Does alcohol-use increase the risk of sexual intercourse among adolescents? Evidence from the NLSY97

Bisakha Sen

Department of Health Care Organization & Policy, University of Alabama at Birmingham, RPBH 330 1665, University Blvd., Birmingham, AL 35294, USA

Received 1 August 2001; received in revised form 11 February 2002; accepted 11 July 2002

Abstract

This study investigates the causal link between alcohol-use and adolescent sexual activity. In a recent paper, using data from the 1995 wave of the National Longitudinal Study of Adolescent Health, Rees et al. [Journal of Health Economics 20 (5) (2001)] found little evidence of such a link. The data used here are from the National Longitudinal Study of Youth, 1997 (NLSY97), and results indicate that alcohol-use increases the probability of sexual intercourse, even after accounting for the potential endogeneity. However, consistent with Rees et al., there is less evidence that heavy drinking has a significant effect on sexual intercourse.

JEL classification: J13

Keywords: Adolescents; Alcohol; Sexual activity

1. Introduction

A consistent finding in the social science and health science literature is a strong, positive association between adolescent alcohol-use and sexual activity (e.g. Butcher et al., 1991; Cooper et al., 1994; Bentler and Newcomb, 1986; Mott and Haurin, 1988; Staton et al., 1999), apparently suggesting that policies that curb the former will curb the latter. However, both behaviors could well reflect other unmeasured factors such as an individual’s propensity for risk-taking—in which case policies restricting alcohol will not reduce the incidence of adolescent sexual intercourse.

Some indirect evidence of a causal relationship between alcohol-use and adolescent sexual activity is provided by two studies that use state-level panel data. Chesson et al. (2000) find that higher alcohol taxes and higher legal minimum drinking ages (MDAs)
reduce STD rates among adolescents, and Dee (2001) finds that higher minimum legal drinking ages reduce childbearing among black adolescents. To my knowledge there is only one existing study that investigates the causal relationship between alcohol-use and adolescent sexual activity using individual level data. Rees et al. (2001) use the 1995 wave of the National Longitudinal Study of Adolescent Health (hereafter ‘Add Health’), and consider the effects of alcohol (and marijuana) on adolescent sexual activity. By and large, they find no evidence of a real relationship between use of either substance and sexual intercourse once the potential endogeneity is accounted for, and conclude that any link between alcohol (marijuana) use and sexual activity is weak.

One problem that Rees et al. face is that ‘Add Health’ provides no information on the county or state of residence of the respondents, thus making it impossible to merge in state-level alcohol policy variables for use as instrumental variables. The authors are restricted to using policy variables already included in the dataset—which, barring one exception, relate to anti-social behavior in general rather than substance use in specific. Furthermore, Rees et al. model alcohol-use dichotomously, based on respondents’ answer to the question of whether they had “gotten drunk” or “very, very high” on alcohol in the past year. There is scope for subjectivity here, as respondents who had consumed alcohol, but believed that they had not really gotten “drunk” or had only gotten “mildly high”, might answer in the negative. This creates potential for measurement error in the alcohol-use variable, which may bias effects towards zero.

This paper studies the link between alcohol-use and both sexual intercourse per se as well as non-contracepted sexual intercourse using data from the first round of the National Longitudinal Study of Youth, 1997 (NLSY97). The NLSY97 interviewed a sample of 6748 respondents representative of the US population aged 12–16 years on 31 December 1996, and a supplemental over-sample of 2236 Hispanic and black people of the same age group. An advantage of this dataset is that it makes available information regarding the respondents’ state and county of residence, permitting the inclusion of area-specific alcohol policy variables, as well as other state/county characteristics that might affect both alcohol-use and sexual behavior. A self-administered section of the NLSY97 asks respondents whether they consumed any alcohol in the 30 days preceding the survey interview, and whether in that time-period they ever consumed five or more drinks at a stretch. Therefore, there is less scope for subjective interpretations of the questions. That section also asks the respondents aged 14 or more about how often they had sexual intercourse in the 12 months preceding the survey (with 0 being an option), and the regularity of contraception use. The issue of interest is whether Rees et al.’s findings continue to hold after utilizing more specific policy variables, and using more ‘objective’ questions to create the alcohol-use variable.

