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BINGE DRINKING & SEX IN HIGH SCHOOL

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ABSTRACT

This paper estimates the impact of binge drinking on sexual activity among a nationally representative set of high school students during the 1990s and 2000s. The main innovations are explicitly controlling for time-invariant preferences regarding sexual behavior and alcohol use, and eliminating non-drinkers from the comparison group. I find that binge drinking significantly increases participation in sex, promiscuity, and the failure to use birth control, albeit by amounts considerably smaller than implied by merely conditioning on exogenous factors. For all outcomes, impacts rise substantially with binge drinking frequency. Results are similar using alternative comparison groups defined by excluding those who do not exhibit other risky behaviors, and by gender and race/ethnicity, but vary by grade level and over time in different ways for engaging in sex than protective behavior. Effects are much larger for the small fraction of students that has not been taught about AIDS/HIV infection in school.

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1. Introduction

Does the strong relationship between alcohol consumption and sexual activity reflect a causal impact of drinking? More precisely, does inebriation, by impairing judgment and limiting inhibition, induce sexual risk-taking that would not otherwise occur? Many economic studies have addressed this question over the last decade, but the answer is still unclear. The difficulty, not surprisingly, is identifying a component of alcohol use that is not associated with unobserved factors also related to sexual behavior. Various empirical approaches have been pursued, but as DeSimone (2010) reviews, each has weaknesses offsetting its particular advantages.

Chesson et al. (2000), Dee (2001), Sen (2003) and Carpenter (2005) each estimated reduced form relationships between sexually transmitted disease (STD) or birth rates and either alcohol taxes, minimum legal drinking ages, or zero tolerance drunk driving laws in U.S. state panel data. Results generally show a negative impact of restrictive alcohol policies, but vary somewhat across different studies as well as age and racial groups within studies. Moreover, while inclusion of state fixed effects and time trends yields credibly exogenous variation, neither drinking nor sexual behavior is observed.

In contrast, analyses of individual-level behavioral data by Rees et al. (2001), Sen (2002), Averett et al. (2004) and Grossman et al. (2005) have encountered difficulty in identifying exogenous changes in alcohol use. Their instrumental variables (IV) estimates are often unexpected, including larger effects for any than intense alcohol use and effects that are unfeasibly large yet statistically insignificant. Rashad & Kaestner (2004) criticized the instruments used in the initial two of these studies for being both weakly related to drinking and separately correlated with sexual behavior, showing that an analogous strategy for cigarette use produces nonsensical large impacts of smoking. The instrument sets employed in the latter

articles have similarly low first-stage *F*-statistics. Grossman et al. (2004) circumvented the need for instruments by using bivariate probit models, but these rely on the strict assumption of joint normality for identification and construction of the estimator. Using individual fixed effects in longitudinal data, Grossman et al. (2005) estimated coefficients that are significant and reasonably sized in one data set, but insignificant in another, while acknowledging that this strategy does not eliminate time-varying endogeneity.

DeSimone (2010) departs from the earlier literature by using cross-sectional data on individual behavior, specifically among college students, but neither utilizing IV (as a primary strategy) nor imposing functional form assumptions. Instead, my approach was to introduce strict controls for previous sexual and drinking activity as proxies for previously-formed preferences, while simultaneously holding constant other behaviors likely to be affected by the same unobservable factors that influence decisions regarding sex and alcohol use. Results showed that binge drinking, a standard measure of intoxication-producing alcohol use in the literature defined as having at least five drinks over a short contiguous period, is unrelated to recent participation in sex but strongly raises the likelihood of having two or more recent sex partners. In both cases, the conclusions hold when the given type of sex is interacted with not having used a condom during the last episode. Thus, the study finds that binge drinking increases the riskiest form of sex, i.e. promiscuity without protection against STD transmission.

Although the results seem sensible, with coefficients which are meaningful yet considerably smaller than without the additional preference and heterogeneity controls, this earlier study still has several limitations. The data set is small, precluding the analysis of protective behavior separately from whether sex occurred at all or with multiple partners while restricting viable identification strategies. Also, the policy relevance of the relationship between

drinking and sexual activity clearly extends beyond college students.

This paper studies high school students, for whom the relationship in question is arguably even more important: most individuals initiate both drinking and sex before finish high school, and very few people fail to at least reach 9th grade whereas many never attend college. Reyna & Farley (2006) note that U.S. adolescents experience three million new sexually transmitted infections annually and two new HIV infections hourly, the latter among the highest rates for any age group. They argue that delaying sexual activity decreases subsequent risky sexual behavior by allowing the maturation of neurological structures that improve judgment and behavioral inhibition. Although most of the earlier cited research likewise focused on teenagers, only Grossman et al. (2005) similarly restricted attention to high school students.

I use data from the national Youth Risk Behavior Surveys (YRBS) administered to U.S. high school students during the 1990s and 2000s (www.cdc.gov/HealthyYouth/yrbs/). In the analysis sample, 53% of students have previously had sex and 38% have done so in the past three months. Among the latter, 28% had at least two sex partners during that time, while 44% did not use a condom and 16% used no birth control during their last sexual encounter. Meanwhile, 78% of respondents have consumed at least one alcoholic beverage in their lives and 49% have done so in the past month. During that time 30% of YRBS participants binge drank, 13% on at least three occasions, and 21% used alcohol or drugs before the most recent episode of intercourse.

The YRBS data convey several advantages. They cover two decades while extending through 2009. More importantly, even using strict inclusion criteria, the initial analysis sample contains over 100,000 observations, providing statistical power to identify small effects and pursue identification strategies not feasible in DeSimone (2010).

In parallel to the earlier study, I begin by accounting for previously-formed preferences

regarding sexual activity and alcohol use, as well as consumption of cigarettes and marijuana, while also holding constant several other covariates likely to reflect factors spuriously correlating the behaviors of interest. As with college students, this severely reduces the estimated impacts of binge drinking on sex outcomes, though all but protection use remain significant and sizable.

The main contribution is moving beyond the above strategy by isolating more restricted non-binge drinking control groups. Specifically, I eliminate non-drinkers, defined in several different ways, from the comparison group.[1] Separately controlling for non-binge alcohol use reveals a strong positive relationship with sexual activity that was not apparent for college students. Under the strong assumption that a causal effect of drinking requires intoxication which can occur only with binge drinking, this association with non-binge alcohol use suggests additional time-varying heterogeneity not eliminated by the controls for lifetime engagement in the behaviors of interest. Consequently, I estimate models that successively remove from the sample students who have never drank, did not do recently, and did not frequently do so recently.

Although binge drinking coefficients continue to shrink, they also maintain statistical significance and remain large enough to be policy-relevant. This typically holds even when samples are further restricted to students who have previously been or are currently sexually active, or based on alternative criteria designed to limit the presence of respondents likely to be unobservably different from binge drinkers. As expected, more frequent binge drinking is more strongly linked to sexual activity.

