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Reducing Risky Sex Among College Students: Prospects for Context-Specific Interventions

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Abstract

Better understanding the contribution of specific drinking contexts to alcohol use and risky sexual behaviors can help target effective prevention programs to specific locations and types of drinkers. We used a sample of college students to investigate whether more frequent and heavier drinking in specific drinking contexts was associated with unplanned sex, unprotected sex, and number of sexual contacts. Greater frequencies of drinking in almost all contexts (Greek parties, off-campus parties, campus events, dorms, and bars) were associated with greater numbers of sexual partners, unplanned sex and unprotected sex; heavier drinking at bars increased risks related to all outcomes. Risks related to frequencies of use of contexts were similar for men and women, but heavier drinking at bars was associated with more unprotected sex among males only. We discuss these observations in light of their implications for developing context-specific interventions to reduce community viral load in high-risk populations.

Keywords

Unprotected sex; alcohol; risky sex; context specific; environmental interventions

Introduction

Heavy alcohol use is associated with high-risk sexual behaviors such as having sex with a new partner (1). More frequent alcohol use is also linked to a greater number of sexual partners and increased likelihood of engaging in unprotected sex (2). While the evidence linking overall alcohol consumption, high-risk sexual behaviors, and incidence of HIV is strong, associations between situations in which alcohol is used, high-risk sexual behaviors, and HIV are mixed (3-6). One reason for this may be that the contexts in which people drink and meet new sex partners, and the relationships of drinking in these contexts to high-risk sex, have not been systematically or adequately addressed. Exposure to sexual risks is context dependent; the social environments where people drink (e.g., bars/clubs) often serve as locations not just for alcohol consumption but for individuals to meet potential sex partners (7). Importantly, better understanding the contribution of specific drinking contexts

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to alcohol use and risky sexual behaviors can help identify effective prevention contexts and target specific locations and types of drinkers. In this analysis, we use a sample of college students to investigate whether more frequent and/or heavier drinking in specific drinking contexts are associated with unplanned sex, unprotected sex, and number of sexual contacts.

Alcohol use is neither necessary nor sufficient to cause high-risk sexual behavior, but there is a clear and strong association between alcohol consumption and increased likelihood of risky sex amongst college students (8). A national survey of college students found that heavy episodic drinkers were three times more likely to have had multiple sexual partners in the past twelve months than non-drinkers (2). The relationship between alcohol and risky sex has sometimes been found to vary by gender, although findings are inconsistent (8). These associations exist at the global level (e.g., frequency of past-year alcohol use and risky sex), and to a lesser extent at the event level (1, 9). While not all event-level studies have found associations between alcohol use and risky sexual behaviors, studies in high-risk populations and those that have accounted for background levels of substance use often find significant associations (10). High-risk sexual behavior may be influenced by alcohol use through several pathways. First, greater levels of alcohol use may impair judgment (11) and lead to poor decision making in risky situations. Second, expectancies related to drinking and sexual behavior may affect sexual risk-taking (12, 13). Third, the presence of other intoxicated individuals may increase the probability of risky sexual behaviors regardless of one's own level of use. These observations lead to the conclusions that (1) high-risk sexual behaviors may arise in contexts characterized by heavy use; (2) expectancies for risky sexual behavior are elevated in contexts with heavy drinking; and (3) social exposures to others' drinking and related sexual risk behaviors are substantial, regardless of one's own drinking. Independent of background risks specifically related to these contexts, some settings may be safe places to drink, i.e. greater levels of use may be unrelated to greater risks in these contexts. Other settings may be high-risk, i.e. greater levels of use may be related to greater risks in these contexts.

Putting aside possible influences of drinking per se on individual risky sexual behaviors, drinking contexts may serve to mediate sexual contacts and place individuals at risk (14). Drinking places may serve as locations where sexual contacts are more frequent, acting as nodes in affiliation networks which put individuals in contact with one another through their common affiliation with a group or setting (such as Greek members who frequent fraternity parties) (14, 15). Affiliations can act to concentrate high risk individuals into specific drinking places (like bars (16)) and provide opportunities for individual interactions which may lead to other problem behaviors (17). In this regard, affiliation networks of this sort may serve to accelerate risks for drinking problems, a network effect of perhaps neglected importance.