---

1 Specifically, they use whether the state requires schools to offer drug and alcohol education, per capita government expenditure on police protection, number of arrests per violent crime and number of arrests per crime at the county level. The authors state that ideally they would have liked to include policies pertaining more specifically to substance use, had the data permitted.

2 There is an admitted problem in that the questions regarding recent sexual activity relate to the preceding 12 months, whereas the questions regarding alcohol-use relate to the preceding month only. Hence, for estimation purposes I have to assume that the respondent’s behavior regarding alcohol-use in the preceding month represents her/his ‘typical’ behavior in that regard over the past 12 months.
2. Model, variables and results

The empirical model utilized closely follows that of Rees et al., and is only briefly summarized here. \( S_i^* \) and \( A_i^* \), respectively indicate the unobserved propensities to engage in sexual intercourse and to consume alcohol. Therefore:

\[
S_i^* = \gamma A_i + X_i \beta_1 + Z_{1i} \beta_2 + \epsilon_{1i}
\]

\[
S_i = \begin{cases} 
1, & \text{if } S_i^* > 0 \\
0, & \text{otherwise} 
\end{cases} \tag{1}
\]

\[
A_i^* = X_i \alpha_1 + Z_{2i} \alpha_2 + \epsilon_{2i}
\]

\[
A_i = \begin{cases} 
1, & \text{if } A_i^* > 0 \\
0, & \text{otherwise} 
\end{cases} \tag{2}
\]

where \( X_i \) denotes a vector of observables that can affect both sexual intercourse and alcohol-use, \( Z_{1i} \), the observables that directly affect sexual intercourse only, and \( Z_{2i} \) denotes the observables that directly affect alcohol-use only. Given the potential correlation between \( \epsilon_{1i} \) and \( \epsilon_{2i} \), estimating Eq. (1) using a standard single-equation probit produces biased estimates of the parameter \( \gamma \). Therefore, I adapt the same two estimations methods used by Rees et al. The first method estimates the two equations together using a bivariate probit model. The second method uses 2SLS to estimate Eq. (1).

Two alternate dichotomous indicators of sexual activity are utilized. The first indicates participation in sexual intercourse per se in the past 12 months. The second indicates participation in non-contracepted intercourse.\(^3\) Similarly, two alternate dichotomous indicators of alcohol-use are used—drinking per se in the past 30 days, and ‘heavy drinking’ (i.e. five or more drinks at a stretch) in the past 30 days. The NLSY97 provides extensive information on socio-economic characteristics of respondents. I include in \( X_i \) the respondent’s age, race, ethnicity, religious affiliation, parental family status, dummy indicators for whether the parents (or parent figures) are ‘strict’, family income, and urban residence. Inclusion of any measures of peer behavior poses a problem. The NLSY97 asks about the behavior of students in the respondent’s current (or most recent) school. While peer behavior is typically a strong determinant of the behavior of adolescents, if the respondent’s perceptions about behavior of the general student body are based on the students (s)he ‘hangs out’ with, then ‘peer behavior’ may be endogenous to her/his own behavior. To accommodate this, I estimate and present all results both with and without the peer behavior indicators.\(^4\) Finally, I use the county/state of residence information to merge in selected economic indicators.\(^5\)

\( Z_{1i} \) includes the years since the respondent attained puberty, and merged in state-level variables including the AIDS rate per 100,000 population, maximum monthly AFDC payment

\(^3\) In the latter case, ‘0’ denotes either abstinence in the last 12 months or always practicing contracepted sex.

\(^4\) Details about construction of the peer behavior indicators are available on request.