For these coefficients to reflect causal effects, binge drinkers cannot differ from non-binge alcohol users in ways that influence sexual behavior. Like any identification assumption, there is no way to conclusively prove that this is true. However, three important considerations

[1] This approach contradicts the argument in Sen (2002) that a causal impact can occur only for non-binge alcohol use, because individuals who have consumed five or more drinks are too intoxicated to engage in sex.

point to this conjecture being reasonable. First, it need merely hold conditional on observed determinants, meaning for those who have initiated sex and alcohol at about the same age, had a similar number of previous sex partners and lifetime drinking occasions, analogously comparable previous experience with cigarettes and marijuana, and engaged in an identical set of recent behaviors strongly correlated with drinking and sexual activity. As such, if nothing else, the analysis isolates a highly idiosyncratic form of unobserved heterogeneity. Second, because the "previous" period encompasses the current timeframe under examination, lifetime sex partners and occasions of alcohol (and marijuana) use might respond to current alcohol use while also affecting current sexual behavior, so that holding constant these lifetime measures biases the estimator away from finding an impact of drinking. Third, this strategy treats the entire association between non-binge alcohol use and sexual activity as non-causal, even though many individuals, particularly adolescents who in some cases have had little previous drinking experience with which to build up tolerance, might require less than five drinks for alcohol to affect their decision-making capacities.[2]

Under the interpretation that the evidence implies a direct impact of binge drinking on promiscuous and unprotected sex, an implication is that public policy has a potential role in reducing disease transmission and unintended pregnancies resulting from binge drinking. Indeed, a final set of regressions finds that the impact of binge drinking on risky (though not overall) sexual activity is significantly larger among a small minority of students who have not learned about AIDS/HIV infection in school.

[2] For instance, the U.S. Department of Transportation reports that most drivers, including experienced drinkers, are significantly impaired at a blood alcohol concentration of .08, which a 135-pound female could reach by consuming three drinks in the span on one hour (www.nhtsa.gov/people/outreach/safesobr/13qp/facts/perselaws.html).

2. Data

Data for this study come from all 10 existing waves of the YRBS (Brener et al., 2004), administered between February and May in every odd-numbered year since 1991. The sampling scheme is designed to yield a nationally representative group of 9^{th}–12^{th} grade students. Schools were selected, with probability proportional to enrollment, from primary sampling units (PSUs, comprising sub-areas of very large counties, single large counties or groups of small, adjacent counties) which themselves were selected from strata that allowed for oversampling of schools with large concentrations of black and Hispanic students. From each school, one or two classes of a required subject were chosen randomly from every grade level.[3]

Sample frequencies for the six binary sexual behavior outcomes and binge drinking are reported in the regression tables, since these vary over the numerous different samples that are analyzed. Students are asked with how many people they have had sexual intercourse during the past three months, with choices ranging from zero to six or more. From these responses, I construct indicators for having sex at all and with at least two partners during that time. Simply having sex might convey little risk, if it involves a long-term partner and appropriate protection. However, some sex is risky and, obviously, having sex is a requirement for sexual risk-taking. Having multiple recent partners captures promiscuity, one measure of potentially risky sex. Although this variable might partially pick up transitions from one regular partner to another, it seems probable that at least some sexual activity among students with two or more partners in a three month span occurs outside the context of stable relationships.

Two additional questions ask whether respondents or their partners used a condom and to select "what one method" was used to prevent pregnancy among several choices including "no

[3] All students in these classes were eligible to participate, with student response rates of 83–90% depending on the year. Local parental permission procedures were followed, and students completed self-administered questionnaires in their classrooms during a regular class period.

method." From these responses, I create four additional indicators reflecting interactions between one of the two sexual activity indicators and one of two indicators for not using birth control, one for condoms and the other for any birth control, all of which serve as response variables capturing unprotected sex.

Because the birth control questions pertain to the last episode of intercourse, the timing between these and sexual activity is mismatched. Since having sex is a prerequisite for being labeled as not using birth control, the interaction responses underestimate the incidence of unprotected sex: categorization errors occur only among the sexually active who used protection the last time they had sex but failed to do so on a previous occasion during the last three months. The direction of any resulting bias depends on the relationship between binge drinking and birth control nonuse frequency. If binge drinkers regularly forego protection during sex but non-bingers do so only sporadically, miscategorized respondents are mostly non-bingers, which biases the estimated effect of binging on unprotected sex positively, i.e. towards finding an impact in the expected direction. However, if a prevailing negative association between binge drinking and not utilizing birth control implies that binge drinkers are more likely to be mislabeled, a negative bias, i.e. away from finding the predicted effect, could result. In any case, it is clear that one layer of mismeasurement exists for the four unprotected sex responses that does not for two other sexual activity dependent variables.

Binge drinking is defined as having "5 or more drinks of alcohol in a row, that is, within a couple of hours." Most specifications analyze an indicator of having done so on at least one day in the past month, but I later estimate models that instead include indicators for past month days categories that serve as the actual survey responses.

This, unfortunately, presents another timing mismatch, this time between drinking and

sexual behavior. Any ensuing bias could again go in either direction: some past month binge drinkers might have had sex 1–3 months ago but not more recently, while others who did not drink in the past month might have had sex that was induced by binge drinking 1–3 months ago. We do know, at least, that if these two types of misclassification offset, measurement error is primarily random and any bias will be towards zero, and that minimal bias will occur if binge drinking 1–3 months ago is similar to that in the past month.

Table 1 lists the full set of control variables, all of which are also binary indicators, along with their sample means. Exogenous factors are gender, age, grade, race/ethnicity, and PSU-by-year combinations. Participating in the 10 surveys were 1,479 schools, ranging from 110–159 per year, from a total of 529 PSUs, varying by wave from 42–76. Thus, although not as precise as school fixed effects, each PSU-by-year indicator represents an average of fewer than three schools. Moreover, schools from the same PSU and year are also part of the same sampling stratum, meaning they are homogeneous in terms of racial/ethnic concentration and MSA status.

As a way of controlling for time-invariant preferences regarding the two behaviors under scrutiny, included among the covariate set are indicators for age at which respondents first had intercourse and first drank alcohol "other than a few sips." Similarly incorporated are indicators for the number of sex partners and categories representing the number of days on which students had at least one drink of alcohol, both of which encompass the entire lifetime. To avoid deterministic relationships with recent binge drinking and sexual activity, I make adjustments to all of these variables. Ages of first intercourse and drink are recoded to current age for those who have not engaged in the corresponding activity, as if the variables were specified in terms of years since initiation. Regressions also exclude indicators for 0–2 lifetime sex partners, which thereby becomes a reference group into which students reporting multiple recent partners could

still fall. Similarly, models omit several of the lowest lifetime drinking days categories so that the reference group becomes having ever consumed alcohol on nine or fewer days.

I also control for previous use of marijuana and cigarettes, again as measures of earlier-formed preferences. Each could provide a pharmacological effect that either complements or substitutes for that from consuming alcohol. Or, similar unmeasured characteristics might predict the use of all three substances, along with that of sexual behavior.[4] Marijuana use might also compromise judgment sufficiently to induce sex that would not otherwise take place. Age of first use is included for both marijuana and cigarettes, with a separate category for never having used each. Indicators for times previously used are also specified for marijuana. No such information is recorded for cigarettes, so I alternatively incorporate indicators for having ever tried smoking and smoked at least one cigarette every day for at least a month.

