COLLEGE STUDENT BINGE DRINKING AND THE “PREVENTION PARADOX”: IMPLICATIONS FOR PREVENTION AND HARM REDUCTION*

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ABSTRACT

Considerable attention has been paid to heavy episodic or “binge” drinking among college youth in the United States. Despite widespread use, the binge measure is perceived by some as a low intervention threshold. We use data from the Harvard School of Public Health College Alcohol Study (n = 49,163) to describe patterns of consumption and harms along a continuum including the binge measure to demonstrate the validity of the binge threshold and prevention paradox in college. While the heaviest drinkers are at greatest risk for harm, they are relatively few and generate proportionately small amounts of all drinking-harms. The risk of harms is not zero among lower level drinkers in college. Because they are numerous, they account for the majority of harms. This paradoxical pattern suggests we moderate consumption among the majority using environmental approaches, the efficacy of which are described using case study data from a national prevention demonstration. Implications for prevention policy, programming, and media advocacy are discussed.

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INTRODUCTION

The problem of heavy episodic or “binge” drinking among young adults in college in the United States has received considerable attention from researchers, college administrators, substance abuse educators, students, parents, politicians, and the media [1]. Defined as 5/4 consecutive drinks among men/women at least once in the two weeks prior to be surveyed, binge drinking occurs among two out of every five U.S. college students, half of whom did so multiple times [2]. Binge drinking may typify consumption among other populations of drinkers in the United States as well [3].

Despite its common use and its stability in repeated national surveys [1, 4], the binge measure is controversial. Some think that the 5/4 drinking measure is too low a threshold on which to base preventive interventions [5, 6]. This perspective may reflect a belief that heavy drinking among youth is a normal expression of experimentation and development and that chronic effects of long-term alcohol use and diagnosable alcoholism are more salient consequences, which college students are likely to avoid when they reduce their consumption after leaving college [7]. This perspective is not supported by recent longitudinal study [8].

Attempts to address problems associated with the heavy drinking of college students have employed a variety of methods, including increased punitive sanctions, expedited judicial process, and counseling and treatment for problem drinkers [9]. Social marketing strategies that promote a latent healthy drinking norm in hopes that it will encourage students to reduce their own consumption have also become popular, although the empirical evidence for these programs is mixed [10-12].

No major shifts in the prevalence of alcohol-related problems among college students have been noted during the 1990s [1, 2]. Both traditional and newer approaches have attempted to intervene among drinkers deemed at “high risk” for alcohol-related problems based on self-reported consumption patterns or harms. These high-risk or secondary prevention efforts which often rely on screening, counseling, and brief interventions, hold a great deal of appeal for university administrators, health professionals, and interested activists. At the same time, students who are considered to be normal and not at high-risk are not targeted by interventions that may potentially limit their consumption. Unfortunately, little evidence exists to support the efficacy of high-risk approaches [13]. Very few students perceive that they have a problem with alcohol and even fewer voluntarily present to a passive health care system for alcohol treatment or help [1]. Increased emphasis on screening and the development of screening tools to identify problem drinkers have largely been unsuccessful [13], a difficulty associated with use of a screening approach and not this health problem or population [14, 15]. Within the college setting and population, high-risk students typically come to the attention of authorities such as the Office for Student Affairs or the local police department. Individual motivation to stop drinking is low.
among college student drinkers [16, 17], and lasting change is difficult to attain in the face of underlying environmental conditions that promote alcohol use in this population, such as a saturation of alcohol outlets in some college environments [18, 19] and targeted marketing practices [20].

One strategy that has received less attention in college health prevention is the population approach, which looks at the entire population rather than focusing solely on the members of that group whose behavior is the most extreme [21]. This view acknowledges that risk is distributed throughout the entire population and deviance in the group is directly related to the prevailing normative behavior in the population. Interventions to reduce problem behaviors thus focus on the community and are directed at producing incremental change throughout a population, rather than wholesale change among subgroups with extreme behavior patterns.

Population approaches that address alcohol have demonstrated effectiveness in reducing the problems that result from alcohol consumption [22-24]. Decreasing availability of alcohol to underage drinkers, raising alcohol taxes and prices, instituting mandatory responsible beverage service, and changing the conditions of availability by limiting outlets are examples of specific population-based approaches that appear effective at reducing consumption and harms. These interventions influence all members of a population and result in incremental change at the individual level, yielding large public health benefits.