\(^5\) The county unemployment rate, proportion of adult population in the county who have completed ninth grade or less in education, proportion of adult population with a graduate degree or higher, whether the state is in the south, and median state household income.
to a family of four, and whether the state enforces parental involvement before a minor can obtain an abortion.  

$Z_2$ includes the per gallon beer tax and the per pack cigarette tax in the state, the year in which the state eventually increased the legal MDA to 21 years, per capita spending on police protection by the state, whether the state requires alcohol and drug education at middle school levels or earlier, the county-level juvenile ‘driving under influence’ (DUI) arrest rates per 100,000 population aged 10–17, and per capita alcohol consumption by adults in the state.  

Beer taxes are a standard proxy in the economic literature for alcohol prices (Coate and Grossman, 1988), and have been used to instrument alcohol consumption in studies considering the effect of alcohol on STD rates (Chesson et al., 2000), as well as on violent behavior (Markowitz and Grossman, 2000). Cigarette taxes are included because Dee (1999) finds interrelations in the consumption of cigarettes and alcohol among adolescents, suggesting a possible cross-price effect between cigarette taxes and alcohol-use. The year in which the legal MDA was increased to 21 years should serve as a good indicator for unobserved state attitudes towards drinking among youth.  

Specifically, the later the year in which the MDA was increased, the greater ought to be the tolerance in that state for drinking among youth, and hence the greater the likelihood of alcohol-use by adolescents in that state. Per capita spending on police protection indicates the allocation of state resources to law enforcement. Higher allocations might reduce alcohol-use by deterring proprietors from selling alcohol to underage consumers. Higher rates of arrests for DUI may both deter alcohol-use and indicate a lower tolerance in the community for drinking. On the other hand, it could be argued that rate of DUI arrests might be higher and states might have even increased the MDA more quickly because of a higher propensity for alcohol-use among resident adolescents. This requires that a credible control for that propensity also be included in the model. Accordingly, I include actual adult per capita ethanol consumption in the state to instrument the state’s adolescents’ propensity towards alcohol-use.

Like Rees et al., I do my analyses separately by gender. My final sample consists of never-married adolescents aged 14 or more as of 31 December 1996 who have non-missing information on the important variables. Sample means for alcohol-use and sexual activity are presented in Table 1. Table 2 presents single-equation probit estimates and bivariate probit estimates of the effects of variables in $Z_2$, on alcohol-use, which are of primary interest since they identify the model. Results from likelihood ratio tests indicate that, for girls, variables in $Z_2$ are jointly significant at better than 1% level in all cases. Specifically, juvenile arrest rates for DUI, how late the minimum drinking age was increased, and per capita spending on police protection seem to have significant effects in most cases. In contrast, the variables perform relatively poorly for boys, and are at best just short of being significant at the 10%

---

6 Detailed sources of the state and county variables included in $Z_2$ and $Z_1$ are available on request.
7 Rees et al. include a dummy for state policy on drug and alcohol education in schools that ‘Add Health’ includes. Public use information on this is available only for the year 2000. I did repeat the estimations including that variable, but it was insignificant and had no noticeable impact on the main results of interest.
8 All states eventually increased the legal MDA to 21 years, under threats of losing Federal funding for highway maintenance otherwise. However, there was considerable variation in the year in which different states enforced the MDA of 21. Dee (2001) provides a useful summary of this.
Table 1
Means of alcohol-use and sexual activity