HIV prevention efforts focused on changing individual behaviors have failed to halt transmission in high-risk groups such as men who have sex with men (MSM), who make up the majority of incident HIV cases in the United States (18). The population-level mean viral load (community viral load (CVL)) has been shown to predict HIV incidence (19). Reducing CVL through community interventions focused on transmission in high-prevalence populations has immense potential to reduce HIV incidence. Focusing efforts on high risk

contexts, and differentiating those that are “high risk” through heavy alcohol consumption or other social mechanisms, is a potentially powerful way to reduce CVL. Unfortunately, data on the frequency and amount of alcohol consumed within specific types of drinking contexts are rarely collected. While college students are a low risk population for HIV transmission, analyses focused on contexts of use and risky sex can illustrate the importance of contexts for prevention efforts and differentiate associations between any alcohol use and heavy alcohol use with risky sex. The focus on contexts of use and related problems has yielded fruitful results in certain areas, such as intimate partner violence (20) and adolescent physiological and violence-related problems, and may be important for detecting risks for HIV transmission.

In this analysis, we apply a quantitative theoretical framework used to assess risks related to drinking in different contexts (20) to the study of context specific risks for risky sexual behavior among college students. We quantify the extent to which consuming alcohol in contexts and greater levels of alcohol use in contexts are associated with risky sex.

Methods

Study Population

Data were obtained from the Safer California Universities study, an evaluation of community-based environmental alcohol intervention strategies (21). Survey data were collected from random cross-sections of undergraduate students in eight randomly chosen University of California and six California State University campuses during fall semesters from 2003 through 2011 (17). Environmental alcohol interventions were implemented in seven campuses in 2005 and in the remaining seven campuses in 2008. Response rates ranged from 50% in 2003 to 39% in 2008. We limited analyses to students aged 25 and younger, as non-traditionally aged students (7.4% of the sample) may differ systematically from those in the traditional age range. 34,566 past-year drinkers provided complete data on measures of alcohol use, high-risk sexual behaviors, and demographics.

Measures

Sexual risk taking—Two measures of risky sex and one measure of the number of sexual partners were used. Students reported the number of times their drinking had caused them to “engage in unplanned sexual activity” (unplanned sex) and “not use protection when you had sex” (unprotected sex) between the beginning of the current semester and the time of the survey. Respondents were asked how many people they had sexual intercourse with since the beginning of the semester. Self-reports were converted to problem rates per 28 days, using the number of days since the beginning of the semester when the survey was completed for each participant.

Overall and context-specific frequency of drinking and continued volumes—Two measures were used to examine overall and context-specific relationships of alcohol use to risky sex. These measures are derived from a model that relates overall drinking risks, R , to frequencies of drinking (F) and continued drinking volumes (total number of drinks

beyond one per drinking occasion, $V-F$) (20, 22, 23). Risks related to drinking, b , and risks related to heavier drinking, c , can be estimated using the following equation:

$$R=a+bF+c(V-F)$$

This approach can be extended to model context-specific risks:

$$R_i=a_i+b_iF_i+c_iF_i(V_i-F_i)$$

Estimates of b_i represent different risks related to frequency of attending each drinking context and estimates of c_i represent different risks related to heavier drinking within contexts.

Frequency of alcohol use was measured by asking frequent drinkers (those who reported drinking more than once in the past 28 days) the number of days they had at least one drink in the past 28 days or, for infrequent drinkers, the number of days since the beginning of the semester/quarter they had at least one drink (rescaled to a 28-day equivalent metric). Respondents were also asked how many drinks they typically had on days they drank (Q). Overall $V-F$ was calculated as $[(F \times \text{typical number of drinks}) - F]$.

Context-specific frequencies (F_i) and continued volumes (V_i-F_i) were derived for five distinct drinking contexts: Drinking at fraternity or sorority parties at Greek houses; parties in university residence halls; on-campus sporting events, concerts, or dances; parties at someone's off-campus apartment or house; and pubs, bars, and restaurants within a few blocks of campus. Respondents were asked if they drank in each context since the beginning of the semester; if they reported drinking in the context they were then asked how many days they drank there since the beginning of the semester (F_i) (rescaled to a 28-day equivalent metric and Winsorized at 28). They were also asked how many drinks they consumed the last time they were in each drinking context (Winsorized at 15), with volume V_i then estimated as the frequency F_i times this most recent number of drinks in a location.

Other covariates—Other measures included campus (fourteen dummy variables), intervention campus (which varied by year) (yes/no), and self-reported gender, age (21+ vs. under 21), race (white vs. non-white), class (freshman, sophomore, junior, senior), current living situation (dorm, house/apartment, student co-op, fraternity/sorority, other), use of a motor vehicle on campus (yes/no), relationship status (married or in a steady relationship/not), living with a spouse or significant other (yes/no), employment (full/part time vs. none), and membership in a fraternity or sorority (yes/no). These measures were coded and used in a manner consistent with prior publications using these data (e.g., (21)).