To account for more broad and recent characteristics that are prospectively correlated with drinking and sex but not directly observed, such as risk or time preferences, aggression and impulsiveness, I make use of information on frequency of seatbelt use as a passenger, past year physical fighting, and past month weapon carrying and riding with a driver who has been drinking.[5] The latter could also mark socializing with alcohol-consuming peers. In addition, learning about AIDS/HIV infection in school could directly affect both sexual and drinking proclivities, particularly if such classes cover potentially unhealthy behaviors more generally.

Finally, bodyweight and exercise-related behavior might be relevant if driven by the same unmeasured factors that contribute to alcohol use and sexual activity. These could include traits associated with unhappiness, such as low self-esteem, or that are productive, such as

[4] For instance, Farrell & Fuchs (1982) argued that cigarette smoking reflects higher rates of future discounting.
[5] As an example, Anderson & Mellor (2008) showed that risk aversion predicts both more seatbelt use and less heavy drinking.

sociability. Variables integrated into the analysis include self-described weight relative to ideal, what students are trying to do about their bodyweight, past week days of aerobic exercise and past year sports teams. Particularly in the absence of information on actual bodyweight (and height), each of these could also directly impact sexual activity through attractiveness.

Of the 144,266 participants in the 10 surveys, 21,000 are missing information on recent sexual or alcohol behavior or having learned about AIDS/HIV in school, which I later examine as a policy exercise. I also drop 1,602 students who do not report values for at least one exogenous factor, 160 who are age 12–13, 7,678 for whom previous sexual or drinking behavior is unobserved, 5,927 without information on previous cigarette or marijuana use, 3,114 who are missing values for an additional heterogeneity control and 1,783 with an unobserved bodyweight or exercise measure. This yields an initial analysis sample of 103,002 respondents, though as described below further restrictions are imposed in many specifications.

3. Results

The empirical analysis consists of OLS models in which one of the six sexual behavior indicators is regressed on binge drinking, usually the indicator for whether or not it occurred, and other covariates. Standard errors adjusted for heteroskedasticity and PSU-by-year clustering.

Controlling for time-invariant sex & drinking preferences

Table 2 shows results for the full sample of 103,002 observations, before any restrictions are placed on control group inclusion. Each cell gives the binge drinking coefficient and *t*-statistic from a different regression of the dependent variable listed in the row heading. Successive columns represent specifications in which a new set of regressors is added. The aim

is to examine how holding constant previously established preferences for sex and drinking, along with the other unobserved heterogeneity proxies described earlier, alter the estimates.

Column 1 is a baseline model that conditions on only gender, age, grade, race/ethnicity and PSU-by-year fixed effects. Relative to the dependent variable means listed in the row headings, binge drinking is associated with increases in sexual activity of around 75% for any sex and not using protection, and over 100% for the other three outcomes. These effects, and the corresponding *t*-statistics, are much too large to possibly reflect causation from drinking to sex.

To begin purging endogeneity, column 2 controls for the two measures of previous sexual activity. Simply eliminating differences in sexual behavior linked to initiation age and number of previous sex partners reduces the estimates by 56–67%. Moving to column 3, doing the same for drinking initiation age and lifetime drinking days categories lowers effect sizes by comparable proportions for the two protection outcomes, but less so for having sex and hardly at all for the three promiscuity-related outcomes.

The logic behind the column 2 and 3 specifications is that components of the binge drinking coefficients that are attributable to previous sex- and alcohol-related behavior cannot reflect impacts of current drinking. Already, at least five-eighths of the baseline effects, and up to about five-sixths of those on condom and birth control use, have been eliminated. On the flip side, any sexual and drinking activity that took place during the recent periods encompassed by the dependent and binge drinking variables also, by definition, constitutes overall lifetime experience, implying that controlling for total sex partners and drinking days negatively biases the estimates. This problem is mitigated somewhat by broadening the lower-bound omitted ranges, but could still be relevant given the narrow intervals other than the top-codes and next-highest drinking days category.

Controlling for marijuana & cigarette use, and other heterogeneity proxies

The distinguishing characteristics of the controls added to the regressions in columns 4–7 of table 2 are that they are not manifestations of either binge drinking or sexual activity, and except for possibly marijuana use they are unlikely to occupy the causal pathway from one to the other. Some regressors might directly influence both variables, but cannot stem directly from binge drinking. Many others likely reflect spurious correlates such as time or risk preference.

For all six outcomes, the net impact of adding all the additional heterogeneity proxies, moving from column 3 to 7, is substantially smaller than that of simply conditioning on previous sexual activity in column 2, and is comparable to that of controlling for previous drinking in column 3 in all but one case (having multiple partners, for which the estimates in columns 2 and 3 are essentially the same). Coefficient changes result almost exclusively from adding previous marijuana use and the "other heterogeneity proxies" to the explanatory variable set, with previous cigarette use and the bodyweight/exercise measures making little difference.

Column 7 represents the full sample model that controls for all observables. Binge drinking no longer impacts the overall use of condoms or birth control. However, coefficients in the other four equations remain highly significant, though appreciably smaller than in column 1. Binge drinking is accompanied by increases of 12% in having sex and 40–50% in promiscuity-related outcomes.

Restricted comparison groups: sex participation

Although it is encouraging that most of the binge drinking coefficient changes in table 2 occur when accounting for previous sexual and drinking activity, it is still the case that the preferences reflected by such behavior might change over time, and that the other additional

controls are not explicitly related with drinking or sex. I address both of these issues by next restricting the comparison groups to those who have consumed alcohol but are not past month binge drinkers. The identification assumption thereby becomes that binge drinkers are not unobservably different, in terms of omitted sexual behavior determinants, from non-binge alcohol users when previous sexual activity and alcohol use are held constant along with the other heterogeneity proxies. This strategy attributes all alcohol-related causation to binge drinking, which implicitly presumes that any relationship with non-binge alcohol use entirely reflects unobserved differences between drinkers and nondrinkers in the propensity to have sex. Although some individuals might require fewer than five drinks in a short time span for decisions about engaging in sex to be affected, I choose to impose this restriction and thus err on the side of biasing the estimator away from finding a drinking effect.

Table 3 shows results for participation in sex, with each column alluding to a separate regression. It is useful to begin with this most general measure of sexual activity because even protected sex with a regular partner can carry a small risk of pregnancy if not STD transmission, having sex at all is the most basic behavioral margin without which risky sex cannot occur, and whether the respondent has had sex is apt to be the best-measured response variable.

Columns 1–4 illustrate the four ways in which I make the aforementioned comparison group restrictions. In column 1, I simply insert an indicator for any past month alcohol use as an additional regressor. The estimates imply that drinking in less than binge quantities is associated with a 4.4 percentage point increase in the likelihood of having sex, while binge drinking further raises this likelihood by another 2.5 percentage points. This reflects a nearly 50% reduction in the binge drinking coefficient compared to column 7 of table 2. However, binge drinking still increases the probability of sex by a highly significant 6.5%. Also of note is the *R*-squared of

nearly 0.42 which, though implying that well over half of the variation in whether students are sexually active remains unexplained, is quite high for a regression in a micro data set of this size.

Going a step further, column 2 removes from the sample the 22% of students who have never tried alcohol, raising the binge drinking rate from 30% (as reported in introduction) to 38%. Non-binge alcohol use is not as strongly, though still significantly, correlated with sex when compared to non-drinking just among students who have ever consumed alcohol. More relevantly, the significance and proportionate impact of binge drinking rise slightly.