<table>
<thead>
<tr>
<th></th>
<th>Adolescent girls (N = 2490)</th>
<th>Adolescent boys (N = 2771)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had sexual intercourse in past 12 months</td>
<td>0.219 0.413</td>
<td>0.241 0.427</td>
</tr>
<tr>
<td>Had non-contracepted sexual intercourse in past 12 months</td>
<td>0.109 0.311</td>
<td>0.091 0.288</td>
</tr>
<tr>
<td>Proportion of sexually active sample who had non-contracepted intercourse</td>
<td>0.497 0.500</td>
<td>0.380 0.485</td>
</tr>
<tr>
<td>Consumed alcohol in past 30 days</td>
<td>0.260 0.439</td>
<td>0.272 0.445</td>
</tr>
<tr>
<td>Consumed five or more alcoholic drinks at a stretch in past 30 days</td>
<td>0.118 0.322</td>
<td>0.160 0.367</td>
</tr>
<tr>
<td>Proportion of sample consuming alcohol who had five or more drinks at stretch</td>
<td>0.452 0.498</td>
<td>0.590 0.492</td>
</tr>
</tbody>
</table>

Notes: The sample consists of never-married adolescents aged 14 or more as of 31 December 1996 from the NLSY97. Descriptive statistics for all other control variables used in the study are available from the author on request.

level. This may raise some concerns regarding the validity of the results pertaining to boys, but I include them to maintain compatibility with Rees et al.⁹

All models are estimated allowing for within-county correlation of error terms. Adjusted standard errors use the Huber–White method.¹⁰

Table 3 presents the marginal effects of alcohol-use on sexual intercourse and of non-contracepted intercourse. Unsurprisingly, single-equation probit estimations of Eq. (1) indicate strong associational relationships between those activities, with alcohol-use being associated with 20–27% (20–37%) increase in the probability of sexual intercourse and 11–16% (10–17%) increase in the probability of non-contracepted intercourse for adolescent girls (boys). These results are, of course, subject to endogeneity problems. However, unlike Rees et al., I find reasonably strong evidence that alcohol-use continues to have a statistically significant effect on sexual intercourse even after the endogeneity is accounted for. Specifically, bivariate probit results indicate that drinking positively affects the likelihood of sexual intercourse and non-contracepted intercourse at better than 5% level of significance for both genders. 2SLS results indicate that drinking positively affects sexual intercourse for girls, though the results are less statistically significant for boys. Results regarding the effect of drinking on non-contracepted intercourse are less robust, with bivariate probits indicating significant effects, but 2SLS effects falling just short of statistical significance at the 10% level.

One possible reason for the differences between my results and those of Rees et al. is the measure of drinking that is utilized. Recall that their alcohol-use measure was based on respondents’ response to the question of whether or not they had “gotten drunk” or “very, very high” on alcohol within a specified period. That measure would correspond more closely with my indicator of ‘heavy drinking’ (i.e. five or more drinks at a stretch). Table 3 shows that, while the associational effects of heavy drinking on sexual intercourse

⁹ Results from models where the dependent variable is heavy alcohol-use and results from bivariate probits using non-contracepted sexual intercourse are very similar, and therefore not reported separately.

¹⁰ This may be done in STATA by specifying the ‘robust, cluster (county)’ option after the model specification.
Table 2

Effects of selected variables on alcohol-use

<table>
<thead>
<tr>
<th></th>
<th>Adolescent girls</th>
<th></th>
<th>Adolescent boys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-equation probit</td>
<td>Bivariate probit</td>
<td>Single-equation probit</td>
<td>Bivariate probit</td>
</tr>
<tr>
<td></td>
<td>No peer effects</td>
<td>With peer effects</td>
<td>No peer effects</td>
<td>With peer effects</td>
</tr>
<tr>
<td>Beer tax ($ per gallon)</td>
<td>–0.033 (−1.52)</td>
<td>–0.036 (−1.42)</td>
<td>–0.036 (−1.58)</td>
<td>–0.04 (−1.55)</td>
</tr>
<tr>
<td>Cigarette tax ($ per pack)</td>
<td>0.001 (0.02)</td>
<td>0.013 (0.21)</td>
<td>–0.0003 (−0.05)</td>
<td>0.0008 (0.11)</td>
</tr>
<tr>
<td>Minimum legal drinking age raised to 21 years</td>
<td>0.008*** (3.35)</td>
<td>0.007*** (3.21)</td>
<td>0.010*** (3.29)</td>
<td>0.009*** (3.03)</td>
</tr>
<tr>
<td>Juvenile arrest rate for driving under influence&lt;sup&gt;8&lt;/sup&gt;</td>
<td>–0.037*** (−2.93)</td>
<td>–0.020** (−2.48)</td>
<td>–0.005*** (−3.17)</td>
<td>–0.004*** (−2.65)</td>
</tr>
<tr>
<td>Per capita state spending on police protection (S)</td>
<td>–0.0002*** (−4.86)</td>
<td>–0.0002*** (−4.89)</td>
<td>–0.0002 (−1.30)</td>
<td>–0.0002 (−1.32)</td>
</tr>
<tr>
<td>Per capita adult alcohol consumption</td>
<td>0.026 (0.80)</td>
<td>0.029 (0.97)</td>
<td>0.030 (0.58)</td>
<td>0.033 (0.84)</td>
</tr>
</tbody>
</table>

