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Extreme College Drinking and Alcohol-Related Injury Risk

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Abstract

Background—Despite the enormous burden of alcohol-related injuries, the direct connection between college drinking and physical injury has not been well understood. The goal of this study is to assess the connection between alcohol consumption levels and college alcohol-related injury risk.

Methods—12,900 college students seeking routine care in 5 college health clinics completed a general Health Screening Survey. 2,090 of these students exceeded at-risk alcohol use levels and participated in a face-to-face interview to determine eligibility for a brief alcohol intervention trial. The eligibility interview assessed past 28-day alcohol use and alcohol-related injuries in the past 6 months. Risk of alcohol-related injury was compared across daily drinking quantities and frequencies. Logistic regression analysis and the Bayesian Information Criterion were applied to compute the odds of alcohol-related injury based on daily drinking totals after adjusting for age, race, site, body weight and sensation seeking.

Results—Male college students in the study were 19% more likely (95% CI: 1.12–1.26) to suffer an alcohol-related injury with each additional day of consuming 8 or more drinks. Injury risks among males increased marginally with each day of consuming 5–7 drinks (Odds ratio=1.03, 95% CI: 0.94–1.13). Female participants were 10% more likely (95% CI: 1.04–1.16) to suffer an alcohol-related injury with each additional day of drinking 5 or more drinks. Males (OR=1.69, 95% CI: 1.14–2.50) and females (OR=1.81, 95% CI: 1.27–2.57) with higher sensation seeking scores were more likely to suffer alcohol-related injuries.

Conclusions—College health clinics may want to focus limited alcohol injury prevention resources on students who frequently engage in extreme drinking, defined in this study as 8+M/5+F drinks per day, and score high on sensation seeking disposition.

Keywords

Alcohol; College drinking; Injury; Heavy drinking; Sensation-seeking

Introduction

Alcohol drinking on college campuses is a pervasive problem associated with numerous adverse effects (Perkins, 2002). It is estimated that over 500,000 US college students suffered alcohol-related injuries in 2001 (Hingson et al., 2005).

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Despite the enormous burden of alcohol-related injuries, the direct connection between college drinking and physical injury has not been well understood. Harvard's College Alcohol Study (CAS) links increases in average alcohol consumption with a rise in injury rates. The CAS data suggest a linear association between average consumption and injury, with every additional drink per occasion in the past 30 days leading to a 3–5% increase in injury rates (Wechsler et al., 2002; Wechsler and Nelson, 2006).

In addition, frequency of binge drinking is also linked to higher injury rates on college campuses. Students who drink 5+M/4+F drinks (i.e. binge) on 1–2 occasions in the last 2 weeks are nearly three times more likely to be injured than those with no heavy drinking episodes. Students binging on 3 or more occasions experience 8 times greater injury rates, after adjusting for age, gender, marital status, race and parental college education (Wechsler and Nelson, 2001). Students who exceed the 5+M/4+F binge drinking threshold on 6 or more occasions in the past 2 weeks have an odds ratio of injury more than 11 times that of non-binge drinkers (Presley and Pimentel, 2006).

To summarize, a number of studies uncover a correlation between average drinking quantities or binge drinking frequencies and college injury rates. Unfortunately, several considerations make these findings hard to interpret in a format easily accessible to students, clinicians, and school administrators. First, dichotomizing heavy drinking as above or below a certain threshold, for example averaging 5+M/4+F drinks per occasion, fails to consider consumption at more extreme levels. Analyses of peak drinking levels among college students show that students with the same average consumption per occasion vary widely in peak amounts (Gruenewald et al., 2003; White et al., 2006). Second, average alcohol consumption does not allow to evaluate the "dose-response" effect associated with increasing frequencies. Third, not all of the reviewed studies on alcohol-related injury risk among college students control for potential confounders.

The literature available on alcohol drinking and risk for college injury lacks precision in demonstrating how the combined effect of alcohol quantities and frequencies contribute to injury risks among students. The present investigation will address this gap in the literature. The data are derived from the College Health Improvement Projects (CHIPS) study, a randomized controlled brief alcohol intervention trial conducted at 4 U.S. and 1 Canadian university. Twenty-eight day Alcohol Timeline Follow-Back data collected at baseline assessment prior to randomization into the trial allow for examination of both drinking quantities and frequencies in relation to injury rates, while adjusting for potential confounders. The objective of this analysis is twofold: (1) to assess the association between college drinking patterns (i.e., frequencies and quantities) and alcohol-related injury risk; and (2) to present information about alcohol-related college injury in a format that can be easily understood by students, clinicians and school administrators. To the best of our knowledge, this will be the first college drinking study which demonstrates the risks associated with the combined effects of increasing daily drinking levels and frequencies of heavy alcohol consumption.

Materials and Methods

Study Sample

The source of data used for this investigation is the College Health Intervention Project Study (CHIPS), a randomized controlled clinical trial of screening and intervention for high risk drinking college students conducted at five primary care college health clinics in the US and Canada. The study was approved by the Institutional Review Boards for the Protection of Human Subjects in Research at the participating sites.