In column 3, students who did not drink in the past month, comprising another three-eighths of remaining observations, are excluded. This explicitly uses a control group of current non-binge alcohol consumers to identify the effect of binge drinking, rendering binge drinkers and the sexually active as majorities in the sample. Still, results are essentially unchanged, with the binge drinking coefficient signifying a 6.2% increase in the incidence of sex.

The most constrained specification is in column 4, where I eliminate the nearly half of respondents still left who drank on only 1–2 days in the past month. This should make the control group, which now consists of students who drank on at least three days but did not binge, even more homogeneous with binge drinkers. A disadvantage is that only one-sixth of those still in the sample did not binge drink, making it even less representative of the high school population. Yet, other than a slight decrease in proportionate size, the coefficient is unchanged.

Columns 5–8 re-estimate the models in columns 1–4, respectively, with the additional inclusion requirement of having previously engaged in sex. Binge drinking effects are somewhat smaller, especially standardized by the larger fraction of sample respondents who had sex in the past three months. But this should be expected, as all exclusions relative to the corresponding preceding specification (four columns to the left) are, by definition, students who are currently

sexually inactive. Coefficients maintain significance at 1% except in column 8, but even in this most restrictive model, with a comparison group of non-virgins who drank on at least three past month days, binge drinking raises the incidence of sex by 2% at the 5% significance level.

In sum, the impact of binge drinking remains significant and nontrivial even when compared to relatively frequent current drinkers and/or those with sexual experience. The column 3 estimate, which is stringent in eliminating current non-drinkers but preserves both non-binge alcohol users and the sexually inactive as a substantial minority of observations, implies that binge drinking raises the likelihood of having sex by just over 6%.

Restricted comparison groups: promiscuity

Table 4 displays estimates for having sex with at least two partners in the past 3 months. Having sex with an additional partner clearly raises the risk of disease transmission, for a given level of protective effort. The format and specifications mimic table 3, except that columns 5–8 now limit the sample to students who have had sex in the past three months. Thus, the column 1–4 estimates show the net effect on promiscuity, whereas columns 5–8 isolate the impact on moving beyond having a single sex partner into the category of promiscuous sex.

A couple differences emerge compared with table 3. Coefficients for any alcohol use, though significant, are smaller than those for binge drinking, suggesting that selection plays less of a role for promiscuous than overall sexual activity. In contrast, as a percentage, the impact of binge drinking falls as comparison groups become more restricted in columns 1–4 and again in columns 5–8. Still, effects remain highly significant with much larger semi-elasticities than those for simply having sex. The net effect of binge drinking in column 3 is to make promiscuity more likely by one-sixth. Even among the sexually active, binge drinking increases the

probability of having sex with a second partner by one-in-seven. Thus, binge drinking raises the incidence of promiscuity at least in part by inducing students who have already had one recent sex partner to have an encounter with a different person.

Restricted comparison groups: protection

Table 5 repeats the exercises of the previous two tables, this time for sex without condoms or any birth control during the last episode within the past three months. Each column of each panel presents a distinct regression, with identical specifications across panels in a given column other than the different dependent variables.

Panel A shows that binge drinking has little bearing on condom use. In columns 1–4, neither type of alcohol use is significantly related to whether respondents had sex without a condom. Coupled with the strong positive effects on the overall incidence of sex, this implies an unexpected negative impact of drinking on condom use among the sexually active, which is statistically significant in the column 5–6 specifications that include past month nondrinkers. For binge drinking, this seems unlikely to reflect a direct impact, but the implied semi-elasticity is small and becomes insignificant when binge drinkers are compared strictly with current non-binge alcohol users in columns 7–8.

In panel B, the negative alcohol use coefficients are noticeably larger, taking into account the considerably smaller proportion of students who fail to use any birth control than simply do not use a condom. However, the effects of binge drinking are positive and become significant, at 1% overall and 10% conditional on having sex, once current non-drinkers are removed from the sample. Columns 3 and 7 imply, respectively, that binge drinking elevates birth control nonuse

by 10% on net and 6% among the sexually active.[6]

Combined with the results from tables 3–4, the negative coefficients on any alcohol use in both panels of columns 5–6 (and associated change in binge drinking coefficients moving to columns 7–8) suggest selection into sexual activity among alcohol users, apart from any causal impact of binge drinking. If drinkers are more likely to have sexual relationships in part because they are simply more socially interactive, they would presumably be aware of this (regardless of whether drinking is motivated by a desire to engage in sex) and thus prepared to protect against infection and pregnancy. This evidence provides further justification for purging current nondrinkers from the control group.

In examining protective behavior in conjunction with promiscuity rather than simply any sexual activity, table 6 follows the same pattern as table 5, with columns 9–12 added to provide estimates in samples further restricted to include only respondents who had sex with at least two partners in the past three months. The positive association between alcohol use and having sex observed in tables 3–4 seems to dominate the negative association with birth control non-use viewed in table 5, as coefficients are significantly positive (but relatively small) in the condom use regressions not restricted to those with multiple partners, and insignificant otherwise. In panel A, columns 1–8, binge drinking increases the incidence of promiscuous sex without a condom, by 18% overall (column 3) and 16% among the sexually active (column 7). Presumably this occurs via strong effects on promiscuity, which inevitably involves some absence of condom use, given that binge drinking does not influence condom use in table 5 or among those with multiple partners in columns 9–12. The analogous birth control nonuse semi-elasticities in panel B, 27% among all drinkers and 26% among those who had sex in the recent

[6] These results are likely to be conservative in the sense that students who chose withdrawal, "some other method" (besides a condom, the pill and injection) and "not sure" are coded as having used birth control.

period, are even larger. And binge drinking reduces the use of protection even among those with multiple partners, by 15% in column 11. Thus, binge drinking raises the incidence of the riskiest type of sex that can be studied in these data, particularly with regard to the transmission of STDs.

Binge drinking frequency

It would seem that a necessary (though not sufficient) condition for binge drinking to causally influence sexual activity is that their association becomes stronger as binge drinking frequency increases. As such, table 7 shows estimates for models in which binge drinking is specified using separate indicators for five categories of days on which it took place during that time.[7] In this and remaining tables, each column corresponds to a different sexual behavior, with specifications matching those in column 3 of tables 3–6, i.e. the only sample inclusion criterion is past month alcohol use. This highlights the net impact of binge drinking, incorporating but not directly examining effects at the margin for those who are sexually active.

Results are as expected. There are only four cases in which coefficients are not monotonically non-decreasing in days, all in columns 2–4, and in each of these the difference in adjacent coefficients is small and highly insignificant. Effects of binge drinking on only one day are substantially smaller than the corresponding average effects in tables 3–6, yet are significant for the four outcomes besides overall condom and birth control use. In contrast, binge drinking on at least 10 days has impacts that are considerably larger than those of binge drinking on average and are significant even for the two protective behavior responses. Implied semi-elasticities for this highest binge drinking frequency category are 10–15% for any sex and condom nonuse, 35–40% for birth control nonuse and multiple partners, and 80–100% for

[7] These categories are the ones reported in the survey, except that 10–19 and 20 or more days are combined because relatively few students binge drink on 10 or more days. Regressions also control for identically constructed overall alcohol use frequency indicators, with an omitted category of 1–2 days because these are not reported separately.

promiscuity without a condom and any protection, respectively.

