Adolescent Drinking and Sex: Findings from a Daily Diary Study

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CONTEXT: *Alcohol consumption often has been cited as increasing adolescents' risk of HIV, and several studies have shown positive relationships between drinking and risky sexual behavior among adolescents. Because most of these studies used global measures of drinking and risky sex, and conducted comparisons across persons, they could not determine whether alcohol use was a cause of risky sex or simply a correlate.*

METHODS: *A sample of 112 U.S. adolescents completed daily diaries about their health behaviors, including drinking and intercourse, for eight weeks. In analyses using t-tests and hierarchical linear modeling, each respondent's rate of condom use after drinking was compared with his or her rate of use when not drinking, and predictors of condom use were examined.*

RESULTS: *Rates of condom use did not differ significantly between sexual events preceded by drinking (use in 54% of events) and those not preceded by drinking (use in 52% of events). Condoms were more likely to be used during sexual events with casual partners than in those with steady partners, less likely to be used on occasions when other birth control was used and more likely to be used when the sexual encounter was expected. In the multivariate analyses, the odds of condom use were not associated either with whether a teenager had been drinking before sex or with the quantity of alcohol consumed.*

CONCLUSIONS: *These findings challenge the widely accepted hypothesis that drinking is a cause of sexual risk-taking. Rather, they underscore the need for interventions to increase teenagers' access to and ability to use condoms.*

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Adolescents have high rates of sexual risk-taking. Although condom use has increased among U.S. adolescents[1] and rates of teenage pregnancy decreased during the 1990s,[2] teenagers do not consistently protect themselves from sexually transmitted diseases (STDs) or unintended pregnancy.[3] In a study of sexually active urban minority youth, about a third of young teenagers and a quarter of older teenagers reported using condoms in no more than half their sexual encounters.[4] College students have even lower rates of use: A quarter report never using condoms, and nearly a third report using them inconsistently.[5] Moreover, although the rate of HIV infection among women in general decreased between 1994 and 1998, it more than doubled among women aged 19–23.[6] In addition, teenagers have higher rates of some STDs than adults,[7] enhancing their risk of HIV. Clearly, prevention of HIV transmission among adolescents should remain a high priority.

Alcohol consumption has often been cited as increasing adolescents' risk of HIV infection. Several studies have shown positive relationships between drinking, drug use and risky sexual behavior among adolescents.[8] One study found that relative to rates before alcohol policy changes, rates of gonorrhea infection decreased in states that increased their beer tax or increased the minimum legal age for drinking;[9] these results further suggest that drinking and unsafe sex are related. Such findings, bolstered by the widely held belief that alcohol is disinhibiting, have led researchers and clinicians to conclude that drinking or drug use is a cause of risky sexual practices.

This conclusion, however, has been questioned for methodological and empirical reasons. Several cross-sectional studies have found no association between use of alcohol or other drugs and use of condoms.[10] Furthermore, cross-sectional studies have significant methodological limitations: Many use global measures of drinking and risky sexual behaviors (e.g., how often one drinks and how often one uses a condom).[11] In such studies, it is not clear whether drinking and risky sex occurred on the same occasions—a necessary condition to prove that a causal relationship exists. Research findings are consistent with a number of explanations—causal, correlational, cultural and coincidental[12]—that emphasize different factors, from pharmacologically induced disinhibition[13] to deficits in information processing,[14] risk-taking or sensation-seeking personality tendencies,[15] "problem behavior syndrome,"[16] expectations about the effects of alcohol,[17] the use of intoxication as an excuse for unacceptable behavior[18] or the role of situation-specific rituals.[19]

Critical-incident studies, in which participants are asked details about a given sexual occasion (e.g., first or most recent intercourse), ensure that data reflect drinking and risky sex that occurred together; however, their results cannot exclude the possibility that a third variable may explain

the relationship. For example, risky sex might be associated with parties where both beer and potential sexual partners are available—or persons who engage in high-risk behaviors may tend to both drink and not use condoms. In the absence of controls for such third-variable explanations, it remains unclear whether drinking is a cause of unsafe sex. Critical-incident studies involving adolescents and adults, as well as studies of gay men, have tended to find no relationship between drinking and unsafe sex.[20]

Studies in which respondents report on multiple, specific sexual encounters remedy a number of these problems by allowing comparison within individual persons of the rate of condom use after drinking with that when no drinking is involved.[21] One such study of teenagers has been reported:[22] Young women, who were recruited from an STD clinic, kept logs of their sexual encounters. No relationship between alcohol consumption and condom use was found. Partner change was associated with use of condoms; use was more likely with new sexual partners than with continuing ones.