Enrollment in the CHIPS study was limited to full time students at the research university sites who were 18 years or older. The study screened 12,900 students seeking routine medical care at 4 university health centers, or at a health orientation class at a fifth site, with a Health Screening Survey (HSS). The HSS is an embedded alcohol screening instrument that includes questions on smoking, exercise, weight control and alcohol use (Fleming et al., 1997; Fleming et al., 1999). Students screening positive for at-risk drinking on the HSS were invited for a face-to-face baseline interview to determine eligibility for the randomized controlled trial. The criteria for at-risk drinking were defined as either: (1) 3+ drinking days per week; (2) 15+ drinks per week for men; (3) 12+ drinks per week for women; (4) 5+ standard drinks on 5 or more occasions in the past 30 days for men or women; or (5) 2 or more positive responses to the CAGE alcohol questions.

A total of 4,532 students screened positive on the HSS. 2,442 students declined participation in the face-to-face interview portion of the trial. The data analyzed here are derived from the 2,090 subjects who screened positive on the HSS and who agreed to participate in the face-to-face eligibility interview prior to randomization into the trial.

CHIPS Baseline Eligibility Interview

Trained researchers conducted the CHIPS baseline eligibility interviews, which lasted for about one hour in a clinical setting. Subjects were paid $30 for completion of the interview. Baseline interviews consisted of 20 scales or groups of questions. The Alcohol Time-Line Follow-Back (TLFB) method was used to elicit daily drinking quantities over the past 28 days. In the 28-day Alcohol TLFB approach, participants are asked to identify days they drank alcohol and the number of standard drinks consumed per day (Sobell and Sobell, 1992; Sobell and Sobell, 2000). No time period for alcohol consumption per occasion is available with the TLFB method. To ensure accuracy, the interviewer verifies that the subject understands the definition of standard drink sizes in relation to drinks served in a bar setting. In the study, the standard drink size is defined as 14g of alcohol, which corresponds to 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of 80 proof liquor.

In addition to questions on alcohol use and alcohol related injury the interview also inquired about tobacco use, depression, sensation seeking, interpersonal violence, health care utilization, and alcohol driving. Sensation-seeking disposition was evaluated with a Brief Sensation Seeking Scale (BSSS) that has a proven reliability and validity record (Hoyle et al., 2002). Height and weight were measured directly by the interviewer.

Measures

Heavy drinking day (HDD) variables were created from the Alcohol TLFB data. The HDD variables were defined as days in the past 28 days that the subject met or exceeded a particular daily drinking threshold, starting at 4+ drinks in a day and increasing up to 10+ drinks per day. Each HDD variable is an integer variable ranging in value from 0 to 28.

The outcome variable of interest for the analysis was physical injury as a result of alcohol use. Students were asked two questions regarding injury: ‘In the past 6 months, how many accidents or injuries have you had? (e.g., sprained ankle, fender bender, bad falls)’ and ‘Was your alcohol consumption a factor in any of these accidents/injuries?’ A positive response to both questions was defined as the affirmative for the dichotomous outcome variable of alcohol-related injury used in the analysis.

Statistical Analysis

Separate analyses were conducted for males and females in the study. Men and women metabolize alcohol at different rates and may therefore experience vastly different injury risk,

even if body weight and drinking amounts are similar (NIAAA, 1999). As a first step of the analysis, alcohol-related injury rates were plotted against number of days that subjects exceeded alternate heavy drinking day thresholds (HDD4-HDD10) to determine unadjusted risk of injury. Second, the logistic regression Bayesian Information Criterion (BIC) was used to determine which heavy drinking day definition best fit the data (Schwarz, 1978). The best fitting model from the alternatives under consideration is the one which minimizes the BIC statistic. When sample size is large and the number of parameters in the model is small, the BIC model selection procedure is considered to be a reliable method for choosing between available options (Raftery, 1986; Burnham and Anderson, 2004). Third, injury rates were plotted for the best-fit definitions of a heavy drinking day. Finally, a full logistic regression model was constructed to calculate odds of injury associated with varying quantities and frequencies of alcohol use while adjusting for potential confounders such as age, race, university site, body weight, and sensation seeking. All analyses were performed with SAS version 9.1 for Linux (SAS Institute Incorporated, 2002).

Results

Sample Characteristics

Descriptive statistics for the sample of college students who completed the baseline interview for the CHIPS study are presented in Table 1. Of the 2,090 students included, 1,218 were female and 872 were male. A majority of the students in the study sample were ages 18–21, with 21% age 25 or older. Most of the participants were non-Hispanic white (86%), with 5% Asian and 4% Hispanic. One third of study participants attended a large US Midwestern university, and another third attended a large US university in the Pacific Northwest (enrollment at both sites >40,000). The remaining participants were students enrolled at two small US universities in the Midwest (<12,000 enrolled) or at a large Canadian university (>35,000 enrolled). Mean scores on the brief Sensation Seeking Scale averaged 3.3 on a 1–5 scale, slightly higher than the median score of 3 observed in population-based studies (Hoyle et al., 2002).