The observation underlying population approaches to prevention is the “prevention paradox” [21, 25]. This phenomenon is observed for a range of health areas including alcohol, tobacco, obesity and injury [15, 26]. It is observed when a large number of people at small risk contribute more cases of a disease or negative health outcome in a population than do a small number of people at large risk. Researchers in the United States and internationally have demonstrated the importance of this perspective for alcohol using large representative data sets for a variety of negative alcohol related outcomes [27-31].

A major implication of the preventive paradox, when it is used to shape prevention strategies, is that there may be substantial benefits to the community from these approaches but relatively small gains to specific individuals. As a consequence, these types of prevention strategies may be both controversial—by seeking to incrementally change the behavior of a majority who may correctly perceive they are at low individual risk of harm—and counterintuitive—by investing prevention resources and attention toward changing the upstream determinants of behaviors that may appear benign individually while seemingly ignoring the easily identified problems of persons with more acute symptoms or disease. For these reasons, it may be important to demonstrate both the validity of the prevention paradox through examining interrelationships of consumption and harms, and the impacts of prevention program models that take their cue from its logic. The “A Matter of Degree” (AMOD) program is a community-based prevention demonstration that is guided by the prevention paradox and uses a
population prevention approach [32]. Funded by the Robert Wood Johnson Foundation, the goal of the AMOD program is to produce sustained reductions in alcohol consumption and harms among college students by addressing features of the college environment that promote heavy and harmful consumption. These include factors related to alcohol’s accessibility and availability, marketing, promotion and pricing.

In this article we use aggregated data from four national cycles of the Harvard School of Public Health College Alcohol Study (CAS) conducted in 1993, 1997, 1999, and 2001 to examine whether the prevention paradox can be observed for alcohol consumption and related harms among college students. By describing the balance of harms according to drinking levels in the population we aim to identify targets and strategies for intervention efforts that would yield the greatest population or public health benefit. We also use case study data to describe how environmental prevention programs that are consistent with strategies suggested by the prevention paradox may be reducing harms in select college communities participating in the “A Matter of Degree” (AMOD) program. Findings are discussed in the context of their significance for policy, programming, and media advocacy efforts.

METHODS

The Survey

The study is based on student reports about drinking behaviors and harms collected through the Harvard School of Public Health College Alcohol Study (CAS). The CAS is a national survey program that describes patterns of alcohol and drug use and other health risk behaviors among a representative sample of young adults in college. CAS data are collected using a 20-page anonymous mailed questionnaire administered to students enrolled in a representative sample of four-year postsecondary institutions in the United States. The CAS has ongoing approval from the Harvard School of Public Health Human Subject Committee for analysis of the data. This study used aggregated panel data from the 1993, 1997, 1999, and 2001 College Alcohol Study. In all four surveys, the administrators at each college were asked to provide a random sample of approximately 225 undergraduates drawn from the total enrollment of full-time students. Further details about the sampling, design and characteristics of the CAS have been published elsewhere [1, 16, 33, 34].

Measures

We selected four measures of alcohol consumption that represent a continuum of consumption behaviors and five measures of alcohol-related harms that represent salient self-reported problems to the population and setting. We examined the
usual number of drinks consumed on a drinking occasion during the past 30 days (responses ranged from one to nine or more), number of drinking occasions in the past 30 days (responses ranged from 1 to 20 or more), number of occasions where the respondent drank enough to become drunk (i.e., unsteady, dizzy, or sick to your stomach) (responses ranged from 1 to 20 or more), and number of drinks consumed in the past 30 days. These data were transformed into categories for analysis.

We selected five measures of alcohol-related harms from the 15 measures collected in the CAS. Measures were selected as exemplary and for salience. Other measures of harm showed similar distributions of risk throughout the college student population and are summarized in the results section for brevity and efficiency.

The harms were self-reported experience of adverse consequences of drinking at least one time since the beginning of the school year due to student’s own alcohol use. Subjects were asked to respond to the following question: “Since the beginning of the school year, how often has your drinking caused you to . . . ?” A list of consequences from drinking were provided, which are described in greater detail elsewhere [1]. The selected measures were: 1) fell behind in school work; 2) did not use protection during sex; 3) damaged property (vandalism); and 4) got hurt or injured. An aggregate measure of five or more harms is also reported that draws from the full set alcohol-related problems from the CAS survey. In addition to the above listed harms, the full set includes self-report of: miss a class; do something later regretted; forget where you were/what you did; argue with friends; engage in unplanned sexual activity; get into trouble with the campus or local police; require medical treatment for an alcohol overdose; and among those who drove a vehicle in the past 30 days, driving after drinking.