Alternative comparison groups

As a way of homogenizing the control group with binge drinkers while not systematically ignoring non-drinkers, table 8 shows results using alternative comparison groups. All cells represent the binge drinking coefficient from separate regressions using the sample described in the row heading, with the dependent variable mean also listed. In each of the eight rows, the inclusion criterion is engaging in a behavior that is highly correlated with binge drinking.

Although sample sizes and rates of binge drinking and sexual activity vary in accordance with the behaviors used to construct the samples, results are remarkably stable across the different comparison groups. For the four outcomes with the strongest results in tables 3–6, i.e. those other than use of condoms and any birth control, binge drinking is significant at 1% in all cases except with regard to any sex among those who have smoked cigarettes daily for at least a month, in which case it still significant at 5%. The smallest proportionate effects are 3% for any sex and 15% for multiple partners, both in the sample of regular smokers, and 17% and 23% for promiscuity without a condom or any protection, respectively, both in the sample of students who rode with a drinking driver in the past month. Not coincidentally, binge drinking is most prevalent in these two samples. Coefficients are significant for sex without birth control in five of eight samples, with semi-elasticities as large as 17%, and remain insignificant for sex without a condom, as with the original comparison groups, in all but one case. Thus, the earlier binge drinking findings are not idiosyncratic to the particular way in which the control group is made more comparable to the set of binge drinking students.

Stratified samples

Table 9 investigates whether the relationship of interest differs by gender, grade, race/ethnicity, or time period.[8] Perhaps surprisingly, considering differences in rates of risky behavior, birth control options and risky sex consequences, results are strikingly similar by gender in panel A. Estimates are also comparable for white non-Hispanics and other racial/ethnic groups in panel B., although are proportionately larger among the former with regard to any sex and especially not using birth control.

Two distinct patterns emerge across grade levels in panel C. For the three outcomes not involving multiple partners (columns 1, 3 and 4), coefficients are monotonically decreasing with advancing grade level. Binge drinking significantly increases sex participation in all grades, but reduces use of any birth control only for 9th–10th graders and condoms just for 9th graders. This trend is consistent with the conclusion in DeSimone (2010) that binge drinking does not impact these outcomes for college students, including the negative (but insignificant) relationships with condom use for both 12th graders and undergraduates. Meanwhile, coefficients are uniformly significant in the promiscuity equations other than for condom use among 10th graders, but are somewhat smaller for 10th than 9th graders before rising when moving to 11th and again to 12th grade. Effects on promiscuous sex that are strong for 12th graders, and increasing starting in 10th grade, are again consistent with large impacts on college students estimated in the earlier study.

In panel D, binge drinking has a stronger effect on having sex, with at least one and multiple partners, in the 2000s than 1990s. However, the opposite is true for remaining outcomes except promiscuity without birth control, for which coefficients are about the same.

[8] Results by age are similar to those by grade. I show the latter disaggregation because this does not require dropping any of the indicators for age of first experience, it seems logical that behavior would be shaped at least as much by school cohort as chronological age, the grouping is more natural given associated sample sizes, and the results are more directly comparable with those for college students in DeSimone (2010).

Impact of AIDS/HIV education

A direct impact of binge drinking on unprotected and promiscuous sex increases any existing justification for policy intervention to reduce adolescent binge drinking and risky sex, the latter because it is more likely to occur without intention than if it was not increased by binge drinking. One common approach is to raise awareness of the issue by providing information to students as part of classes during school. As listed in table 1, my covariate set includes a measure of whether students learned about AIDS/HIV infection in school, or are unsure whether they did, versus not having done so. I use this to examine whether an educational program can mitigate the deleterious sexual behavior consequences of binge drinking.

Table 10 reports estimates for models in which interactions between binge drinking and the two AIDS/HIV variables are added to the right-hand side. In the top row, binge drinking effects are slightly smaller than before, as expected because the effects now reflect behavior of the vast majority of students who have learned about AIDS/HIV in school. More importantly, the interaction terms in the second and third rows are uniformly positive, and at least one is significant in all regressions other than that for simply having sex, the least-risky outcome. Column 2 reveals that binge drinking raises the incidence of promiscuous sex by 15% for students who have learned about AIDS/HIV, but by 26% for students who have not. In column 3, binge drinking boosts the likelihood of sex without a condom by one-sixth among those unsure about AIDS/HIV education, but negligibly otherwise. Analogously, the binge drinking effects in columns 4–6 are 3–4 times greater for those who have not (and in column 5, are unsure about having) received AIDS/HIV information. Moreover, the two interactions are jointly significant in columns 2–6, even though both are individually significant in only one case. Thus, AIDS/HIV education substantially reduces the adverse impact of binge drinking on risky sex.

Definitive policy inferences cannot be drawn from these results. The amount and quality of other relevant information simultaneously transmitted to students is unclear and likely varies widely across schools, and as my grouping of the AIDS/HIV variable with "other heterogeneity controls" implies, the receipt of such education is not necessarily exogenous. However, 7 in 8 students report such learning (and over one-third of others might simply not recall experiencing it), and PSU-by-year indicators identify effects within small sets of schools of similar racial composition and metropolitan area status.[9] Also, it is suggestive that AIDS/HIV education mitigates the impact of binge drinking on all sexual behaviors except the incidence of sex, which conveys minimal risk if accompanied by the appropriate protective behavior.

4. Conclusion

This study has estimated positive impacts of binge drinking on sexual activities with varying inherent risks, using comparison groups of non-binge alcohol users and holding constant previous sexual and drinking experience as well as many other related behaviors. Assuming that remaining unobserved differences between binge drinkers and non-binge alcohol users are unrelated to sexual proclivities, these impacts reflect sex that would not occur in the absence of binge drinking. If so, binge drinking elevates the incidence of risky sex by both prompting students who would otherwise be sexually inactive to engage in sex, and the sexually active to take on an additional partner and forego the use of birth control, with the latter occurring even conditional on having more than one recent sex partner.

Binge drinking raises the likelihood of having sex by 6%, at least two recent partners by 5%, sex without birth control by 10%, multiple recent partners without a condom by 18%, and

[9] Interestingly, the percentage responding affirmatively was nearly 82% even in 1991, and has remained between 88–90% in every survey starting with 1995.

multiple recent partners without any protection by 27%. Furthermore, binge drinking increases the probability of current sex participation by 2% among those who have previously had sex, promiscuity by 14% and failure to employ birth control by 6% among those who are currently sexually active, and nonuse of birth control by 15% among those who have had at least two recent sex partners. Greater binge frequencies have larger effects, with all sex outcomes occurring significantly more often among students who binge drank on at least six days in the past month. Results are similar using alternatively constructed control groups.

A broad implication is that reduced risky sex is a prospective benefit of policies that are able to diminish binge drinking among high school students. The analysis illustrated that one potentially effective policy is school-based AIDS/HIV instruction, which appears to lower the impact of binge drinking on risky sex outcomes. There appears limited scope for extending such education to new recipients, since only a small fraction of students is not already exposed to it. Increasing the amount provided in schools that already offer it, or targeting programs towards alcohol offenders and abusers, is a possibility, but whether doing so would convey additional benefits that are worth the opportunity costs is unclear.