Analyses

Data were analyzed using censored Tobit models with frequencies of number of sex partners, unplanned sex, and unprotected sex measured as rates of events per 28 days; this enabled direct assessments of these rates relative to rates of drinking, F_i , and volumes consumed, V_i , measured on the same time scale. Models were run for each of the three

outcomes and stratified by gender in order to assess whether the context-specific risky sex-alcohol relationships were different for men and women. For each problem outcome, analysis models were first run with only demographic characteristics and campus controls (Model 1); next, context-specific frequencies of use were added and tested as a block for significance (Model 2); finally, continued volumes for each context were added and tested. If continued volumes were jointly significant, all contexts with associations related to continued volumes having p-values less than 0.05 were retained in the final model (Model 3). Based upon results of previous work (24), controls for multiplicative heteroskedasticity related to F, F², and V-F were included. Specification tests were run to assess the associations of non-drinking visits to each context, by adding the frequency of non-drinking visits to the models. Post hoc sample weights were used to ensure that the sample at each university was representative of the target sample in terms of gender and racial/ethnic composition.

Results

As shown in Table 1, roughly half of the sample was white (53.2%), female (55.1%), and of legal drinking age (49.4% aged 21 and over). Most students lived in houses or apartments (78.1%). 53.3% were employed full-time or part-time, while 68.4% had access to a car while on campus. Respondents reported 0.3 sex partners in the past 28 days (range: 0.0 to 5.8 partners). Unplanned sex was reported on average 0.12 times in the past 28 days (range 0.0-6.0), with unprotected sex reported slightly less frequently (mean 0.07, range 0.0-6.1). Students reported drinking most frequently at off-campus parties, and also reported the greatest volume of alcohol consumed in this setting. Students under age 21 drank more often than those of legal drinking age at fraternity/sorority parties, in dorms, and at off-campus parties, while those 21 and over drank approximately ten times as frequently at bars/restaurants (data not shown).

More frequent and heavier drinking were both associated with a greater number of sex partners and more frequent unplanned sex in the past 28 days (data not shown). Heavier drinking, but not more frequent drinking, was associated with a greater number of unprotected sex events in the past 28 days. Breaking down by contexts, more frequent drinking in all five contexts was associated with a greater number of sex partners in the past 28 days, as well as a greater number of unplanned sexual encounters (Table 2). More frequent drinking in dorms, at campus events, off-campus parties, and at bars were associated with a greater number of unprotected sex events. Associations with drinking at campus events were consistently greater than for other contexts, but not significantly so. In contrast, heavier drinking was less often associated with any of the risky sex outcomes. Notably, heavier drinking at bars was associated with all outcomes, while heavier drinking at off-campus apartments and Greek parties were also associated with unprotected sex. In fully adjusted models (Model 3), Greek members, males, and non-white students were more likely to report unplanned sex. As expected, those married or in a steady relationship reported fewer partners and less unplanned sex but more unprotected sex.

Stratifying by gender, frequency of drinking in all five contexts was almost universally associated with each of the three risky sex outcomes for both men and women, again with

consistently greater associations with drinking at on-campus events. Heavier drinking, on the other hand, was less consistently associated with risky sex. Heavier drinking at off-campus parties was associated with a greater number of unplanned and unprotected sex events for males (Table 3), while heavier drinking at bars was associated with more frequent unprotected sex. For women, the only significant relationships between heavier drinking and risky sex were between unprotected sex and heavier drinking in bars and dorms. Specification tests found that the frequency and continued volumes coefficients were very robust to the introduction of controls for non-drinking visits to contexts.

Discussion

In this sample of California college student drinkers, more frequent drinking in most contexts was associated with a greater number of unplanned and unprotected sexual encounters and a greater number of sex partners in the past 28 days. Heavier drinking was more rarely associated with these risky sex behaviors, with some important exceptions. In particular, heavy drinking at Greek parties and in bars were both associated with a greater number of unprotected and unplanned sex events in the past 28 days. These results are quite different than those observed for other alcohol-related problems in general adult populations (20), which tend to find significant associations in only a handful of drinking contexts and have a balance of significant associations with both frequency of drinking and heavier drinking. The implication of these results is that heavy drinking is not a strong risk factor for unplanned and unprotected sex among college students in all settings, but that there is something in the milieu of some contexts on college campuses with opportunities to drink that leads to increased risky sex events and number of sexual partners.

Results of this study highlight the need to better understand the role affiliation networks within drinking settings play in risky sexual behaviors. The frequency coefficients in these analyses can be used to estimate the rates at which risky sex behaviors are associated with the use of each contextual node for drinking. Put another way, frequency estimates can be thought of as risks associated with the network of affiliations within each context. Campus events (sporting events, concerts, dances) had the largest frequency associations; these relatively infrequently attended contexts appear to carry the greatest risks per drinking occasion. Collecting precise information on affiliation networks within drinking settings can help shed light on social mechanisms within affiliation nodes which underlie the frequency associations.