Since each of these questions were asked for drinkers only, we identified all respondents who reported that they abstained from using alcohol using a separate survey question and assigned a value of zero. We did this to include those students who did not consume alcohol in the population of all college students for this analysis.

Students with missing data on any of these variables of interest for this manuscript were deleted from the analysis, resulting in a sample size of 49,163 across the four national survey samples. No differences in the relationship between consumption and experience of harm were observed by survey year.

Case Study Data

This report also draws on case study data about the “A Matter of Degree” (AMOD) program to reduce binge drinking and harms in college. Ten CAS schools are participating in AMOD, which tests the efficacy of environmental prevention programs. AMOD schools were selected because of their high levels (>50%) of binge drinking and their commitment to testing environmental
strategies to reduce heavy drinking and harms. As part of a comprehensive evaluation of AMOD being conducted by HSPH investigators, all preventive interventions are described and characterized formally at each site and compared over time to a time series of that site’s CAS data. Trained on-site evaluators at each site characterize interventions by: chronology, purpose/objective, strategy and methods, target groups, resources, barriers and facilitators. Intervention-related data are collected using participant observation, one-on-one interviewing with key program personnel, and document review (i.e., quarterly reports, minutes, and other program communications). All intervention-related data are stored in a standardized tracking database after they are coded using a uniform observation protocol developed by the evaluation. The tracking database is then combined with CAS reports about alcohol-related beliefs and behaviors, including harms.

CAS data are collected from an expanded sample of students \((n = 750)\) at each AMOD site on an annual basis to generate a complete program time series. Detailed methods about the evaluation are published elsewhere \([32, 35]\).

Within each AMOD site, intervention and CAS data are compared over time to assess the impact on student drinking beliefs and behaviors of the range of prevention activities undertaken. Aggregate and subgroups analyses are conducted. Tests for trends in each site’s CAS data are conducted using student data adjusted for age, sex and race. Point estimates and 95% confidence intervals are generated for each time series measure. This report describes significant behavioral trends and related harms within given settings that were targets of specific environmental intervention initiatives at two exemplary sites. This approach is consistent with methodology in case study research \([36, 37]\).

### Data Analysis

Cross-tabulation analyses of experience of each alcohol-related harm with each of the four measures of alcohol consumption were conducted. The percentage of students who experienced the harm at each level of alcohol consumption was considered the risk of experiencing that harm at the population level. The total percent of students (the number of students per level divided by the total number of students) at each drinking level was the percentage of students in the population.

We selected the measure being hurt or injured to demonstrate the relationship of harms to several measures of alcohol consumption (Figure 1, parts a-d) and we selected the measure of usual number of drinks consumed when drinking to examine the relationship of consumption to multiple measures of harms (Figure 2, parts a-e). These measures were exemplary and representative of the consumption and harms relationship. Additional analyses are available upon request from the authors.

Logistic regression models were fit to examine the consumption-harm relationship using the aggregate national survey data. We modeled all of the 12 alcohol-related harm measures, plus the measure driving after five or more drinks and an
aggregate measure of five or more of these harms with each of the three alcohol consumption measures. Additionally a spearman rho correlation coefficient was calculated to examine the relationship between each of the alcohol consumption measures. The change in alcohol related harms at the exemplary AMOD sites was examined using logistic regression.

Figure 1. Individual risk of being hurt or injured from one’s own drinking overlaid on population distribution of this harm by four consumption measures.
All analyses were conducted using SAS version 8.2 [38] on the Unix platform. Consistent with other analyses of multiple year CAS data [1, 35], the data sets were directly standardized for age, sex, and race to a single survey year to ensure valid aggregation and longitudinal assessment.
Figure 2. Percentage of students reporting specific drinking-related harms by usual number of drinks per drinking occasion in the past 30 days.
Figure 2. (Cont’d.)

C. Vandalized others property
(8.4% of all students)

D. Got Hurt or Injured
(9.8% of all students)

E. Experienced Five or more Problems
(16.8% of all students)
RESULTS

Consumption and Harms

Individual reports of drinking-related harms increased as level of consumption increased for multiple measures of drinking style.

Figure 1.a displays the relationship between self-report of being hurt or injured across usual number of drinks consumed when drinking. Figure 1.b shows this same relationship for being hurt or injured and the number of drinking occasions in the past 30 days. Figure 1.c shows the same relationship between being hurt or injured and the number of drunken occasions in the past 30 days. Figure 1.d shows the same relationship for the number of drinks consumed in the past 30 days.