Most existing research on drinking and sex has focused on adolescents and young adults, suggesting that investigation of the relationship for older adults might be a fruitful avenue for future research. The divergence in results for high school and college students implies that the relationship might also vary for, say, the population of working-age adults or married couples with children at home. This is particularly true because the baseline situation (a stable long-term partner) and intrinsic cost of risky sex (including family dissolution) is likely to differ for these groups compared with those in their teens and early 20s.

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Table 1: Control variable definitions and means

Exogenous factors
Female (.525)
Age: 14 (.090), 15 (.218), 16 (.257), 17 (.268), ≥ 18 (.168)
Grade: 9^{th} (.230), 10^{th} (.245), 11^{th} (.256), 12^{th} (.269)
Race/ethnicity: white (.457), black (.205), Hispanic (.260), all others (.078)
Previous sexual activity
Age first had sex: ≤ 11 (.044), 12 (.041), 13 (.071), 14 (.173), 15 (.255), 16 (.218), ≥ 17 (.199)
Lifetime sex partners: 0–2 (.748), 3 (.071), 4 (.045), 5 (.031), ≥ 6 (.105)
Previous alcohol use
Age first drank: ≤ 8 (.089), 9–10 (.065), 11–12 (.125), 13–14 (.291), 15–16 (.320), ≥ 17 (.111)
Lifetime days drank: 0–9 (.538), 10–19 (.119), 20–39 (.117), 40–99 (.104), ≥ 100 (.122)
Previous marijuana use
Age first used: never (.588), ≤ 8 (.012), 9–10 (.017), 11–12 (.056), 13–14 (.156), 15–16 (.142), ≥ 17 (.029)
Lifetime times used: 0 (.588), 1–2 (.097), 3–9 (.086), 10–19 (.049), 20–39 (.048), 40–99 (.044), ≥ 100 (.088)
Previous cigarette use
Age first smoked whole cigarette: never (.496), ≤ 8 (.035), 9–10 (.050), 11–12 (.108), 13–14 (.168), 15–16 (.115), ≥ 17 (.028)
Ever tried (.633)
Ever smoked daily for at least month (.168)
Other heterogeneity proxies
Learned about AIDS/HIV in school: yes (.876), no (.078), not sure (.045)
Rode with drinking driver past month (.351)
Seatbelt use as passenger: never (.050), rarely (.114), sometimes (.172), most of time (.287), always (.378)
Carried weapon past month (.186)
Physical fights past year: 0 (.661), 1 (.185), ≥ 2 (.155)
Bodyweight/exercise measures
Describe weight as: very under (.019), slightly under (.136), about right (.538), slightly over (.266), very over (.041)
Trying to do about weight: lose (.438), gain (.189), maintain (.187), nothing (.186)
Days aerobic exercise past week: 0 (.182), 1 (.092), 2 (.106), 3 (.121), 4 (.091), 5 (.138), 6 (.070), 7 (.201)
Sports teams played on past year: 0 (.457), 1 (.229), 2 (.155), ≥ 3 (.159)

All variables are binary indicators. Parentheses contain sample frequencies. Age first had sex and drank are recoded to current age for those who have never engaged in the activity. Regressions exclude one indicator for each categorical variable (and never used marijuana, which is redundant with zero lifetime uses), and include a constant and indicators for all PSU-by-year combinations except one.

Table 2: Effects of binge drinking on sexual behavior with expanding control variable sets

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Any sex past 3 months	.280	.120	.080	.062	.058	.047	.046
μ = .384	(72.6)	(36.3)	(20.9)	(15.8)	(14.7)	(12.0)	(11.6)
2+ partners past 3 months	.155	.054	.053	.050	.051	.043	.042
μ = .107	(49.0)	(25.1)	(20.4)	(19.3)	(19.3)	(16.4)	(16.0)
No condom last time	.129	.050	.022	.009	.007	–.001	.002
μ = .168	(41.4)	(17.0)	(6.22)	(2.51)	(1.91)	(0.17)	(0.52)
No birth control last time	.045	.015	.007	.002	.001	–.003	–.001
μ = .061	(23.1)	(7.82)	(3.03)	(0.89)	(0.41)	(1.28)	(0.60)
2+ partners & no condom	.074	.031	.027	.025	.025	.020	.021
μ = .045	(36.4)	(18.7)	(14.6)	(13.5)	(13.3)	(10.6)	(10.7)
2+ partners & no birth control	.032	.014	.012	.011	.011	.009	.009
μ = .018	(24.6)	(13.0)	(10.9)	(9.69)	(9.63)	(7.59)	(7.84)
Controls for:							
Exogenous factors	X	X	X	X	X	X	X
Previous sexual activity		X	X	X	X	X	X
Previous alcohol use			X	X	X	X	X
Previous marijuana use				X	X	X	X
Previous cigarette use					X	X	X
Other heterogeneity proxies						X	X
Bodyweight/exercise measures							X

The sample contains 103,002 respondents, among whom binge drinking frequency was .298. Each cell reports the coefficient of the past month binge drinking indicator in the OLS regression of the sexual behavior outcome in the row heading, which occurs with frequency μ, with absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering in parentheses. Variables included in each category, as listed in table 1, are: exogenous factors (gender, age, grade, race, PSU-by-year indicators), previous sexual activity (age at first intercourse, lifetime partners), previous alcohol use (age at first drink, lifetime days drank), previous marijuana use (age at first use, lifetime times used), previous cigarette use (ever tried, ever smoked regularly, age at first whole cigarette), other heterogeneity proxies (ever taught about AIDS/HIV in school, rode with drunk driver past month, seatbelt use, carried weapon past month, physical fights past year), and bodyweight/exercise measures (self-described weight category, trying to lose or gain or maintain weight, aerobic exercise days past week, sports teams past year).

Table 3: Effects of binge drinking on sex participation using various comparison groups

Drinking variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Binge drank past month	.025	.031	.032	.032	.016	.017	.019	.016
	(5.77)	(7.01)	(6.80)	(4.50)	(2.80)	(3.01)	(3.19)	(1.96)
Any alcohol use past month	.044	.027			.035	.034		
	(11.6)	(7.02)			(6.25)	(5.94)		
Proportion had sex	.384	.450	.518	.596	.729	.738	.763	.785
Proportion binge drank	.298	.381	.603	.822	.420	.464	.658	.845
R-squared	.417	.380	.367	.355	.147	.147	.147	.161
Sample size	103,002	80,539	50,942	27,540	54,252	49,081	34,603	20,888
Sample restrictions:								
Drank in lifetime		X				X		
Drank in past month			X				X	
Drank 3+ days in past month				X				X
Had sex in lifetime					X	X	X	X

Each column reports results from an OLS regression of having sex in the past three months on the drinking indicators in the row headings, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 4: Effects of binge drinking on promiscuous sex