In addition to the observation that frequencies of use of drinking contexts are associated with risk sex among both men and women, associations between heavier drinking and risky sex differed between males and females. This suggests some asymmetry in alcohol use and its effects between genders that may bear upon prevention efforts in these contexts. Greater alcohol use may differentially disinhibit risky sexual behaviors between men and women, because of differential beliefs and expectations with regard to alcohol effects between genders (25), differential alcohol impacts on risky or aggressive behaviors (26), or because heavy drinking marks for greater risk taking among men. There is some evidence that greater alcohol use is differentially related to greater risks for aggression among men, in contrast to women, and that sexual aggression, in particular, is responsive to use (26, 27).

Future research exploring gender differences in greater detail is warranted. Additionally, heavier drinkers exhibit lower levels of impulse control and greater risk taking (16). Unfortunately the data collected for these analyses did not include individual social cognitive measures such as impulsivity. It may be that the drinking of potential sex partners, rather than one's own drinking, increases the number of risky sex events for women to a greater extent than men. However, empirical research to decide the case either way among college students and with respect to these specific problems is not adequate to draw specific conclusions. Furthermore, the inconsistent findings across types of sexual behaviors needs to be better understood before proposing specific intervention efforts. Regardless, the results of the current study indicate the emergence of differential associations with regard to sexual risks between men and women across contexts, suggesting different prevention messages would seem suitable for men vs. women concerning specific drinking contexts.

The measures of context-specific drinking volume used in these analyses rely on the number of drinks consumed the last time in the context rather than the average quantity. While this is unlikely to bias our results, due to the fact that the estimates of last time quantity are very stochastic, we may have reduced power to detect context specific effects related to heavy drinking. Because the frequency measure asked about the number of times drinking in a context while the quantity measure asked about the last time attending the context whether or not alcohol was consumed, we were concerned that we may have conflated drinking and non-drinking risks. When we ran specification tests adding in the frequency of non-drinking visits to each context, the associations between risky sex and frequency and heavier drinking were robust. Questions were only asked about five distinct drinking contexts, not all potential contexts where participants drank in the past semester. The unplanned and unprotected sex questions were asked in a general manner without clear definitions of what constitutes "sex". This may have led to differential misclassification among students, some of whom might see oral sex as "sex" and some who only count vaginal sex as such. Furthermore, students were specifically asked about the last time alcohol contributed to sexual risk taking, not the total number of times they had unplanned or unprotected sex regardless of consumption. Another key limitation of this analysis is that the associations explored are not event-level links, but more general associations between drinking contexts and risky sex. The current analyses tell us what the context specific risks are (what needs to be explained), but not why these associations exist. Frequency of drinking in a given context may mark for key mechanisms which remain unmeasured and unspecified in these analyses. In order to begin to understand why drinking contexts are associated with unplanned and unprotected sex, event-specific information collected using Ecological Momentary Assessment or a similar method about the social and physical conditions within these contexts on occasions with a risky sex event would be invaluable.

While college students are not considered a high risk group for HIV, they are at elevated risk for other STIs and have high rates of unwanted pregnancy (8). Better understanding associations between drinking contexts and risky sexual behaviors can help college administrators craft effective prevention programs. From these results, it appears that reducing heavy drinking within specific drinking settings is potentially more important for men than women. Moderation of drinking is called for among males, in particular, and this moderation will have some effect for females (assuming most males are heterosexual).

Preventive interventions (e.g., brief interventions delivered via text messages or computers) could be shaped to be delivered in or about specific contexts. Protective behavioral strategies and interventions could focus on nodes of social or affiliation networks within specific contexts.

The ubiquity of significant associations for more frequent drinking and all three risky sex behaviors investigated in this study raises the question of whether similar results would be found among high HIV-risk populations, such as MSM. It is likely that a narrower range of drinking contexts would be significantly related to risky sex, as MSM tend to frequent a smaller number of types of drinking settings, many of which cater specifically to MSM, when looking to meet potential sex partners (28). Future research would do well to focus on concurrently collecting context-specific information, social cognitive risk factors, and event-level data in higher risk populations. We strongly encourage similar work to be done with high-risk groups.