<sup>2</sup> The effect of increasing driving under influence arrest rates by 10 arrests per 100,000 population.

All marginal effects are evaluated at the sample means as \( \beta \equiv \beta(X_i) \). The \( \beta \)-statistics of the effects are in parentheses. All standard errors (and \( \beta \)-statistics) are adjusted for clustering on county. This accounts for potential correlation between error terms of respondents living within each county. Other controls for determinants of alcohol-use are age, race, ethnicity, religious affiliation, parental family status, strictness of parent figures, controls for household income, urban residence, the county unemployment rate, proportion of adult population in the county who have completed ninth grade or less in education, proportion of adult population who have a graduate degree or higher, if state is in the south, and median state household income. The models with peer effects include an index for ‘bad behavior’ and an index for ‘good behavior’ by peers at school. Variables included only in the sexual activity equation are years since puberty, state AIDS rate per 100,000 population, maximum monthly AFDC payment to a family of four, and whether the state enforces parental involvement before a minor can obtain an abortion.

<sup>*</sup> Indicates statistical significance at the 10% level.
<sup>**</sup> Indicates statistical significance at the 5% level.
<sup>***</sup> Indicates statistical significance at the 1% level.
Table 3
The effect of alcohol-use on sexual intercourse and non-contracepted sexual intercourse

<table>
<thead>
<tr>
<th></th>
<th>Adolescent girls</th>
<th></th>
<th></th>
<th>Adolescent boys</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single-equation probit</td>
<td>Bivariate probit</td>
<td>2SLS</td>
<td>Single-equation probit</td>
<td>Bivariate probit</td>
</tr>
<tr>
<td>Sexual intercourse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No peer effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumed alcohol at all</td>
<td>0.236*** (12.88)</td>
<td>0.078*** (5.63)</td>
<td>0.118** (2.13)</td>
<td></td>
<td>0.278*** (13.19)</td>
<td>0.099** (3.22)</td>
</tr>
<tr>
<td>Consumed five or more drinks at a stretch</td>
<td>0.270*** (8.94)</td>
<td>0.036*** (2.64)</td>
<td>0.084 (1.66)</td>
<td></td>
<td>0.368*** (12.01)</td>
<td>0.011 (0.79)</td>
</tr>
<tr>
<td>With peer effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumed alcohol at all</td>
<td>0.203*** (10.61)</td>
<td>0.067*** (4.01)</td>
<td>0.111** (2.23)</td>
<td></td>
<td>0.235*** (11.71)</td>
<td>0.081*** (3.07)</td>
</tr>
<tr>
<td>Consumed five or more drinks at a stretch</td>
<td>0.217*** (7.52)</td>
<td>0.025* (1.94)</td>
<td>0.082 (1.57)</td>
<td></td>
<td>0.312*** (11.62)</td>
<td>0.023 (0.54)</td>
</tr>
<tr>
<td>Non-contracepted sexual intercourse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No peer effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumed alcohol at all</td>
<td>0.141*** (11.98)</td>
<td>0.040*** (2.59)</td>
<td>0.098 (1.56)</td>
<td></td>
<td>0.124*** (8.37)</td>
<td>0.038** (2.12)</td>
</tr>
<tr>
<td>Consumed five or more drinks at a stretch</td>
<td>0.156*** (7.92)</td>
<td>0.019 (1.34)</td>
<td>0.055 (0.79)</td>
<td></td>
<td>0.177*** (8.51)</td>
<td>0.028** (2.06)</td>
</tr>
<tr>
<td>With peer effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumed alcohol at all</td>
<td>0.117*** (10.04)</td>
<td>0.034** (2.34)</td>
<td>0.066 (1.62)</td>
<td></td>
<td>0.098*** (6.72)</td>
<td>0.031** (2.02)</td>
</tr>
<tr>
<td>Consumed five or more drinks at a stretch</td>
<td>0.119*** (6.63)</td>
<td>0.010 (0.66)</td>
<td>0.031 (0.96)</td>
<td></td>
<td>0.140*** (7.11)</td>
<td>0.018 (1.57)</td>
</tr>
</tbody>
</table>