A comparison of subjects who screened positive for at-risk drinking on the Health Screening Survey (HSS) and who participated in the face-to-face baseline interview to those who were eligible on the HSS but refused the baseline assessment revealed that decliners were somewhat older (63% over age 21 vs 58% over age 21, p=.001), and less likely to have been recently injured (31% vs 39%, p=.001). Baseline subjects had higher average sensation seeking scores (3.3 vs. 3.0, p<.001) than non-participants. Drinking levels (19.0 drinks per week vs 18.9 drinks per week, p=.782), heavy drinking episodes (3.2 episodes vs 3.3 episodes, p=.186) and gender (56% female vs 58% females, p=.094) were similar among decliners and baseline study respondents. Both groups were equally likely to attribute an injury to alcohol use if they were injured (22% vs 26%, p=.123).

Table 1 also provides drinking quantities, frequencies and alcohol-related injuries by gender for the 2,090 study participants. Over half of the male subjects consumed 10 or more drinks in a day on at least one of the past 28 days and nearly half of the females consumed 8 or more drinks in a day at least once in the past 28 days. Students exceeded 5+M/4+F drinks per day more than once per week on average. Among both males and females, heavy drinking days (5 +drinks for females or 8+drinks for males) tended to replace light drinking days (1–4 drinks), so that more heavy drinking days were associated with fewer light drinking days. For example, males consuming 8+drinks on 5 or more days averaged 2.2 days consuming 1–4 drinks, whereas males with no 8+drinking days averaged 7.9 days of 1–4 drinks. Alcohol-related injuries were common, with more than 11% of males and 9% of females reporting an alcohol-related injury in the past 6 months.

Likelihood of Alcohol-Related Injury

Figure 1 displays alcohol-related injury rates for males as a function of heavy drinking days (HDD). The curves start with a heavy drinking day defined as 5+ drinks per day (HDD5) and increase up to 9+ drinks per day (HDD9). As expected, as the HDD definition increases, and as the frequency of heavy drinking days increases, injury rates rise. Male subjects who drink 9+ drinks per day on 11 or more occasions in the past 28 days have a 43% percent chance of an alcohol-related injury over the past 6 months. In contrast, male subjects who drink heavily on 1–2 days in the past 28 days have less than a 10% chance of alcohol-related injury in the past 6 months regardless of the definition of HDD.

Figure 2 displays alcohol-related injury rates for females as a function of heavy drinking days. For females, the continuum of risk is not as uniform as it is for males. Overall, however, the same pattern holds. As the definition of a heavy drinking day increases and the frequency of heavy drinking occasions grows, injury rates rise. Unlike with males, injury rates increase dramatically even at 1–2 heavy drinking days per month. Rates of injury for females drinking 4 or more drinks in a day on 1–2 days are more than double the injury rates for females who do not consume 4 drinks on any day. At higher daily drinking levels, risk of injury continues to rise. Crossing the HDD8 threshold (8+drinks in a day) on 11 or more days is associated with an injury rate of 30%.

Table 2 provides a logistic regression comparison of the outcome variable when applying the alternative definitions of heavy drinking days (HDD4-HDD10). The parameters of interest include the regression parameter for the number of days of heavy drinking (β), the corresponding odds ratio associated with each day of heavy drinking, and the Bayesian Information Criterion (BIC) statistic for the logistic regression model fit. As seen in Table 2, the BIC statistic for model fit among males is minimized with a HDD definition of 8+ drinks per day (BIC=586.21). For female subjects, the BIC floor occurs at HDD5 (BIC=714.74). The second best alternative for females is at HDD7, with a higher β of 0.174 (Odds Ratio=1.19), but with a worse BIC of 717.45.

In Figure 3, alcohol-related injury rates are displayed visually for 3 groups of students: (A) subjects who drink above 8+M/5+F drinks in a day; (B) subjects who drink above 5+M/4+F drinks in a day including those who cross the 8+M/5+F limit; and (C) subjects who drink above 5+M/4+F drinks in a day excluding those who cross the 8+M/5+F daily threshold. Alcohol injury rates in the 8+M/5+F drinking group diverge markedly from the 5+M/4+F drinking group with increasing frequency of heavy drinking. At 11+ heavy drinking days, there is more than a five percentage point difference in injury rates for those exceeding 8+M/5+F compared to those exceeding 5+M/4+F. The curve excluding subjects who exceed 8+M/5+F from the 5 +M/4+F drinkers indicates that a large proportion of the injuries among 5+M/4+F drinkers is associated with higher drinking levels.

The logistic regression models for odds of alcohol-related injury while adjusting for potential confounders such as age, race, university site, body weight, and sensation seeking disposition are presented in Table 3. For males, the odds of injury are 1.19 (95% CI: 1.12–1.26, p<.001) for every day of drinking 8 or more drinks. Odds ratios grow exponentially with each additional day of extreme drinking (8+drinks), so that the odds of injury double with 4 days of extreme drinking and nearly quadruple with 8 days of extreme drinking. Odds of injury do not significantly increase with days of 5–7 drinks (Odds Ratio=1.03, 95% CI: 0.94–1.13, p=.592). Males with higher sensation seeking scores are more likely to be injured, after adjusting for alcohol use level.

For females, the odds ratio associated with each additional day of drinking 5 or more drinks is 1.10 (95% CI: 1.04–1.16, p=.002). Injury rates decrease, albeit non-significantly, when

consuming 1–3 drinks (OR=0.95, 95%CI: 0.89–1.02, p=.127) or 4 drinks in a day (OR=0.94, 95%CI: 0.79–1.11, p=.434). Females with higher sensation seeking scores are more likely to suffer an alcohol-related injury, after adjusting for alcohol use level. Alcohol injury rates are significantly lower for females at one of the small Midwestern university sites included in the study, where screening took place at a health orientation class as opposed to the health services center.