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References

1. Weinhardt LS, Carey MP. Does alcohol lead to sexual risk behavior? Findings from event-level research. *Annu Rev Sex Res.* 2000; 11:125–57. [PubMed: 11351830]
2. Wechsler H, Dowdall GW, Davenport A, Castillo S. Correlates of college student binge drinking. *Am J Public Health.* 1995; 85(7):921–6. [PubMed: 7604914]
3. Rehm J, Shield KD, Joharchi N, Shuper PA. Alcohol consumption and the intention to engage in unprotected sex: Systematic review and meta-analysis of experimental studies. *Addiction.* 2012; 107(1):51–9. [PubMed: 22151318]
4. Baliunas D, Rehm J, Irving H, Shuper P. Alcohol consumption and risk of incident human immunodeficiency virus infection: A meta-analysis. *Int J Public Health.* 2010; 55(3):159–66. [PubMed: 19949966]
5. Stall R, Purcell DW. Intertwining epidemics: A review of research on substance use among men who have sex with men and its connection to the AIDS epidemic. *AIDS Behav.* 2000; 4(2):181–92.
6. Woolf SE, Maisto SA. Alcohol use and risk of HIV infection among men who have sex with men. *AIDS Behav.* 2009; 13(4):757–82. [PubMed: 18236149]
7. Stueve A, O'Donnell L, Duran R, San Doval A, Geier J. Being high and taking sexual risks: Findings from a multisite survey of urban young men who have sex with men. *AIDS Educ Prev.* 2002; 14(6):482–95. [PubMed: 12512849]
8. Cooper ML. Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *J Stud Alcohol Suppl.* 2002; 14:101–17. [PubMed: 12022716]
9. Colfax G, Vittinghoff E, Husnik MJ, et al. Substance use and sexual risk: A participant-and episode-level analysis among a cohort of men who have sex with men. *Am J Epidemiol.* 2004; 159(10):1002–12. [PubMed: 15128613]
10. LaBrie JW, Hummer JF, Ghaidarov TM, Lac A, Kenney SR. Hooking up in the college context: The event-level effects of alcohol use and partner familiarity on hookup behaviors and contentment. *J Sex Res.* 2014; 51(1):62–73. [PubMed: 23127230]
11. Steele CM, Josephs RA. Alcohol myopia. Its prized and dangerous effects. *Am Psychol.* 1990; 45(8):921–33. [PubMed: 2221564]
12. Rohsenow DJ. Drinking habits and expectancies about alcohol's effects for self versus others. *J Consult Clin Psychol.* 1983; 51(5):752–6. [PubMed: 6630690]

13. Darkes J, Goldman MS. Expectancy challenge and drinking reduction: Process and structure in the alcohol expectancy network. *Exp Clin Psychopharmacol.* 1998; 6(1):64–76. [PubMed: 9526147]
14. Frost SD. Using sexual affiliation networks to describe the sexual structure of a population. *Sex Transm Infect.* 2007; 83(Suppl 1):i37–42. [PubMed: 17664363]
15. Newman ME, Watts DJ, Strogatz SH. Random graph models of social networks. *Proc Natl Acad Sci U S A.* 2002; 99(Suppl 1):2566–72. [PubMed: 11875211]
16. Gruenewald PJ, Remer LG, LaScala EA. Testing a social ecological model of alcohol use: The California 50-city study. *Addiction.* 2014; 109(5):736–45. [PubMed: 24304295]
17. Gruenewald PJ. The spatial ecology of alcohol problems: Niche theory and assortative drinking. *Addiction.* 2007; 102(6):870–8. [PubMed: 17523980]
18. Jaffe HW, Valdiserri RO, De Cock KM. The reemerging HIV/AIDS epidemic in men who have sex with men. *JAMA.* 2007; 298(20):2412–4. [PubMed: 18042919]
19. Castel AD, Befus M, Willis S, Griffin A, West T, Hader S, et al. Use of the community viral load as a population-based biomarker of HIV burden. *Aids.* 2012; 26(3):345–53. [PubMed: 22008660]
20. Mair C, Cunradi CB, Gruenewald PJ, Todd M, Remer L. Drinking context-specific associations between intimate partner violence and frequency and volume of alcohol consumption. *Addiction.* 2013; 108(12):2102–11. [PubMed: 24112796]
21. Saltz RF, Paschall MJ, McGaffigan RP, Nygaard PM. Alcohol risk management in college settings: The Safer California Universities randomized trial. *Am J Prev Med.* 2010; 39(6):491–9. [PubMed: 21084068]
22. Freisthler B, Gruenewald PJ. Where the individual meets the ecological: A study of parent drinking patterns, alcohol outlets and child physical abuse. *Alcohol Clin Exp Res.* 2013; 37(6):993–1000. [PubMed: 23316780]
23. Gruenewald PJ, Johnson FW, Ponicki WR, Lascala EA. A dose-response perspective on college drinking and related problems. *Addiction.* 2010; 105(2):257–69. [PubMed: 20078484]
24. Gruenewald PJ, Mair C. Heterogeneous dose-response and college student drinking: Examining risks related to low drinking levels. *Addiction.* In press.
25. Lewis MA, Lee CM, Patrick ME, Fossos N. Gender-specific normative misperceptions of risky sexual behavior and alcohol-related risky sexual behavior. *Sex Roles.* 2007; 57(1-2):81–90.
26. Giancola PR, Levinson CA, Corman MD, Godlaski AJ, Morris DH, Phillips JP, et al. Men and women, alcohol and aggression. *Exp Clin Psychopharmacol.* 2009; 17(3):154–64. [PubMed: 19586230]
27. Davis KC, Norris J, George WH, Martell J, Heiman JR. Men's likelihood of sexual aggression: The influence of alcohol, sexual arousal, and violent pornography. *Aggress Behav.* 2006; 32(6):581–9.
28. Jones-Webb R, Smolenski D, Brady S, Wilkerson M, Rosser BR. Drinking settings, alcohol consumption, and sexual risk behavior among gay men. *Addict Behav.* 2013; 38(3):1824–30. [PubMed: 23261495]