We used a daily diary technique to remedy the major methodological shortcoming of some earlier research and extend the findings of other studies. Our data collection methods and analytic strategy permitted us to assess, over an eight-week period, the extent to which the same individual used condoms, depending on whether alcohol use had preceded specific sexual encounters. Our sample is representative of the youth targeted by public health publicity that equates being high with being high-risk—that is, teenagers who engage in sexual risk-taking and who use alcohol.

METHODS

Participants

The study participants were 137 sexually experienced adolescents in Seattle recruited in 1998–1999 through flyers posted in locations that teenagers frequent (e.g., recreation centers) and distributed by clinicians in adolescent health clinics. Study eligibility was limited to teenagers 14–19 years of age who were unmarried and not in a steady, monogamous relationship of longer than six months' duration. Additional eligibility criteria were used to ensure adequate variation of data on the variables of interest and to achieve sufficient statistical power to examine within-participant relationships between drinking and condom use: Participants had to have used condoms at some time in the previous year but not on every sexual occasion, drunk alcohol on at least four days in the previous two months, sometimes (but not always) drunk in the context of sexual activity in the previous two months and had sex no fewer than four times in the previous two months.

Of the enrolled teenagers, only the 112 reporting at least one occasion of penile-vaginal intercourse during the daily diary period were included in this analysis. Results of analyses involving young men who had sex exclusively with other men or who identified themselves as homosexual are reported elsewhere.[23] Data on oral sex were excluded because such events occurred primarily in conjunction with vaginal intercourse. The number of reported occasions of anal sex was insufficient for meaningful analysis.

The respondents in our final sample ranged in age from 14 to 19 years (mean, 17.0; standard deviation, 1.5). Seventy percent were female. Slightly more than half (54%) identified themselves as white; the others were black (16%), Asian (6%), Hispanic (10%), Native American (3%), or of mixed or other ethnic backgrounds (11%). Most (60%) were still in high school; the 40% who were high school graduates included 14% who had acquired additional education.

Procedures

Recruitment flyers described the study as a "health habits" study examining daily patterns of various health-related behaviors; the flyers included a telephone number to call about the study. Trained interviewers screened potential participants by telephone. Eligible participants were then randomly assigned to maintain written daily diaries or to participate in daily telephone interviews. Potential participants were sent consent forms along with self-addressed, stamped envelopes; a parental consent form and an informational brochure containing the project's telephone number were included for potential participants younger than age 18. On receipt of the signed consent forms, we mailed participants an initial questionnaire to gather data on background variables and sexual and substance-use history. Daily data collection began when the questionnaires were returned.

The daily data collection forms were identical for the two study groups. Participants in the written diary group received a packet each week containing instructions, seven daily diary forms and seven self-addressed, stamped envelopes in which to mail back the daily surveys. Research staff also telephoned participants weekly to offer them encouragement and answer their questions. In the telephone interview group, trained interviewers telephoned participants daily and asked them the questions on the daily diary form. At the conclusion of each interview, an appointment was made for the next day's interview. After eight weeks of daily data collection, participants in both groups were mailed a brief exit questionnaire.

Participants were paid $15 for completing the initial questionnaire and $10 for completing the exit survey. On a weekly basis they received payment of two dollars for each daily report plus a three-dollar bonus if they had no missing days. This study was approved by the University of Washington Human Subjects Review Board.