To highlight how much elevated injury risk is due to greater risk-taking among heavier drinkers, we examined the relation between heavy drinking days and injury where alcohol was not considered a factor. This analysis reveals that females at one of the university sites were significantly less likely to be injured than at the other sites. Recruitment at this particular site took place at a mandatory health orientation class, which could explain the difference in non-alcohol related injury rates. In addition, 18 year old females and heavier females were more likely to suffer non-alcohol related injury. There were no significant findings among males for non-alcohol related injury. Sensation seeking was not a significant factor for non-alcohol related injuries among males or females.

Discussion

The first objective of this undertaking is to offer an assessment of injury rates associated with drinking patterns that account for both alcohol quantity and frequency. Similar to previous studies, college students in this investigation frequently engage in extreme drinking behavior (cf. White et al., 2006; Gruenewald et al., 2003). The males in the study drink, on average, 10 days per month and 6 drinks per drinking day, for a total of 60 drinks in the past 28 days. Females drink, on average, 9 days per month and 4 drinks per drinking day, for a total of 36 drinks in the past 28 days. Subjects reporting 5 or more heavy drinking days (8+drinks M/5 +drinks F) tend to have fewer light drinking days (2.2 days with 1–4 drinks), exhibiting a pattern of frequent extreme intoxication almost to the exclusion of light drinking consumption.

The risk for alcohol-related injury grows rapidly when subjects report high frequency of extreme intoxication days. Male college students who consume 8 or more drinks per day have a 19% greater chance to suffer an alcohol-related injury with each additional day of extreme drinking. Female participants who drink 5 or more drinks per day experience 10% greater risk for an alcohol-related injury with each additional day of extreme intoxication. Compounding the risk over multiple days of heavy drinking, students who drink 8+ drinks for males or 5+ drinks for females on at least 4 days per months (e.g. every weekend) are five times more likely to be injured than those who do not cross the 8+M/5+F drinking limit.

Furthermore, the findings of this investigation lend support to previous research on ER injury patients by uncovering an independent main effect between sensation seeking and self-reported alcohol-related injury among college students seen at university health services for a variety of health issues (cf. Field and O'Keefe, 2004; Cherpitel, 1999). Our results are in line with the findings of an independent sensation-seeking effect in studies of college alcohol drinking and driving behavior, which increases the likelihood of injury (Zakletskaia et al., 2009; McMillen et al., 1992). Interestingly, our comparison of heavy drinking days and non-alcohol related injuries reveals that sensation-seeking is not a significant determinant of injury for males or females if alcohol is not a factor. Future studies may want to look at the cost-effectiveness of injury interventions focused at frequent extreme drinking experienced by sensation seekers on college campuses.

The second objective of this study is to present information on risks for college alcohol-related injury in a format accessible to clinicians, students and school administrators interested in curbing injury rates on college campuses. Our results demonstrate that, at least within this

population of college drinkers, injury risks are considerably greater on days when males exceed 8+drinks or when females drink 5+drinks, and when students score high on a sensation-seeking scale. Health care providers and policy makers may use the results derived from this study to inform students and parents on how injury risk relates to varying alcohol amounts, frequencies of consumption, and to personality disposition.

It should be noted, however, that our results should not be construed as such that drinking less than 8 drinks for men and 5 drinks for women is a safeguard against alcohol-related injury. Simply, students experience rapidly escalating injury rates after the 8+M/5+F threshold is met.

The strength of the study lies in the large sample size, the Alcohol Time-Line Follow-Back method to elicit alcohol use and a variety of explanatory variables available for the analysis.

A potential limitation of the study data is subject selection bias. The study sample may not be representative of the student populations from which it is drawn. Sample recruitment took place at student health centers, so enrollment was limited to students who utilize university health services. However, research indicates that almost all college students have access to a student health center, and that the utilization rate of student health centers is roughly 2 visits per enrolled student per year (Patrick, 1988). In addition, more than 60% of the students screened in the study were females, while just over 50% of the student population at the participating sites is female, indicating a potential gender bias toward females in the study. On the other hand, the study subjects are similar in age to the overall student population. Over 31% of students initially screened with the Health Screening Survey were age 25 years or older, which corresponds to the 32% of students age 25 years or older at the participating universities. Finally, because the baseline interview was performed in conjunction with enrollment in a randomized controlled trial, the study only included subjects who self-reported drinking above at-risk drinking thresholds and who were willing to consent to the more in-depth interview. In contrast to non-responders, baseline participants were younger, more likely to have been recently injured, and had higher sensation-seeking scale scores than those who declined the face-to-face interview. However, variables of interest, such as alcohol consumption and attribution of recent injury to alcohol did not differ among baseline participants and non-responders. While the subjects in the study may not be representative of campus populations as a whole or of college drinkers in general, they may represent the majority of students who would be targeted for a health-services based college alcohol intervention.