Table 1

Descriptive Statistics (n=34,566 drinkers)

Problem and drinking measures	Mean	(SD)	Range
Problem measures, per 28 days:			
Number of sexual partners	0.336	(0.444)	0.000 - 5.833
Times had unplanned sex	0.124	(0.398)	0.000 - 5.957
Times had unprotected sex	0.070	(0.360)	0.000 - 6.087
Drinking frequency per 28 days:			
Across all contexts	5.875	(5.576)	0.000 - 28.000
At Greek events	0.484	(1.535)	0.000 - 28.000
At dorms or residence halls	0.283	(1.153)	0.000 - 28.000
At campus events	0.092	(0.455)	0.000 - 26.654
At off-campus homes / apartments	1.663	(2.639)	0.000 - 28.000
At bars or restaurants	0.838	(2.072)	0.000 - 28.000
Drinking volume over 28 days:			
Across all contexts	23.443	(31.807)	0.000 - 298.076
At Greek events	1.888	(9.715)	0.000 - 420.000
At dorms or residence halls	1.298	(7.931)	0.000 - 420.000
At campus events	0.192	(1.963)	0.000 - 131.250
At off-campus homes / apartments	7.340	(17.538)	0.000 - 420.000
At bars or restaurants	3.058	(11.129)	0.000 - 336.000
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Student characteristics	N	(%)	
Residence:			
Residence hall (reference category)	6,456	(18.68%)	
House or apartment	27,001	(78.11%)	
Student co-op	239	(0.69%)	
Fraternity / sorority	673	(1.95%)	
Other	197	(0.57%)	
Year in school:			
Freshman (reference category)	5,601	(16.20%)	
Sophomore	6,136	(17.75%)	
Junior	10,178	(29.45%)	
Senior	12,650	(36.60%)	
Other characteristics:			
Employed	18,420	(53.29%)	
Greek member or pledge	4,223	(12.22%)	
Married or steady relationship	16,106	(46.59%)	
Live with romantic partner	2,168	(6.27%)	
Have use of a car	23,653	(68.43%)	
White	18,394	(53.22%)	
21 or over	17,064	(49.37%)	
Male	15,506	(44.86%)	

Student characteristics	N	(%)
Intervention Campus	17,253	(49.91%)

Safer California Universities surveys, 2003-2011; sample weighted to be representative of gender and racial/ethnic composition of campuses.

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Table 2

Context-specific dose response models explaining 28-day counts of risky sexual behavior