Drinking variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Binge drank past month	.034	.034	.028	.028	.051	.051	.046	.041
	(11.9)	(11.8)	(9.33)	(5.30)	(9.16)	(9.08)	(7.74)	(4.29)
Any alcohol use past month	.017	.018			.033	.036		
	(8.00)	(8.02)			(6.48)	(6.79)		
Proportion 2+ partners	.107	.128	.169	.229	.279	.285	.326	.385
Proportion binge drank	.298	.381	.603	.822	.448	.489	.670	.851
R-squared	.420	.410	.426	.446	.374	.370	.375	.392
Sample size	103,002	80,539	50,942	27,540	39,558	36,235	26,403	16,403
Sample restrictions:								
Drank in lifetime		X				X		
Drank in past month			X				X	
Drank 3+ days in past month				X				X
Had sex in past 3 months					X	X	X	X

Each column reports results from an OLS regression of having sex with 2+ partners in the past three months on the drinking indicators in the row headings, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 5: Effects of binge drinking on sex without condoms or birth control

Drinking variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			A. Did not use condom					
Binge drank past month	.001	.002	.005	.010	–.015	–.014	–.009	–.000
	(0.25)	(0.59)	(1.10)	(1.42)	(1.98)	(1.91)	(1.24)	(0.04)
Any alcohol use past month	.002	–.005			–.025	–.029		
	(0.58)	(1.47)			(3.71)	(4.04)		
Proportion did not use condom	.168	.201	.231	.270	.438	.447	.445	.454
R-squared	.199	.186	.176	.172	.102	.102	.104	.115
			B. Did not use birth control					
Binge drank past month	.002	.003	.008	.014	.002	.003	.010	.018
	(0.73)	(1.26)	(2.93)	(2.70)	(0.41)	(0.54)	(1.85)	(1.93)
Any alcohol use past month	–.007	–.012			–.033	–.037		
	(3.21)	(5.03)			(6.23)	(6.64)		
Proportion did not use birth control	.061	.072	.080	.096	.160	.161	.156	.161
R-squared	.082	.080	.080	.090	.070	.073	.076	.092
Proportion binge drank	.298	.381	.603	.822	.448	.489	.670	.851
Sample size	103,002	80,539	50,942	27,540	39,558	36,235	26,403	16,403
Sample restrictions:								
Drank in lifetime		X				X		
Drank in past month			X				X	
Drank 3+ days in past month				X				X
Had sex in past 3 months					X	X	X	X

Each column in each panel reports results from an OLS regression of not using a condom (panel A) or any birth control (panel B) during the last episode of sex on the drinking indicators in the row headings, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 6: Effects of binge drinking on promiscuous sex without condoms or birth control

Drinking variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					A. 2+ partners & no condom							
Binge drank	.018	.017	.013	.017	.028	.028	.023	.030	.015	.014	.017	.034
	(8.64)	(8.15)	(5.78)	(4.26)	(6.61)	(6.44)	(5.15)	(3.86)	(1.07)	(0.98)	(1.12)	(1.61)
Any alcohol use	.005	.006			.015	.015			.004	−.001		
	(3.38)	(3.47)			(3.98)	(3.92)			(0.25)	(0.09)		
Proportion 2+ partners & no condom	.045	.055	.074	.103	.116	.122	.143	.173	.416	.427	.437	.451
R-squared	.179	.179	.192	.212	.154	.157	.166	.186	.142	.141	.149	.166
					B. 2+ partners & no birth control							
Binge drank	.009	.009	.008	.012	.015	.015	.015	.020	.023	.023	.027	.038
	(6.75)	(6.64)	(5.50)	(4.16)	(5.51)	(5.52)	(5.01)	(3.83)	(2.30)	(2.25)	(2.56)	(2.38)
Any alcohol use	.001	.000			.002	.002			−.013	−.016		
	(0.86)	(0.44)			(0.92)	(0.73)			(1.07)	(1.23)		
Proportion 2+ partners & no birth control	.018	.022	.030	.042	.048	.049	.058	.071	.170	.173	.177	.185
R-squared	.089	.091	.102	.121	.088	.092	.103	.125	.104	.109	.123	.149
Proportion binge drank	.298	.381	.603	.822	.448	.489	.670	.851	.579	.619	.742	.872
Sample size	103,002	80,539	50,942	27,540	39,558	36,235	26,403	16,403	11,046	10,332	8,616	6,308
Sample restrictions:												
Drank in lifetime		X				X				X		
Drank in past month			X				X				X	
Drank 3+ days				X				X				X
Sex past 3 months					X	X	X	X				
2+ partners 3 months									X	X	X	X

Each column in each panel reports results from an OLS regression of having 2+ partners in the past three months interacted with not using a condom (panel A) or any birth control (panel B) during the last episode of sex on the past month drinking indicators in the row heading, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 7: Effects of binge drinking frequency on sexual activity

Days binge drank past month	(1)	(2)	(3)	(4)	(5)	(6)
1 day	.017	.009	–.001	.004	.004	.004
μ = .197	(3.21)	(2.65)	(0.29)	(1.23)	(1.78)	(2.66)
2 days	.031	.019	.010	.008	.007	.004
μ = .137	(4.49)	(4.10)	(1.47)	(1.68)	(1.91)	(1.90)
3–5 days	.035	.024	.008	.006	.012	.006
μ = .136	(4.84)	(4.36)	(1.08)	(1.10)	(3.00)	(2.03)
6–9 days	.045	.020	.042	.014	.021	.009
μ = .076	(4.83)	(2.47)	(4.15)	(1.95)	(3.11)	(1.91)
10+ days	.054	.065	.035	.029	.059	.030
μ = .057	(5.02)	(6.72)	(2.75)	(3.14)	(6.83)	(4.48)
Dependent variable mean	.518	.169	.231	.080	.074	.030
R-squared	.368	.430	.177	.081	.195	.105
Dependent variable:						
Had sex past 3 months	X					
2+ partners past 3 months		X				
No condom last time			X			
No birth control last time				X		
2+ partners & no condom					X	
2+ partners & no birth control						X

The sample contains 50,942 respondents who drank on at least one day in the past month. Each column reports results from an OLS regression of the dependent variable specified in the last six rows on the binge drinking days indicators in the row headings, which occur with frequency μ, and the full set of explanatory variables listed in table 1 along with indicators for PSU-by-year and whether respondents drank any alcohol on 1–2 days (μ = .459), 3–5 days (μ = .239), or 6–9 days (μ = .153) in the past month, with an excluded category of 10 or more days (μ = .149). Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 8: Effects of binge drinking on sexual activity with alternative comparison groups