Another limitation of the study data is that respondents were asked to self-determine the attribution of alcohol use as a factor in their injuries. It is possible that study participants may minimize the role of alcohol when injuries occur and underestimate alcohol-related injuries. Future studies could examine whether objectively verified alcohol injury data produce higher alcohol injury rates than self-report.

In addition, the study did not collect data on duration of drinking time per occasion. Students binging over a short time span per occasion would reach higher blood alcohol contents and potentially be at much greater risk of injury than the respondents who drink the same alcohol quantity over the course of a day.

Finally, a limitation of modeling prior injuries with recent drinking is that we do not know what exact quantity of alcohol consumption is associated with a particular injury. It is possible that experiencing an alcohol-related injury could influence future drinking behavior. If injury, in fact, affects behavior, it is reasonable to assume that the resulting change will be a reduction in drinking, so more alcohol consumption on a single day, as opposed to less, should be modeled as optimal for predicting injuries. However, Mallett et al. (2006) reports that students who engage in heavy episodic drinking do not learn from past negative consequences and overestimate their tolerance to alcohol intoxication.

Future studies may want to consider types of injury and injury severity in relation to the combined effect of alcohol consumption amounts and frequency. Available literature in traffic crashes shows that the higher the BAC level, the more severe the traffic crash and the injuries sustained (Jones and Lacey, 2001). It would be important to know how frequency, interacting with quantity, impacts injury severity.

Conclusion

By taking into consideration frequency of drinking in relation to alcohol consumption quantities, our results demonstrate that alcohol injury rates grow rapidly. A group of students who frequently engage in extreme drinking, defined in this study as 8+M/5+F drinks per day, and score high on sensation seeking disposition experience greater risk for alcohol-related injuries. Our findings will be useful for clinicians, school administrators and policy makers who wish to warn students about alcohol-related injury.

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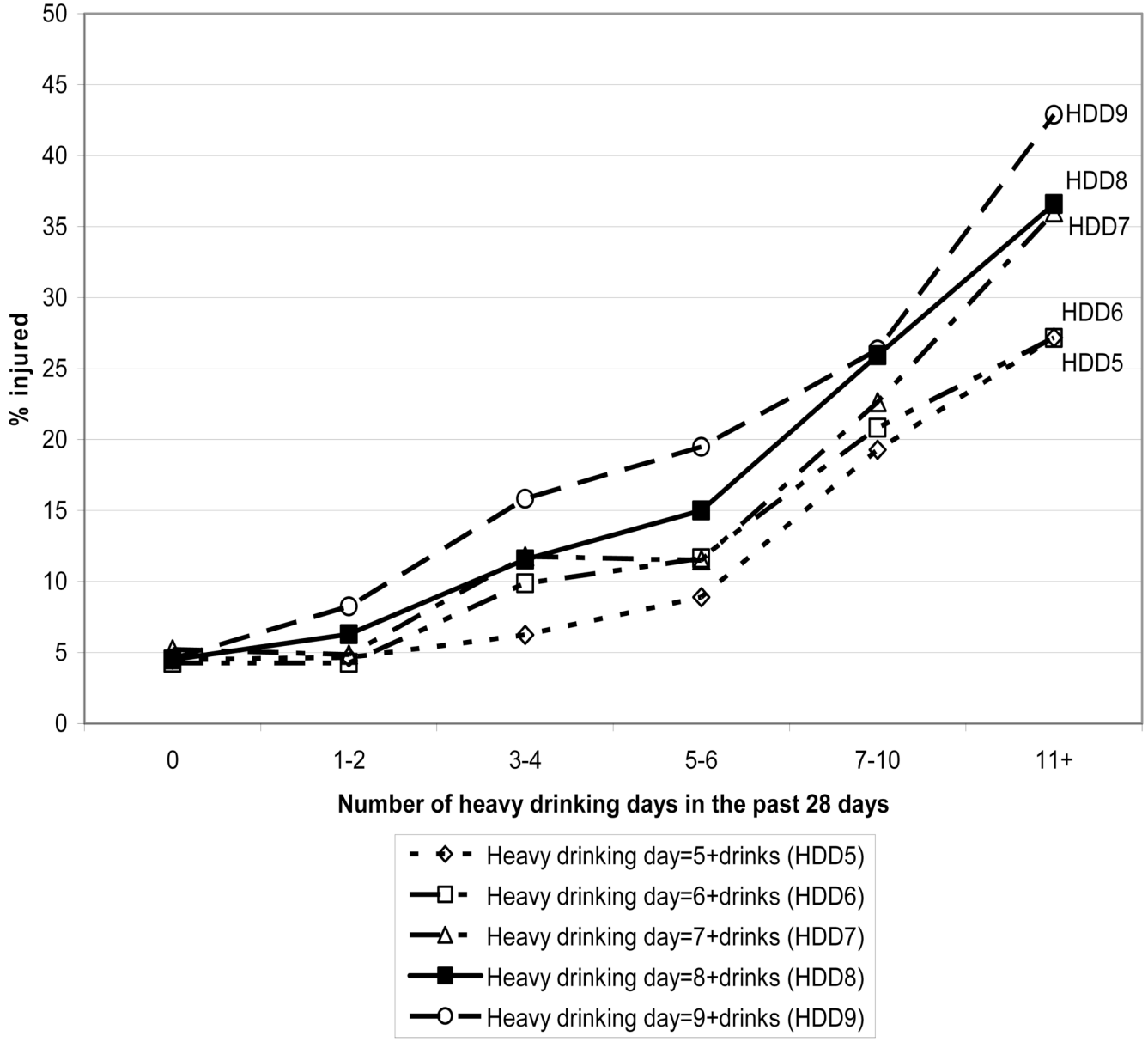