Measures

The entry survey and the daily surveys included measures of various health-related and risky behaviors, including smoking, sleeping habits and driving while intoxicated. These were asked primarily to distract respondents from the study's focus; in this way, any preconceptions that respondents might have had about the link between substance use and risky sex would not bias their responses. Exit in-

TABLE 1. Percentage of teenagers participating in a study of risky sexual behavior and drinking, by selected characteristics at enrollment, Seattle, 1998–1999

Characteristic	% (N=112)
Lifetime sexual history	
Ever had anal sex	38
Ever had an STD	22
Ever had an HIV test	55
Sexual behavior in previous two mos.	
Frequency of vaginal sex	
≤once monthly	9
2–4 times/mo.	32
≥once weekly	59
Condom use with vaginal sex	
Rarely or never	37
Sometimes	23
Always or nearly always	40
Had anal sex	18
Paid someone for sex	1
Was paid for sex	8
Had a partner who injected drugs	2
Alcohol use in previous two mos.	
Frequency of drinking	
≤once monthly	6
2–3 times/mo.	15
1–6 times/wk.	67
≥once daily	12
No. of drinks per occasion	
1–2	19
3–4	45
≥5	36
Frequency of getting drunk	
Never	8
≤once monthly	16
2–3 times/mo.	19
Several times/wk.	49
≥once daily	8
Drank alcohol before having intercourse	
Rarely or never	42
Sometimes	51
Always or almost always	7

terviews with participants in a pilot study* had indicated that this was successful: When asked what they thought was the focus of the study, none answered correctly.

• *Sexual behavior.* As many as three instances of intercourse could be reported each day. Participants who reported having sex were asked the time of day when sex occurred, the type (oral, anal or vaginal), whether a condom was used, partner type (steady, casual, or paid or paying),† whether any other birth control method had been used, whether they had been expecting to have sex, and whether they and their partner had been at the same bar or party before sex occurred.‡ In the initial survey, respondents also reported whether they had ever had an STD diagnosed by a physician.

• *Alcohol consumption.* Up to three drinking occasions could be reported daily. Participants who reported drinking were asked the time the drinking occasion began and ended, as well as the number and type of drinks consumed (beer, wine, liquor or wine coolers). Drinking occasions were matched with sexual encounters if drinking occurred within four hours before having sexual intercourse.[24] The number of drinks consumed on each occasion was calculated by converting the amounts of each beverage consumed to standard drinks (12 ounces of beer, four ounces of wine or one ounce of spirits) and summing across beverages. To estimate the number of drinks consumed in the four-hour interval before intercourse, the number of drinks consumed during a drinking period was converted to drinks per hour, and the total number was prorated according to the fraction of the drinking period that corresponded to the four hours preceding the intercourse.

Analytic Method

The primary goal of the analysis was to compare each respondent's rate of condom use after drinking with his or her rate of condom use when not drinking; that is, we examined whether respondents engaged in riskier behavior when they were drinking than when they were not.

We conducted two types of analyses. First, for every participant who reported at least one occasion each of intercourse with and without drinking, we calculated the proportion of times that condoms were used when intercourse was preceded by alcohol use and when it was not. This allowed a direct test of the within-participant relationship between alcohol and condom use.

Second, to examine risk-taking in greater detail, including both person-level and event-level variables, we conducted a hierarchical linear modeling analysis. In hierarchical models, lower-level observations (in this case, sexual occasions) are nested in higher levels (in this case, respondents). Using such models allows us to predict the probability of condom use in sexual encounters associated with both event-level variables (drinking before intercourse, partner type, use of other methods of birth control and being at the same bar or party before intercourse) and person-level variables (gender and STD history). The analyses control for within-class (in this case, within-person) correlations that would otherwise be problematic. We could use data from all 112 respondents who had had intercourse at least once during the diary period, because this method uses information from all cases for estimation.

We used the statistical software program HLM[25] to construct a random-effects regression model of condom use with binomial sampling and a logit link (because our outcome was dichotomous—i.e., condoms were used or not used). Random-effects regression models provide several advantages over alternative techniques for analyzing data in which multiple measurements are collected from each person.[26] For example, they do not assume that participants provide data at the same time points or for the same number of time points. Most important for this study, they permit estimation of participant-specific change.[27]

*In the pilot study, 79 adolescents and college students gave daily reports of drinking and sexual activities over a four-week period (source: Leigh BC, Gillmore MR and Morrison DM, Comparison of diary and retrospective measures for recording alcohol consumption and sexual activity, *Journal of Clinical Epidemiology,* 1998, 51(2):119–127).

