			(−2.49)			(−1.75)
Jail			0.470			0.275
			(1.28)			(1.20)
Fine			−4.4E−03			4.8E−03
			(−0.56)			(0.84)
F on instruments			3.420			2.130
			[0.006]			[0.066]
Overidentification test		4.091			8.512	
		[0.394]			[0.075]	
Hausman test		1.631			4.496	
		[0.202]			[0.034]	
NUMBER OF PARTNERS						
Drink	0.054	−0.072		0.031	0.010	
	(20.93)	(−1.08)		(12.28)	(0.24)	
Beer tax			−1.002			−0.469
			(−1.22)			(−1.02)
Alcohol outlets			0.256			0.128
			(2.26)			(1.70)
Marijuana price			−0.001			−0.001
			(−1.39)			(−2.15)
Jail			0.818			0.643
			(1.35)			(1.62)
Fine			−1.1E−02			2.0E−03
			(−0.75)			(0.18)
F on instruments			1.720			2.150
			[0.135]			[0.064]
Overidentification test		1.719			10.440	
		[0.787]			[0.034]	
Hausman test		3.611			0.224	
		[0.057]			[0.636]	

TABLE 7—*Continued*
Drinking and Sexual Behaviors

	MALES			FEMALES		
	OLS (1)	TSLS (2)	First Stage (3)	OLS (4)	TSLS (5)	First Stage (6)
BIRTH CONTROL USE						
Drink	−0.004	−0.063		−0.002	−0.074	
	(−4.84)	(−2.48)		(−1.97)	(−2.44)	
Beer tax			−1.067			−0.410
			(−1.28)			(−0.89)
Alcohol outlets			0.239			0.136
			(2.08)			(1.87)
Marijuana price			−0.001			−0.001
			(−1.53)			(−2.41)
Jail			0.824			0.712
			(1.32)			(1.84)
Fine			−1.7E−02			−8.1E−04
			(−1.09)			(−0.07)
F on instruments			1.620			2.580
			[0.160]			[0.030]
Overidentification test		4.460			3.309	
		[0.347]			[0.508]	
Hausman test		5.463			5.668	
		[0.019]			[0.017]	
CONDOM USE						
Drink	−0.004	−0.030		−0.001	−0.062	
	(−5.99)	(−1.27)		(−1.11)	(−2.10)	
Beer tax			−1.054			−0.447
			(−1.26)			(−0.97)
Alcohol outlets			0.232			0.131
			(2.02)			(1.75)
Marijuana price			−0.001			−0.001
			(−1.54)			(−2.33)
Jail			0.832			0.699
			(1.33)			(1.79)
Fine			−1.5E−02			−7.1E−04
			(−0.97)			(−0.06)
F on instruments			1.570			2.430
			[0.174]			[0.039]
Overidentification test		4.632			4.841	
		[0.327]			[0.304]	
Hausman test		1.220			4.272	
		[0.269]			[0.039]	

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year. All models include age, race, age greater than grade, age less than grade, seat belt, sports teams, smoking, AIDS education, real income, unemployment, religion variables, year indicators, and region indicators.

TABLE 8
Marijuana and Sexual Behaviors

	MALES		FEMALES	
	OLS	TSLS	OLS	TSLS
	(1)	(2)	(3)	(4)
HAD SEX				
Marijuana	0.008	−0.003	0.008	−0.040
	(19.34)	(−0.19)	(12.79)	(−0.56)
F on instruments		1.050		0.360
		[0.391]		[0.872]
Overidentification test		4.437		16.474
		[0.350]		[0.002]
Hausman test		0.386		0.449
		[0.534]		[0.503]
NUMBER OF PARTNERS				
Marijuana	0.026	−0.051	0.013	−0.025
	(16.35)	(−0.81)	(8.66)	(−0.48)
F on instruments		0.730		0.760
		[0.604]		[0.579]
Overidentification test		1.738		8.783
		[0.784]		[0.067]
Hausman test		1.498		0.519
		[0.221]		[0.471]
BIRTH CONTROL USE				
Marijuana	−0.002	−0.043	−0.001	−0.043
	(−3.39)	(−1.71)	(−1.30)	(−1.27)
F on instruments		0.880		0.670
		[0.495]		[0.648]
Overidentification test		4.526		9.855
		[0.340]		[0.043]
Hausman test		2.712		1.537
		[0.100]		[0.215]
CONDOM USE				
Marijuana	−0.002	−0.025	−0.001	−0.043
	(−4.26)	(−1.51)	(−1.80)	(−1.13)
F on instruments		0.890		0.710
		[0.490]		[0.617]
Overidentification test		2.805		8.204
		[0.591]		[0.084]
Hausman test		1.969		1.200
		[0.161]		[0.273]

Notes: T-statistics in parentheses, P-values in brackets, and intercept not shown. Standard errors are adjusted for clustering by state and year. All models include age, race, age greater than grade, age less than grade, seat belt, sports teams, smoking, AIDS education, real income, unemployment, religion variables, year indicators, and region indicators.