These results are exemplary of the consumption-harms relationship. For all 12 of the harms, driving after five or more drinks and the five or more aggregate harm measure, we found a significant linear relationship ($p < .0001$ for every tested relationship) with each of the alcohol consumption measures using logistic regression. For the usual number of drinks per occasion (modeled as a continuous variable with 10 categories, min = 0, max = 9 or more) the slope for each of the harms ranged from 0.28 to 0.75 (0.40 for being hurt or injured). For number of drinking occasions in the past 30 days (modeled as a continuous variable with six categories, min = 0 times, max = 20 or more times) the slope for each of the harms ranged from 0.51 to 1.26 (0.73 for being hurt or injured). For the number of drunken occasions in the past 30 days (modeled as a continuous variable with six categories, min = 0 times, max = 20 or more times) the slope for each of the harms ranged from 0.68 to 1.91 (0.85 for being hurt or injured). Finally, for the total number of drinks consumed in the past 30 days (modeled as a continuous variable, min = 0 drinks, max = 360 drinks) the slope for each of the harms ranged from 0.01 to 0.08 (0.02 for being hurt or injured).

The similarity of results by consumption measure is not surprising given the very high correlations between the measures of alcohol consumption. The usual number of drinks on a drinking occasion was strongly correlated with drinking occasions ($\rho = 0.71; p < .0001$), drunken occasions ($\rho = 0.72; p < .0001$), and number of drinks in the past 30 days ($\rho = 0.88; p < .0001$). Similarly, drinking occasions was correlated with drunken occasions ($\rho = 0.70; p < .0001$) and number of drinks in the past 30 days ($\rho = 0.94; p < .0001$), as was drunken occasions with number of drinks in the past 30 days ($\rho = 0.77; p < .0001$).

Despite this relationship of increasing risk with increasing alcohol consumption, there were very few students who consumed alcohol at the highest levels in these distributions. The majority of harms at the population level occurred among drinkers consuming at a less extreme level, as evident by the population patterns of consumption. This results from the larger percentage of students...
overall who drank at a level associated with a lower, but non-zero, level of risk. The percentage of students who experienced a given alcohol-related harm at each level of alcohol consumption is illustrated by the pie charts shown in Figure 2 parts a-e.

**Shifting Drinking Distributions and Reducing Harms at AMOD Sites: Two Case Studies**

Consumption shifted downward incrementally at several AMOD sites as indicated by time series analyses of two sites’ student samples adjusted for age, sex, and race. Larger proportions of students consumed fewer drinks per drinking occasion and/or on fewer occasions when we looked at student self-reports about consumption in off-campus and Greek-house party settings. Sites with substantial downward shifts in consumption among students attending these events reported declines in harms among these same groups, as predicted by the prevention paradox (Figures 3.a–b., and 4.a–b.). Patterns of declining consumption and harms are consistent with preventive interventions undertaken at these sites that target the upstream determinants of drinking. At site A, where we described moderation of off-campus consumption and declines in related harms, interventions included: increased enforcement and sanctions in judicial system; new standards for Greek systems students; parental notification practices to inform parents of students’ illegal behaviors; an increase in substance-free residence halls; mandatory beverage server training; making minor-in-possession a civil not criminal offense; and an off-campus accountability project with compliance and keg checks at liquor licensees. At site B, where we described moderation in Greek-party consumption and declines in related harms, interventions included: institutionalization of a uniform police reporting form; prohibitions of alcohol advertisements in campus publications; landlord ordinances to promote responsible rental practices to youth; institutionalization of a two-strikes and suspension behavioral code; off-campus transportation events policy; parental notification; party host rules (to discourage supply of alcohol to underage students); and a freshman sanction policy to strengthen policy enforcement. All of these changes focused on restricting access and availability of alcohol to youth, limiting advertising about alcohol to youth, and increasing the linkages among authorities that supervise youth.