Figure 1. Alcohol-Related Injuries by Number of Heavy Drinking Days for Males

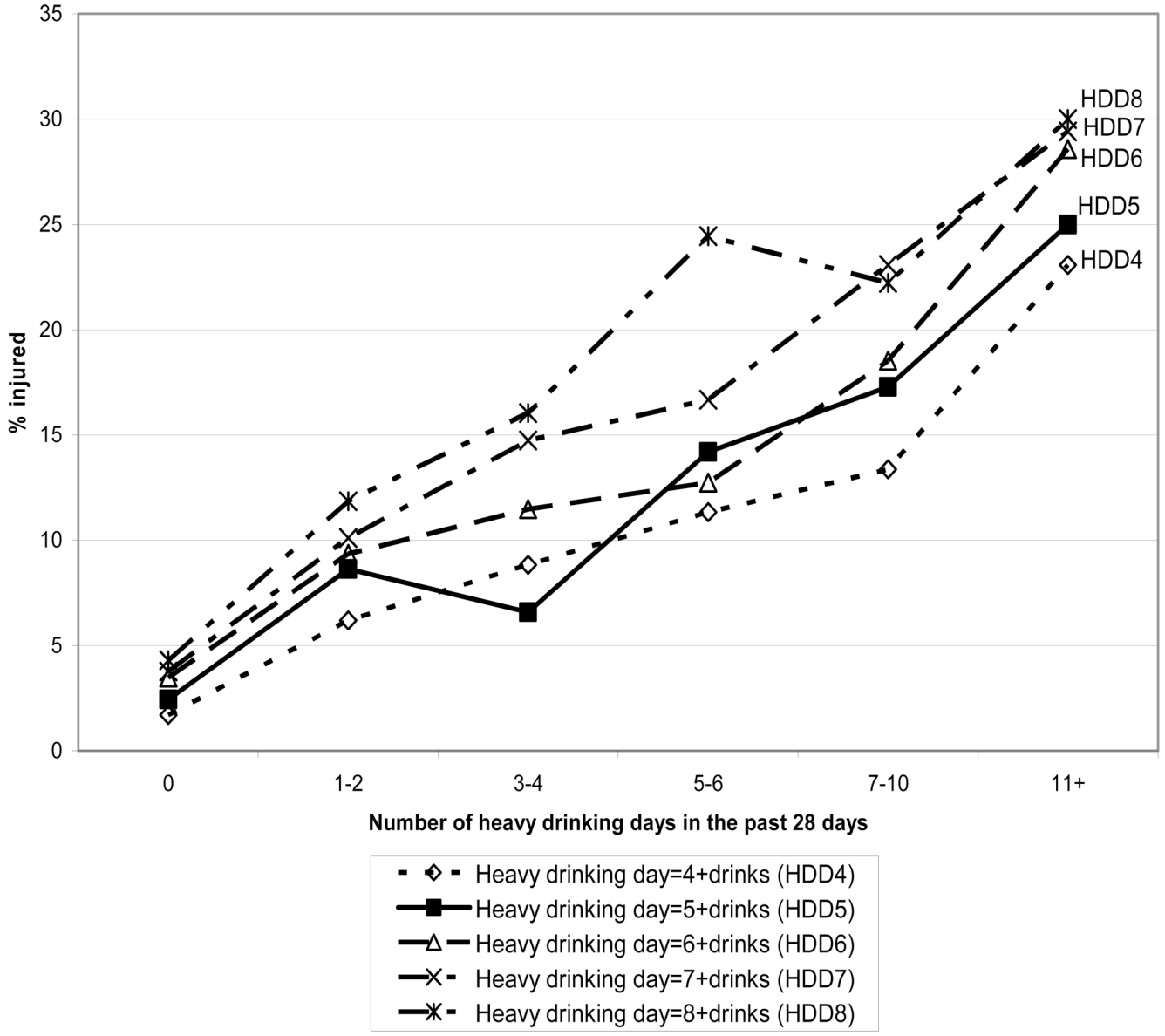

Figure 2. Alcohol-Related Injuries by Number of Heavy Drinking Days for Females

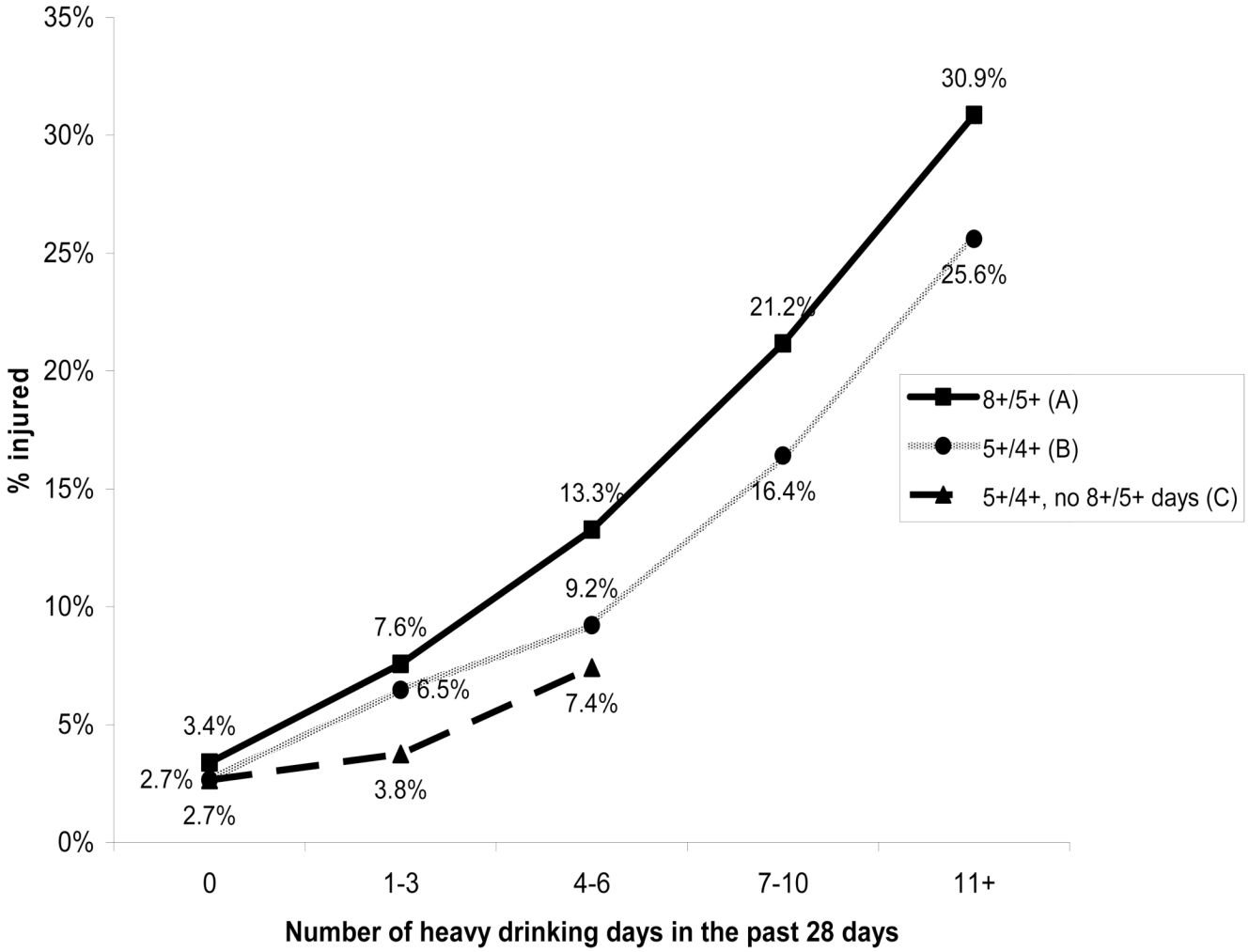

Figure 3. Alcohol-Related Injuries by Definition of Heavy Drinking Days

Curve A: Percent of subjects injured when exceeding 8+M/5+F drinks per day
Curve B: Percent of subjects injured when exceeding 5+M/4+F drinks per day
Curve C: Percent of subjects injured when exceeding 5+M/4+F drinks per day, excluding subjects exceeding 8+M/5+F drinks per day

Table 1
Descriptive Statistics by Gender, CHIPS study

		By Gender	
	Overall	**Male**	**Female**
Characteristic	**n=2,090**	**n=872**	**n=1,218**
Demographics			
Age, (%)			
18 years	12.4	11.6	13.1
19 years	15.3	15.6	15.1
20 years	14.5	14.2	14.7
21 years	15.7	16.6	15.0
22 years	10.9	10.8	11.0
23 years	4.9	6.1	4.1
24 years	4.6	4.0	5.1
25 or more	21.6	21.1	21.9
Race, (%)			
Non-Hispanic white	86.3	86.1	86.5
Black	1.6	1.6	1.6
Native American	1.2	1.4	1.1
Asian	5.5	4.7	6.0