Table 8 shows the OLS and TSLS coefficients when the number of times in the past 30 days the respondent used marijuana is considered. The OLS results show that marijuana use is positively related to the probability of having sex and having multiple partners for both males and females. Marijuana use is negatively related to condom use and birth control for males, but is not related to birth control use for females. Unfortunately, no conclusions can be drawn from the TSLS estimates. None

of the instruments in the first stage are statistically significant predictors of marijuana use, thus the TSLS estimates are unreliable. Recall, however, that the reduced form estimates in Tables 3-6 do provide alternative evidence of the relationship. As previously discussed, a higher marijuana price will raise the probability of a female engaging in sex, while higher jail time for possession may lower the number of partners for females. Higher marijuana prices will also raise the probability of birth control use by both genders and condom use as reported by females. One caveat is that it is difficult to attribute the impact of higher marijuana prices in the reduced form directly to marijuana consumption given that the first stage binge drinking and drinking regressions show that marijuana and alcohol are complement goods.

Other Variables

Estimates of the impact of the other included independent variables are shown in Tables 3-6. Results are unaltered when the other substances are included, and there is little difference between the OLS and TSLS estimations. Beginning with the decision to have sex, the regressions show that older teens are more likely to have recently had sex, and black teens and male teens of races other than white or black are more likely than white teens to have recently had sex. Smoking is associated with a higher probability of having sex, as is playing sports for males. Wearing seat belts and having been taught about AIDS (for males only) are both associated with a lower likelihood of engaging in sex.

Similar character traits predict the number of partners. Sexually active teens who are black or of races other than white or black are more likely than whites to have multiple partners. For females, age decreases the number of partners. Males who smoke or play sports have more partners, and those males who wear seat belts or have been taught about AIDS have fewer partners. For both genders, a higher state unemployment rate is associated with higher numbers of partners.

In regards to condom and birth control use, teenagers of races other than black or white are less likely than whites to use condoms or birth control, black females are less likely than whites to use birth control, and older teens of both genders are less likely to use condoms. Teens who play on sports teams are more likely to use protection. Lastly, the indicator for first sexual encounter is negative for males in the birth control equations and positive for females in the condom use equations.

CONCLUSION

Risky sexual behaviors by teenagers have been shown to be strongly correlated with drug and alcohol consumption. The purpose of this study is to examine the question of whether alcohol and drug use increases the likelihood that teenagers will engage in four risky sexual behaviors: having sex, sex with multiple partners, sex without a condom, and sex without birth control. Simple means and OLS regression estimation show that heavy drinking, drinking any amount, and using marijuana are all positively related to the probability of having sex and increased number of partners, and negatively related to the probabilities of using condoms or birth control.

These results are useful in establishing that substance use and risky sexual behaviors are very highly correlated. From a policy perspective, this finding implies that substance-using teens are a high-risk group for risky sexual practices and might be a target for programs and policies designed to reduce sexual risk-taking behaviors. These OLS results do not necessarily imply that substance use causes risky sexual behaviors, however. The substance use coefficients may be biased because they do not address the possibility that substance use may be correlated with unobserved factors that also determine sexual behavior.

Two-stage least squares and a reduced form model are used to account for the potential endogeneity of substance use. Unfortunately, the TSLS estimates often suffer from the problems associated with weak instruments, so these results are only suggestive. The reduced form estimates serve as an alternative estimation technique and provide a check on the TSLS results. Taken together, the TSLS and reduced form results point to the following conclusions: 1) among teenage males and females, alcohol consumption will not influence the probability of having sex nor will it increase the number of sexual partners among sexually active teens; 2) among sexually active teenage males and females, alcohol consumption lowers the use of birth control and condoms; and 3) the impact of marijuana consumption on teenage sexual behaviors remains unclear.

The finding that alcohol consumption (as defined by either heavy drinking or drinking any amount) is unrelated to the probability of having sex is consistent with the findings of previous studies that also account for the potential endogeneity of alcohol consumption. Previous studies have reached divergent conclusions regarding alcohol and unprotected sex, with results differing based on gender and the measure of alcohol consumption under consideration. Our results help inform this debate by providing the first estimates of the impact of alcohol and marijuana use on unprotected sex among sexually active teens. By limiting the sample as such, we measure the impact of consumption on the specific decision to use a condom or birth control that is separate from the decision to have sex. Our findings imply that the risky behaviors of sexually active teens, who may have made the decision long ago to become sexually active, might be altered through policies designed to reduce alcohol consumption.

NOTES

1. Heckman and MaCurdy [1985] and Angrist [2001] show the validity of using linear probability models for estimating simultaneous equations with dichotomous endogenous variables.
2. See Wooldridge [2002] for mathematical formulas and a description of the TSLS methodology.
3. These three personality variables may be endogenous in that they are likely to be determined by the same unmeasured factors that predict risky sex and/or drug and alcohol use. They are included because these variables are not likely to be causal determinants of sexual behaviors and they will help to control for some of the unmeasured personality traits of each individual. Models that exclude these three variables were tested. Results are similar to those presented in the tables.

4. Models that include state dummies rather than region dummies were tested. Unfortunately, the inclusion of state fixed effects in conjunction with the time fixed effects eliminates virtually all the independent variation in the alcohol and drug policies. An OLS regression of beer tax regressed on state and time effects alone yields an R^2 of 0.99. The same regressions for alcohol outlets and marijuana prices yields R^2 values of 0.78 and 0.86, respectively. These results imply that there is not enough variation in the instruments within states to include state fixed effects in the models.

5. Adjusting the standard errors according to Huber [1967] has a large impact on the value of the tests of the TSLS coefficient. The partial F-statistic based on unadjusted standard errors is much higher, at 7.48, and the Hausman test of the consistency of OLS is rejected at the 5 percent level.

6. Estimating the reduced form equations by probit rather than by linear probability does not alter the statistical significance nor the magnitude of the estimated effects.

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