**DISCUSSION**

Our analyses of national survey data show that the bulk of drinking-related harms reported by college students accrue to drinkers who consume at non-extreme levels, the groups some might consider to be at less than “high-risk.” While we found that a given individual’s risk for experiencing harms increases with consumption, most drinkers do not consume extreme amounts of alcohol.
Figure 3. Moderation of consumption at off-campus parties and concomitant moderation in harms among drinking youth at those events over time.
Figure 4. Moderation of consumption at Greek parties and concomitant moderation in harms among drinking youth at those events over time.
Rather, the abundance of drinking-related harms in college results from a combination of low to moderate individual risk multiplied by the large number of non-extreme drinkers. This pattern held in national analyses of CAS data across multiple consumption measures and in analyses of survey data from each of ten high binge schools participating in the “A Matter of Degree” program. The reported consumption-harms relationship is consistent with predictions of the prevention paradox.

Our finding suggests that, from a public health perspective, targeting the entire population, including non-extreme drinkers, using environmental prevention strategies is both logical and likely to yield substantial community-wide reductions in harm. In addition to having the greatest public health benefit, encouraging small reductions in consumption among the majority of drinkers may be more feasible for prevention practitioners in college than the goal of dramatically changing consumption among frequent heavy drinkers. The latter may have longstanding patterns of frequent heavy drinking that require intensive individual efforts and/or treatment from clinicians.

**The Promise of Environmental Strategies**

Case study analyses of the AMOD demonstration data indicate that: a) designing and implementing environmental interventions even in high prevalence communities is possible; and b) downward shifts in consumption appear to be associated with downward shifts in harms, as predicted by theory. In particular, it appears that environmental strategies to alter access and availability and increase linkages among supervisory agents hold promise for harm reduction in the college setting, as suggested by other studies [19, 39, 40].

These analyses are not experimental, and do not completely rule out alternative hypotheses about a causal relationship between intervention and outcome. However, they do provide a longitudinal perspective in the context of known intervention activity. Further, they are consistent with theory and suggest a plausible mechanism through which change in patterns of harm can occur. Additional research using quasi-experimental study designs of both naturally occurring and planned interventions can provide evidence about the utility of environmental approaches.

**Implications and Challenges**

This study lends support to the use of primary prevention efforts targeting low to moderate drinkers to achieve maximum alcohol-related harm reduction. Drinkers consuming at or below a binge level may best be reached by prevention that targets for change environmental influences (such as outlet density, price, and advertising) while more extreme drinkers may best be reached using individually based secondary or tertiary (treatment-related) approaches. In all likelihood, shifting the distribution of drinking and harms will require a range
of strategies—including ones characteristic of environmental prevention. Ultimately, we need to become more sophisticated in crafting and targeting prevention efforts so that the field moves away from the misconception that “one size fits all” when designing prevention programs.

There are several challenges to creating more rational and environmentally-based prevention programs. The first challenge reflects the need for data resources. A rational approach generally requires good surveillance data in order to match problems to strategies and to monitor change. Investment in epidemiological surveillance may be important for addressing these problems. A second challenge relates to changing public perceptions about the nature of the alcohol abuse problem and its likely solutions. Our findings about the relationship between consumption and harms at the community level may be contrary to conceptions of the problem and its solution held by the lay public and policy makers. If communities think that the bulk of alcohol abuse problems comes from the small number of extreme drinkers (with their highly visible drinking problems), then education about the actual distribution of harms by consumption may an be important step in building support for prevention efforts that focus on the majority. Targets for education would include both the lay public and policymakers since the support of both groups is required to design, enact and sustain environmental prevention efforts. This type of media advocacy effort around alcohol [41-43] is different from the strategy of the social norms approach that has gained popularity in the prevention community. Efforts to change social norms about drinking recently have been based on efforts to correct students’ misperceptions about the drinking levels of other students, to encourage the adoption of moderate drinking norms. While popular, these efforts have not been effective in changing behaviors [10]. Rather, our analyses suggest a two-pronged approach to prevention. First, use media advocacy to explain the links between low levels of consumption and harms and promote harm reduction. To the best of our knowledge, no comprehensive effort has been made to educate the public or policy makers about the relationship between consumption and harms from the perspective of the prevention paradox. Second, use policy controls to limit access to and availability of alcohol to incrementally shift consumption toward lower average levels.

A third challenge relates to generating the political will and wherewithal to implement environmental changes to reduce harms. Within AMOD, efforts to target individual drinkers using traditional information-based approaches met with little resistance but appeared to produce few or no results [35]. However enacting environmental changes at the demonstration sites, including changes to patterns of pricing and promotion of alcohol, met with considerable resistance, including aggressive efforts from the alcohol industry [18, 32]. Being able to generate and sustain the political will be necessary to change the environment to reduce harms may require both a well educated public and policy sector, as well as time and other resources.
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