Variable	Number Sexual Partners			Times Unplanned Sex ^a			Times Unprotected Sex		
	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b
Past 28 days frequency:									
Fraternalities / sororities		0.014 ^{**} (3.78)	0.014 ^{**} (3.89)		0.070 ^{**} (9.24)	0.068 ^{**} (8.94)		0.059 ^{**} (4.3)	0.020 (1.08)
Dormitories / residence halls		0.012 ^{**} (3.14)	0.022 ^{**} (3.05)		0.076 ^{**} (7.54)	0.053 ^{**} (3.48)		0.047 [*] (2.5)	0.036 [*] (2.22)
Campus events		0.038 ^{**} (3.22)	0.037 ^{**} (3.18)		0.162 ^{**} (5.38)	0.161 ^{**} (5.28)		0.166 ^{**} (4.11)	0.166 ^{**} (4.11)
Off-campus houses / apartments		0.011 ^{**} (6.98)	0.011 ^{**} (6.80)		0.075 ^{**} (16.07)	0.061 ^{**} (8.75)		0.071 ^{**} (9.54)	0.050 ^{**} (4.87)
Bars / restaurants		0.013 ^{**} (7.17)	0.008 ^{**} (3.25)		0.072 ^{**} (12.41)	0.060 ^{**} (7.15)		0.089 ^{**} (10.38)	0.061 ^{**} (4.85)
Past 28 days continued volume:									
Fraternalities / sororities			-0.002 [*] (-2.28)			0.004 [*] (2.19)			0.008 ^{**} (2.88)
Dormitories / residence halls									
Campus events									
Off-campus houses / apartments									
Bars / restaurants			0.001 ^{**} (2.59)			0.004 [*] (2.18)			0.008 ^{**} (3.2)
Residence (vs. dormitories):									
House or apartment	0.003 (0.28)	0.006 (0.59)	0.007 (0.71)	0.069 [*] (2.11)	0.093 ^{**} (2.67)	0.089 [*] (2.56)	0.261 ^{**} (3.73)	0.273 ^{**} (3.66)	0.257 ^{**} (3.52)
Student co-op	0.002 (0.10)	0.002 (0.07)	0.004 (0.15)	0.218 [*] (2.16)	0.258 [*] (2.49)	0.256 [*] (2.47)	0.295 (1.39)	0.315 (1.44)	0.302 (1.39)
Fraternity / sorority	0.039 (1.38)	0.011 (0.37)	0.011 (0.37)	0.207 ^{**} (2.91)	0.092 (1.24)	0.093 (1.26)	0.316 [*] (2.18)	0.196 (1.29)	0.195 (1.29)
Other	0.102 [*] (1.97)	0.112 [*] (2.19)	0.113 [*] (2.21)	0.236 [*] (1.97)	0.294 [*] (2.42)	0.291 [*] (2.40)	0.541 [*] (2.28)	0.575 [*] (2.37)	0.562 [*] (2.33)
Year in school (vs. freshman)									
Sophomore	-0.001 (-0.12)	0.001 (0.09)	0.001 (0.11)	-0.048 (-1.39)	-0.046 (-1.28)	-0.047 (-1.31)	0.000 (0.00)	-0.004 (-0.06)	-0.010 (-0.13)
Junior	-0.008 (-0.72)	-0.004 (-0.34)	-0.003 (-0.31)	-0.081 [*] (-2.17)	-0.063 (-1.62)	-0.061 (-1.58)	-0.017 (-0.23)	-0.005 (-0.06)	-0.006 (-0.08)
Senior	0.001 (0.08)	0.002 (0.16)	0.003 (0.25)	-0.120 [*] (-2.64)	-0.125 [*] (-2.66)	-0.121 [*] (-2.60)	-0.022 (-0.25)	-0.035 (-0.39)	-0.034 (-0.38)

Variable	Number Sexual Partners			Times Unplanned Sex ^a			Times Unprotected Sex		
	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b	Model 1: Demographics Only	Model 2: Add drinking frequencies	Model 3: Add significant continued volumes ^b
Employed	0.002 (0.38)	0.002 (0.28)	0.002 (0.30)	0.089 (4.42)	0.092 (4.45)	0.090 (4.40)	0.072 (1.94)	0.069 (1.83)	0.069 (1.82)
Greek member or pledge	0.04 (3.38)	0.016 (1.44)	0.015 (1.39)	0.184 (6.07)	0.077 (2.43)	0.084 (2.64)	0.144 (2.54)	0.048 (0.80)	0.067 (1.13)
Married or steady relationship	-0.204* (-22.9)	-0.188* (-20.81)	-0.188* (-20.92)	-0.142* (-7.17)	-0.13 (-6.47)	-0.131 (-6.54)	0.259** (7.14)	0.296** (7.90)	0.289** (7.77)
Live with romantic partner	-0.057* (-8.01)	-0.045* (-6.17)	-0.045* (-6.18)	-0.229* (-4.38)	-0.158* (-3)	-0.160* (-3.04)	-0.222* (-2.79)	-0.156 (-1.94)	-0.159* (-1.98)
Have use of a car	-0.011 (-1.52)	-0.012 (-1.62)	-0.012 (-1.57)	0.063 (2.61)	0.061 (2.45)	0.061 (2.46)	0.078 (1.72)	0.081 (1.74)	0.082 (1.76)
White	-0.004 (-0.58)	-0.017 (-2.79)	-0.017 (-2.75)	0.106 (5.17)	0.054 (2.59)	0.056 (2.68)	-0.066 (-1.78)	-0.113 (-2.97)	-0.109* (-2.88)
21 or over	0.019* (2.20)	0.012 (1.42)	0.013 (1.56)	-0.075 (-2.46)	-0.095 (-2.98)	-0.095 (-2.98)	-0.031 (-0.57)	-0.076 (-1.32)	-0.078 (-1.36)
Male	0.064** (10.42)	0.060** (9.85)	0.059** (9.71)	0.050 (2.53)	0.058 (2.89)	0.047 (2.30)	0.057 (1.60)	0.072* (1.99)	0.048 (1.31)
Intervention	-0.041* (-7.56)	-0.039* (-7.12)	-0.038* (-7.04)	-0.041 (-2.16)	-0.026 (-1.33)	-0.028 (-1.43)	0.032 (0.92)	0.058 (1.60)	0.053 (1.48)
Constant	0.614** (33.36)	0.579** (32.42)	0.577** (33.22)	-1.176 (-22.23)	-1.381 (-24.53)	-1.361 (-24.27)	-2.869 (-22.45)	-3.136 (-23.05)	-3.069* (-22.92)
Sigma	-0.317 (-15.63)	-0.310* (-15.58)	-0.310* (-15.68)	0.747** (31.71)	0.824** (33.66)	0.821** (33.47)	1.180** (27.24)	1.283** (27.97)	1.271** (27.85)
Heteroskedasticity: Frequency	0.022 (1.62)	0.026 (1.89)	0.026 (1.91)	0.074** (15.14)	0.052** (10.4)	0.053** (10.46)	0.051** (11.93)	0.037** (8.37)	0.039** (8.77)
Heteroskedasticity: Frequency ²	0.000 (0.23)	0.000 (-0.06)	0.000 (-0.07)	-0.002 (-10.22)	-0.001* (-6.28)	-0.001* (-6.33)	-0.001* (-7.93)	-0.001* (-5.26)	-0.001* (-5.51)
Heteroskedasticity: V-F	0.003** (3.11)	0.002** (2.85)	0.002** (2.87)	0.004 (10.55)	0.003** (6.86)	0.003** (6.56)	0.004** (11.62)	0.003** (8.34)	0.003** (7.76)
Wald chi-square	1664.45	170.97	12.24	324.97	731.73	17.14	253.55	277.71	29.20
d.f.	29	5	2	29	5	3	29	5	3
Pt. > F	0.0000	0.0000	0.0022	0.0000	0.0000	0.0007	0.0000	0.0000	0.0000