White Hispanic	3.6	3.8	3.5
Other/No Answer	1.9	2.5	1.4
University site (%)			
Large Midwestern university	34.6	33.0	35.7
Large Pacific Northwest university	33.0	32.0	33.7
Small Midwestern university #1	10.7	13.5	8.7
Small Midwestern university #2	10.1	8.9	11.0
Large Canadian university	11.6	12.5	10.9
Body mass index, mean (sd)	23.9 (3.9)	24.6 (3.7)	23.4 (4.0)
Sensation seeking score, mean (sd)	3.3 (0.6)	3.5 (0.6)	3.2 (0.6)
Alcohol Use, past 28 days	*Mean (sd)*	*Mean (sd)*	*Mean (sd)*
Number of drinking days	9.6 (0.1)	10.3 (0.2)	9.1 (0.1)
Total number of drinks	46.5 (0.8)	60.4 (1.5)	36.5 (0.8)
Days exceeding 4+drinks	4.9 (0.1)	6.2 (0.1)	4.1 (0.1)
Days exceeding 5+drinks	4.0 (0.1)	5.3 (0.1)	3.1 (0.1)
Days exceeding 6+drinks	3.2 (0.1)	4.5 (0.1)	2.3 (0.1)
Days exceeding 7+drinks	2.5 (0.1)	3.7 (0.1)	1.6 (0.1)
Days exceeding 8+drinks	2.1 (0.1)	3.2 (0.1)	1.2 (0.1)
Days exceeding 9+drinks	1.5 (0.1)	2.5 (0.1)	0.9 (0.1)
Days exceeding 10+drinks	1.3 (0.1)	2.2 (0.1)	0.7 (0.0)
Injuries, past 6 months	%	%	%
Any injury or accident	38.6	44.6	34.3
Injury due to alcohol	10.1	11.6	9.0