†Steady partner was defined as "someone I am in an ongoing relationship with." Casual partner was defined as "a person I have sex with occasionally but do not have an ongoing relationship with."

‡Being at the same bar or party before sex was of interest because it is a situational predictor of drinking. One hypothesis that has been offered for a link between drinking and condom use is that drinking is associated with these two common venues for meeting new partners (source: reference 11).

TABLE 2. Odds ratios (and 95% confidence intervals) from hierarchical linear modeling assessing the association between condom use for an occasion of sexual intercourse and selected variables, including any use of alcohol

Variable	Odds ratio
Alcohol was consumed before sex	1.06 (0.60–1.87)
Sexual intercourse was expected	1.28 (1.04–1.59)
Casual partner*	3.84 (2.30–6.41)
Had been at same bar or party as partner	1.17 (0.73–1.88)
Another form of birth control was used	0.31 (0.18–0.54)
Female	0.33 (0.11–1.06)
Ever had an STD	0.91 (0.27–3.13)

*Reference group is steady partner.

RESULTS

Sexual Activity and Alcohol Use

In this sample, the reported age at first sexual intercourse ranged from eight to 19 years, and the average was 14.1 years (standard deviation, 2.1). On average, participants had had 9.6 sexual partners (standard deviation, 8.7) before entering the study. Approximately four in 10 participants had ever had anal sex. One-fifth of participants had had an STD, and more than half had undergone HIV testing (Table 1).

In the two months before study entry, participants had had an average of 2.3 partners each (standard deviation, 2.0—not shown), and most had had sex at least once per week (Table 1). Condom use was generally high, but more than a third of participants reported nonuse of a condom on most or all occasions of intercourse in the previous two months. Alcohol consumption during that period also was high, with three-quarters drinking at least a few times per week, most drinking more than one or two drinks per occasion and most getting drunk at least several times per week. Forty-two percent of participants reported rarely or never drinking before sexual intercourse during the previous two months; more than half (58%) reported at least sometimes drinking before sex.

Over the eight weeks of daily data collection, the number of reported occasions of penile-vaginal intercourse varied considerably, ranging from one to 68 per participant (mean, 11.3; standard deviation, 12.1). Of all the occasions reported, 32% were condom-protected, and 20% were preceded by alcohol use; 76% were with steady partners, 22% were with casual partners and 2% were with paid or paying partners. Slightly fewer than half (46%) were protected by a birth control method other than a condom, usually birth control pills (which were used at 92% of those occasions).

TABLE 3. Odds ratios (and 95% confidence intervals) from hierarchical linear modeling assessing the association between condom use for an occasion of sexual intercourse and selected variables, including quantity of alcohol consumed

Variable	Odds ratio
No. of drinks consumed before sex	1.22 (0.69–2.14)
Sexual intercourse was expected	1.32 (1.07–1.63)
Casual partner*	3.20 (1.96–5.24)
Had been at same bar or party as partner	0.98 (0.62–1.54)
Another form of birth control was used	0.30 (0.18–0.52)
Female	0.33 (0.11–1.06)
Ever had an STD	0.45 (0.13–1.56)

*Reference group is steady partner.

Daily Events Analyses

Seventy-three participants reported at least one occasion each of sex with and without prior drinking involved. According to results of a paired t-test comparing the within-participant proportions of occasions with and without alcohol consumption that involved condom use, the rate of use for sexual events preceded by drinking (54% of occasions) and the rate for events not preceded by drinking (52%) were not significantly different (t=0.56; p=0.58; 72 df). Twenty-seven respondents used condoms the same proportion of times regardless of whether they had been drinking, 21 used condoms less frequently when they had been drinking and 25 used condoms more frequently after drinking.

The multilevel analyses are based on 1,217 occasions of intercourse. We estimated two sets of multivariate models of condom use—one using a dichotomous measure of drinking before sex (any vs. none) and the other assessing the quantity of alcohol consumed. Event-level variables included in the model were type of partner (excluding paid or paying partners, because few events with this type of partner were reported), whether the respondent and the sexual partner had been at the same bar or party before they had sex, whether they had used any other contraceptive protection and whether the respondent had expected to have sex. Two person-level variables, gender and ever having had an STD, were included in both models.