Results of Tobit analyses of N = 34,566 cases from Safer California Universities surveys, 2003-2011. Coefficients are followed by z-scores in parentheses.

All models have been weighted for gender and racial/ethnic composition. Models also included indicator variables for campus (not shown).

** p<.01

* p<.05

^aThere is no Model 3 for the "times unplanned sex" outcome because none of the context-specific continued volume associations were significant.

^bTo avoid problems with multiple comparisons, continued volumes were only included if final models if they were significant both as a group and individually.

Table 3

Context-specific dose response models explaining 28-day counts of risky sexual behavior, by gender

Drinking Contest	Males Only		Females Only	
	Frequency	Continued Volume ^a	Frequency	Continued Volume ^a
A: Number of Sexual Partners				
Fraternities / sororities	0.032 ** (2.64)	-0.004 * (-2.51)	0.011 ** (3.35)	
Dormitories / residence halls	0.010 (1.94)		0.011 ** (2.72)	
Campus events	0.031 * (2.26)		0.041 * (2.42)	
Off-campus houses / apartments	0.006 * (2.39)		0.015 ** (8.25)	
Bars / restaurants	0.013 ** (4.36)		0.014 ** (6.22)	
B: Times Had Unplanned Sex				
Fraternities / sororities	0.069 ** (5.34)		0.063 ** (7.81)	
Dormitories / residence halls	0.087 ** (6.12)		0.069 ** (5.55)	
Campus events	0.177 ** (4.26)		0.123 ** (3.13)	
Off-campus houses / apartments	0.058 ** (5.52)	0.004 ** (2.90)	0.071 ** (11.58)	
Bars / restaurants	0.077 ** (8.50)		0.069 ** (9.79)	
C: Times Had Unprotected Sex				
Fraternities / sororities	0.089 ** (4.32)		0.010 (0.65)	
Dormitories / residence halls	0.062 * (2.54)		0.019 (0.88)	0.002 * (2.31)
Campus events	0.160 ** (2.99)		0.153 * (2.44)	
Off-campus houses / apartments	0.035 * (2.05)	0.006 ** (2.68)	0.063 ** (6.69)	0.003 ** (2.67)
Bars / restaurants	0.074 ** (3.57)	0.008 * (2.49)	0.071 ** (6.88)	

n = 14,097 male cases, 20,520 female cases from Safer California Universities surveys, 2003-2011; sample weighted to be representative of gender and racial/ethnic composition of campuses.

**
p<.01

*
p<.01

^aTo avoid problems with multiple comparisons, continued volumes were only included in final models if they were significant both as a group and individually.