Table 2

Logistic Regression Comparison of Alternative Heavy Drinking Day (HDD) Cut-offs for Alcohol Injury, by Gender

	Males (n=872)		
	β (SE)	**Odds Ratio**	**BIC**
HDD4	.135 (.023)	1.14	603.76
HDD5	.157 (.024)	1.17	594.34
HDD6	.155 (.024)	1.17	596.57
HDD7	.181 (.026)	1.20	589.41
HDD8	**.189 (.026)**	**1.21**	**586.21**
HDD9	.196 (.028)	1.22	590.18
HDD10	.193 (.028)	1.21	593.41
	Females (n=1,218)		
	β (SE)	**Odds Ratio**	**BIC**
HDD4	.130 (.024)	1.14	720.37
HDD5	**.151 (.025)**	**1.16**	**714.74**
HDD6	.153 (.027)	1.17	719.67
HDD7	.174 (.030)	1.19	717.45
HDD8	.191 (.033)	1.21	718.33
HDD9	.224 (.039)	1.25	717.91
HDD10	.219 (.042)	1.24	724.29

BIC=Bayesian Information Criterion

Table 3

Results for the Logistic Regression Parametric Specification

	Odds of Alcohol-Related Injury (Males)		
Effect	**Point Estimate**	**95% Wald Confidence Limits**	**P-value**
Age=18 years (reference)	.	.	.
Age=19 years	1.479	0.638 – 3.427	0.361
Age=20 years	1.072	0.444 – 2.592	0.877
Age=21 years	1.717	0.741 – 3.980	0.207
Age=22 years	1.199	0.462 – 3.109	0.709
Age=23 years	1.611	0.542 – 4.790	0.391
Age=24 years	0.753	0.145 – 3.903	0.735
Age=25 or more years	0.352	0.104 – 1.197	0.095
Large Midwestern university	1.473	0.678 – 3.203	0.328
Large Pacific Northwest university	1.513	0.666 – 3.437	0.323
Small Midwestern university #1	0.696	0.258 – 1.877	0.474
Small Midwestern university #2	1.146	0.443 – 2.965	0.778
Canadian university (reference)	.	.	.
White	0.710	0.283 – 1.780	0.465
Hispanic	0.651	0.198 – 2.143	0.480
Asian	1.037	0.310 – 3.462	0.953
Other race (reference)	.	.	.
Body weight (per 10 pounds)	0.967	0.889 – 1.051	0.424
Sensation seeking	1.686	1.138 – 2.498	0.009**
Days drinking 1–4 drinks	1.002	0.943 – 1.065	0.948
Days drinking 5–7 drinks	1.026	0.935 – 1.125	0.592
Days drinking 8+drinks	1.187	1.116 – 1.262	<.001**
	Odds of Alcohol-Related Injury (Females)		
Effect	**Point Estimate**	**95% Wald Confidence Limits**	**P-value**
Age=18 years (reference)	.	.	.
Age=19 years	0.931	0.459 – 1.889	0.844
Age=20 years	0.688	0.330 – 1.433	0.317
Age=21 years	0.734	0.348 – 1.550	0.418
Age=22 years	1.070	0.495 – 2.312	0.864
Age=23 years	0.415	0.088 – 1.955	0.266
Age=24 years	0.534	0.140 – 2.031	0.357
Age=25 or more years	0.569	0.222 – 1.459	0.240
Large Midwestern university	1.310	0.606 – 2.830	0.492
Large Pacific Northwest university	1.319	0.585 – 2.974	0.504
Small Midwestern university #1	0.214	0.053 – 0.862	0.030*
Small Midwestern university #2	1.462	0.610 – 3.506	0.394
Canadian university (reference)	.	.	.
White	2.795	0.742 – 10.527	0.129

	Odds of Alcohol-Related Injury (Males)		
Effect	**Point Estimate**	**95% Wald Confidence Limits**	**P-value**
Hispanic	1.657	0.369 – 7.433	0.510
Asian	2.102	0.536 – 8.248	0.287
Other race (reference)	.	.	.
Body weight (per 10 pounds)	1.057	0.983 – 1.136	0.135
Sensation seeking	1.808	1.271 – 2.570	0.001**
Days drinking 1–3 drinks	0.947	0.884 – 1.015	0.127
Days drinking 4 drinks	0.934	0.787 – 1.108	0.434
Days drinking 5+drinks	1.096	1.035 – 1.161	0.002**

* p<.05

** p<.01