In the analysis using the dichotomous measure of drinking, the odds of condom use were not associated with whether a teenager had been consuming alcohol before sex (Table 2). The odds of condom use were significantly elevated (odds ratio, 1.3) when the adolescent had expected to have sex, and the odds were nearly quadrupled (3.8) if sex occurred with a casual partner rather than with a steady partner. When another method of birth control was used, the odds of condom use were reduced significantly (0.3). Finally, female participants were marginally less likely than male participants to report use of a condom (0.3). Having been at the same bar or party and having ever had an STD were not significantly associated with the odds of condom use.

The results of the analysis in which the drinking measure was number of drinks consumed before sex (Table 3) were similar to the results in the previous analysis. The odds of condom use did not increase or decrease according to how much alcohol had been consumed before intercourse. The likelihood of condom use was significantly elevated if intercourse had been expected (odds ratio, 1.3) or was with a casual partner (3.2); it was significantly reduced if another method of birth control was used (0.3). As in the previous analysis, having been at the same bar or party and having ever had an STD were not significantly associated with the odds of condom use.

DISCUSSION

Implications

Our results indicate that drinking was not associated with condom nonuse among the adolescents in our sample. Our findings are consistent with results reported in earlier research[28] but extend those results to young men and a non–clinic-based sample. Our results suggest that the widely accepted hypothesis that drinking is a cause of sexual risk-taking may not be generalizable across all groups. If the hypothesis were true, we would expect to have seen lower rates of condom use among respondents when drinking was involved.

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The present study differs from much earlier research in several important ways. By comparing each person with himself or herself, instead of with others, we controlled for individual differences in factors such as propensity for risk-taking that may account for higher-than-average rates of both drinking and sexual risk-taking. Perhaps teenagers who drink are less likely overall to use condoms (and are more likely to engage in other high-risk behaviors) than are teenagers who do not drink. Teenage drinkers may be more cavalier than nondrinkers about health and safety risks generally, or they may be more likely to be in settings and situations that encourage risk-taking.

By design, our sample did not include nondrinkers. Instead, we studied a group of adolescents representative of the youth who are the intended target of public health campaigns urging young alcohol users to avoid sexual activity while drinking, to reduce their risk of STDs.

Our data also enabled us to examine other variables predicting condom use at the event level. The association with partner type that we observed echoes diary findings in a study by Leigh[29] and those of numerous retrospective reports of adolescents and adults:[30] People generally use condoms less often with steady partners than with casual partners. Lower condom use with steady partners may stem from a reduced level of concern about disease risk from sex with steady partners or from an increased salience of intimacy in relationships with steady partners. Among teenagers, intimacy and pleasing one's partner are greater concerns with steady partners than with casual partners.[31] Greater vigilance with casual partners may indicate that teenagers have heard and heeded the injunction to "know your partner." It is not clear, however, whether adolescents understand what, specifically, they should know about their partners. Steady partners are not necessarily safer partners for people in any age-group; this may be especially true for adolescents, who tend to have short, serial sexual relationships and consider a partner steady very early on. The fact that most sexual events in this study occurred with steady partners, despite our exclusion of youth in long-term, monogamous relationships, attests to the rapidity with which sexual partners become steady ones among adolescents. Further research is needed into when adolescents consider a partner steady (and, apparently, decrease their use of condoms), and how much information they have at that time about the partner's sexual and disease histories.

The finding that use of another birth control method predicted nonuse of a condom suggests that the adolescents were using condoms to prevent pregnancy—at least in part, and perhaps primarily. Pregnancy risk is immediate and widely understood, and is not assumed to be conditional on partner status. Although our "other methods" variable included any method of birth control other than condoms, the method cited 92% of the time was the pill. Because the pill is not appropriate for women having only occasional intercourse, its use in this sample is probably confounded with sex with a steady partner.

We found that condom use was considerably more likely on occasions of expected intercourse than on occasions of unexpected sex. Although our data cannot explain the reason for this finding, we speculate that teenagers who had sex unexpectedly may not have had a condom at hand, or the sexual situation may have developed too rapidly for discussion of the topic to occur. This finding suggests that interventions with teenagers should include a focus on being prepared. However, this may be more challenging than it sounds, because some teenagers, especially females, may worry that carrying condoms conveys a message of promiscuity.