	Sample	Binge mean	(1)	(2)	(3)	(4)	(5)	(6)
A.	Drank on 10+ days in life	.564	.036	.037	.005	.008	.018	.010
	(*n* = 47,555)		(6.92)	(10.9)	(0.93)	(2.44)	(6.94)	(5.98)
			μ=.53	μ=.17	μ=.24	μ=.08	μ=.07	μ=.03
B.	Used marijuana in life	.539	.027	.036	–.001	.007	.018	.011
	(*n* = 41,276)		(4.56)	(8.55)	(0.11)	(1.70)	(5.87)	(5.52)
			μ=.59	μ=.20	μ=.28	μ=.10	μ=.09	μ=.04
C.	Tried cigarettes in life	.448	.032	.033	.004	.006	.017	.010
	(*n* = 60,447)		(6.48)	(10.3)	(0.82)	(1.83)	(6.94)	(6.41)
			μ=.50	μ=.15	μ=.23	μ=.08	μ=.07	μ=.03
D.	Smoked regularly in life	.644	.021	.033	.004	.019	.020	.016
	(*n* = 16,965)		(2.27)	(4.55)	(0.38)	(3.01)	(3.74)	(4.78)
			μ=.62	μ=.22	μ=.32	μ=.11	μ=.11	μ=.04
E.	Rode with drinking driver	.589	.032	.036	–.003	.006	.015	.009
	(*n* = 33,818)		(4.86)	(7.75)	(0.51)	(1.42)	(4.34)	(4.16)
			μ=.54	μ=.19	μ=.25	μ=.09	μ=.09	μ=.04
F.	Use seatbelt sometimes or	.467	.023	.035	.003	.004	.023	.011
	less (*n* = 29,301)		(3.27)	(6.10)	(0.44)	(0.74)	(5.10)	(4.01)
			μ=.55	μ=.19	μ=.26	μ=.10	μ=.09	μ=.04
G.	Had physical fight	.471	.042	.037	.010	.006	.019	.012
	(*n* = 30,133)		(6.06)	(7.29)	(1.55)	(1.23)	(5.22)	(4.81)
			μ=.53	μ=.19	μ=.23	μ=.09	μ=.08	μ=.03
H.	Carried weapon	.546	.046	.044	.016	.014	.025	.016
	(*n* = 17,473)		(4.95)	(6.20)	(1.85)	(2.56)	(4.24)	(4.34)
			μ=.57	μ=.25	μ=.24	μ=.10	μ=.11	μ=.05
	Dependent variable:							
	Had sex		X					
	2+ partners			X				
	No condom				X			
	No birth control					X		
	2+ & no condom						X	
	2+ & no birth control							X

Samples are restricted to respondents who have previously consumed alcohol in their lifetimes and as described in the row heading. Each cell reports results, including the dependent variable frequency μ, from an OLS regression of the dependent variable specified in the last six rows on indicators for past month binge drinking and use of any alcohol, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 9: Effects of binge drinking on sexual activity in stratified samples

	Sample	Binge mean	(1)	(2)	(3)	(4)	(5)	(6)
A.	Females	.544	.030	.025	.007	.009	.013	.007
	(*n* = 25,823)		(4.94)	(6.51)	(1.27)	(2.24)	(4.37)	(3.63)
			μ= .51	μ=.12	μ=.26	μ=.09	μ=.06	μ=.02
	Males	.663	.034	.029	.007	.009	.014	.009
	(*n* = 25,119)		(5.33)	(6.59)	(1.15)	(2.37)	(3.87)	(4.01)
			μ=.53	μ=.22	μ=.20	μ=.07	μ=.09	μ=.04
B.	White non-Hispanics	.673	.037	.024	.005	.008	.009	.005
	(*n* = 24,948)		(5.57)	(6.93)	(0.95)	(2.72)	(3.24)	(3.67)
			μ=.48	μ=.13	μ=.21	μ=.05	μ=.06	μ=.02
	All others	.536	.026	.031	.004	.008	.016	.009
	(*n* = 25,994)		(4.22)	(6.41)	(0.64)	(1.81)	(4.42)	(3.71)
			μ=.56	μ=.21	μ=.25	μ=.11	μ=.09	μ=.04
C.	9th graders	.532	.040	.027	.016	.012	.016	.009
	(*n* = 9,951)		(4.25)	(4.49)	(1.95)	(2.12)	(3.47)	(2.31)
			μ=.38	μ=.14	μ=.15	μ=.07	μ=.06	μ=.03
	10th graders	.583	.031	.020	.008	.010	.007	.004
	(*n* = 11,908)		(3.58)	(3.44)	(0.91)	(1.98)	(1.56)	(1.66)
			μ=.47	μ=.16	μ=.19	μ=.07	μ=.06	μ=.03
	11th graders	.629	.019	.028	.006	.008	.013	.006
	(*n* = 13,507)		(2.15)	(4.53)	(0.78)	(1.54)	(2.63)	(2.02)
			μ=.55	μ=.17	μ=.24	μ=.08	μ=.08	μ=.03
	12th graders	.640	.018	.033	–.008	.002	.017	.010
	(*n* = 15,576)		(2.19)	(5.88)	(0.94)	(0.29)	(3.53)	(3.47)
			μ=.62	μ=.19	μ=.30	μ=.09	μ=.09	μ=.03
D.	1991–1999	.596	.025	.022	.008	.011	.016	.008
	(*n* = 27,261)		(3.72)	(5.02)	(1.29)	(2.80)	(4.63)	(4.15)
			μ=.51	μ=.17	μ=.25	μ=.09	μ=.08	μ=.03
	2001–2009	.611	.039	.034	.001	.004	.010	.007
	(*n* = 23,681)		(5.99)	(8.85)	(0.22)	(1.16)	(3.61)	(3.76)
			μ=.52	μ=.16	μ=.21	μ=.07	μ=.07	μ=.03
	Dependent variable:							
	Had sex		X					
	2+ partners			X				
	No condom				X			
	No birth control					X		
	2+ & no condom						X	
	2+ & no birth control							X

Samples are restricted to respondents who drank on at least one day in the past month and as described in the row heading. Each cell reports results, including the dependent variable frequency μ, from an OLS regression of the dependent variable specified in the last six rows on the past month binge drinking indicator, the full set of explanatory variables listed in table 1, and PSU-by-year indicators. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering.

Table 10: Impact of AIDS/HIV education on relationship between binge drinking & sex

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Binge drank past month	.030	.025	.003	.006	.009	.006
μ = .603	(6.29)	(8.20)	(0.58)	(2.07)	(3.99)	(4.22)
Binged × no AIDS/HIV classes	.008	.019	.007	.025	.031	.017
μ = .051	(0.54)	(1.89)	(0.49)	(2.63)	(3.60)	(2.71)
Binged × unsure if had	.017	.017	.039	.005	.029	.001
AIDS/HIV classes [μ = .027]	(0.99)	(1.41)	(2.31)	(0.42)	(2.77)	(0.22)
No AIDS/HIV classes	.019	−.001	.028	.003	.001	.002
μ = .079	(1.65)	(0.12)	(2.51)	(0.48)	(0.16)	(0.52)
Unsure if AIDS/HIV classes	−.024	−.003	−.015	−.007	−.007	−.002
μ = .043	(1.72)	(0.31)	(1.18)	(0.76)	(1.13)	(0.40)
F-statistic for joint significance	0.61	2.70	2.83	3.55	9.39	3.67
of 2 interaction terms	[.546]	[.069]	[.060]	[.029]	[.000]	[.026]
Dependent variable mean	.518	.169	.231	.080	.074	.030
Dependent variable:						
Had sex past 3 months	X					
2+ partners past 3 months		X				
No condom last time			X			
No birth control last time				X		
2+ partners & no condom					X	
2+ partners & no birth control						X

The sample contains 50,942 respondents who drank on at least one day in the past month. Each column reports results from an OLS regression of the dependent variable specified in the last six rows on the indicators in the row headings, which occur with frequency μ, and the full set of explanatory variables listed in table 1 along with indicators for PSU-by-year. Parentheses contain absolute *t*-statistics adjusted for heteroskedasticity and PSU-by-year clustering, while brackets contain *F*-statistic *p*-values.