All marginal effects are evaluated at the sample means as $\frac{dP}{dX} = \phi(X)b$. The $t$-statistics of the effects are in parentheses. All standard errors (and $t$-statistics) are adjusted for clustering on county. Other controls included in the models are described in the main paper and in the notes for Table 2.

* Indicates statistical significance at the 10% level.
** Indicates statistical significance at the 5% level.
*** Indicates statistical significance at the 1% level.
(non-contracepted intercourse) from single-equation probits are larger in magnitude than the effects of any drinking, the bivariate probit and 2SLS results find indicate that the effect of heavy drinking is, in fact, less than that of any drinking. In all cases but one, heavy drinking fails to have a statistically significant positive impact on the risk of non-contracepted intercourse. Furthermore, heavy drinking has, at best, very weak effects on sexual intercourse in both the bivariate probit and 2SLS models for boys, and in the 2SLS model for girls. Finally, the magnitudes of the real impact of heavy drinking on sexual intercourse (non-contracepted intercourse) in the above models are consistently smaller than the corresponding magnitudes of drinking per se.

The above results suggest that heavy drinking in itself is not very conducive to sexual activity, and that the associational relationship between heavy drinking and sexual activity essentially arises from unobserved individual characteristics. Taken in conjunction with the results indicating that any drinking does have causal effects on sexual activity, this suggests that it is relatively ‘lighter’ levels of alcohol consumption (still sufficient to lessen inhibitions and hamper judgment) that really increase the probability of sexual intercourse. This is not surprising, since heavy drinking may result in physical sickness, nausea, passing out, or a total loss of mental control—none of which are particularly conducive to voluntary participation in sexual activity. However, the degree of intoxication caused by the ‘lighter’ levels of alcohol-use may not be interpreted by many adolescents as being truly ‘drunk’ or ‘very, very high’. Therefore, adolescents who participate in sexual intercourse due to being mildly intoxicated could answer the alcohol-use question from the ‘Add Health’ in the negative, but would answer the NLSY97 question about consuming any alcohol in the past 30 days in the affirmative. This could contribute to the difference between Rees et al.’s empirical results and mine.

In sum, the findings from this paper indicate that alcohol-use does have a real, positive effect on the likelihood of sexual intercourse among adolescents. This suggests that policies that curtail teen alcohol-use should help reduce the incidence of adolescent sexual intercourse.

**Acknowledgements**

I greatly appreciate the many helpful suggestions from Junsoo Lee, Susan Averett, two anonymous referees and the journal’s co-editor, Thomas McGuire. Aimee Rosenberg provided useful research assistance. The responsibility for all errors and opinions is mine.

**References**