Our finding that history of an STD was not associated with an increased likelihood of condom use was unexpected. We had anticipated that youth who had had an STD would be more aware than others of the risk of disease and therefore more likely to protect themselves. Almost a quarter of the youth in our analysis had had an STD; thus, the lack of association cannot be attributed to low rates of previous infection. Moreover, more than half of participants had undergone HIV testing at some point in their young lives. However, the absence of an association between condom use and history of an STD is consistent with an emerging picture of youth who are primarily concerned at the time of intercourse with pregnancy, not disease, risk.

Of note, our finding that teenagers were no less likely to use condoms when drinking than when not drinking does not preclude the possibility that drinking could affect condom use, one way or another, for some individuals or on some occasions. The number of respondents whose condom use was more likely after drinking than in the absence of alcohol consumption was about the same as the number whose condom use was less frequent when they had been drinking. What accounts for individual differences among respondents? Cooper and Orcutt[32] have suggested that internal conflict about intercourse, at least among males, may affect the propensity to use condoms less often when drinking than when not. In a review of the literature on the relation between alcohol use and risky sex, Halpern-Felsher and colleagues[33] suggested that alcohol may have effects only at particular points in a relationship; these authors called for analyses that explore more thoroughly relationship dimensions such as intimacy and communication, and for studies of these patterns over the course of relationships. Two studies have shown negative effects of alcohol use on condom use at first intercourse, for example.[34] Future studies might examine individual differences,

including differences in users' expectations about how alcohol will affect their behavior, and in condom use at sexual debut.

Limitations

Several limitations of our study deserve mention. Our study used a convenience sample of adolescents, and we therefore cannot know to what extent the results are generalizable. As is often the case in studies of this sort, female participants were overrepresented in the sample. Moreover, as is true of all studies of sexual behaviors, the data are based on self-reports, and we cannot assess the accuracy of these reports. Previous research suggests that self-reports of substance use and sexual behaviors are valid in carefully conducted studies.[35] We asked the participants to report up to three instances of sexual intercourse daily, which could have resulted in some selection bias if many respondents had had sex more than three times per day. However, most participants reported no more than one occasion of sex on any given day; therefore, we do not think selection bias affected our results.

Our screening criteria excluded potential study participants who never or always drank before having sex because there would be no within-participant variation to examine. For the same reason, those who always or never used condoms were excluded. Rather than limiting our results, however, we believe these criteria strengthen our analysis, because such teenagers are the target of public health messages warning about the dangers of mixing sexual activity with alcohol consumption and are therefore an appropriate sample in which to study the presumed link between substance use and risky sex.

Conclusion

Our findings do not support focusing on alcohol use as a general cause of decreased condom use. What, then, should be the focus of interventions to increase condom use among teenagers? It may be important to clarify for teenagers what it means to "know your partner." College students base safer-sex decisions partly on superficial partner characteristics unrelated to actual risk, including physical appearance.[36] This finding suggests that teenagers need to hear that to "know your partner" means to ask about a partner's STD and HIV history and status, and current risk behaviors, including having other partners. They need to be taught the skills with which to have these conversations—which are not easy to master, even for adults. The dangers of STDs, and the fact that birth control methods other than condoms do not protect against disease transmission, need to be emphasized. Many teenagers do not realize that a person can have an STD without symptoms, that not all STDs are curable and that STDs can affect long-term fertility.

Teenagers may also need encouragement to consider the ways in which their increasing interpersonal commitments, as partners progress from casual to steady, may overshadow their legitimate health concerns. Intercourse is not primarily a health behavior but rather an expression of intimacy, and concerns about increasing intimacy and pleasure naturally become more important as relationships grow. Interventions that help teenagers to have candid conversations with their partners, in the spirit of increasing intimacy, may be most effective.

Finally, programs that increase teenagers' access to condoms or that encourage youth to carry condoms regularly may increase condom use on occasions of unexpected intercourse. Providing condoms—in machines or just open bowls—is perhaps the easiest and least expensive intervention we can offer. Skills-based intervention programs should not neglect the skills of learning where to find condoms as well as rehearsals of purchasing condoms in stores or requesting them in clinics.

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