Reducing Drinking and Related Harms in College
Evaluation of the "A Matter of Degree" Program

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Objectives: To examine the effects of a multisite environmental prevention initiative, the "A Matter of Degree" (AMOD) program, on student heavy alcohol consumption and resultant harms at ten colleges.

Methods: A quasi-experimental longitudinal analysis of alcohol consumption and harms was employed, using repeated cross-sectional survey data from the Harvard School of Public Health College Alcohol Study (CAS). Areas examined included seven measures of alcohol consumption, thirteen measures of alcohol-related harms, and eight measures of secondhand effects of alcohol use by others. Comparisons were conducted on self-reported behavior of students for the ten AMOD sites in aggregate and by level of program implementation, with students at 32 comparison colleges in the CAS, for each outcome.

Results: No statistically significant change was found in the overall ten-school AMOD program for outcome measures of interest from baseline (1997) to follow-up (2001). However, there was variation in the degree of environmental program development within AMOD during the intervention period. A pattern of statistically significant decreases in alcohol consumption, alcohol-related harms, and secondhand effects was observed, reflecting minor to more substantial changes across measures among students at the five program colleges that most closely implemented the AMOD model of environmental change. No similar pattern was observed for the low implementation sites or at 32 comparison colleges.

Conclusions: While there was no change in the ten AMOD schools in study measures, significant although small improvements in alcohol consumption and related harms at colleges were observed among students at the five AMOD sites that most closely implemented the environmental model. Fidelity to a program model conceptualized around changing alcohol-related policies, marketing, and promotions may reduce college student alcohol consumption and related harms. Further research is needed over the full course of the AMOD program to identify critical intervention components and elucidate pathways by which effects are realized.
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Introduction

Misuse of alcohol is a major social and health issue for colleges in the United States.[1–5] Significant attention has been paid to college student drinking over the past decade, but little has changed since the early 1990s.[1–2] In 1993, the Harvard School of Public Health College Alcohol Study (CAS) found that rates of binge drinking and related harms vary widely across colleges (e.g., binge drinking rates ranging from 0% to 78%),[6] yet these rates were remarkably stable within colleges over time.[1]

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This finding suggests that powerful contextual forces operate on student drinking habits. To date, most campus-based prevention efforts use educational and counseling programs to target the drinker.[7,8] Although implementation of these approaches is widespread, few have been evaluated rigorously and there is little scientific evidence that these programs are effective.[9–12]

Emerging evidence indicates the importance of environmental determinants of heavy alcohol use,[13–17] and suggests a broader selection of prevention strategies for addressing college student drinking.[5,18–25] Effective program models might combine individually focused strategies with ones that address the environment,[26,27] such as enforcement of minimum drinking-age laws; limiting access to low-cost, high-volume drink specials, advertising of alcohol to youth, the proliferation of alcohol outlets; and instituting responsible beverage service training.[28–37] These approaches are

effective prevention measures when implemented in the general population and are recommended for addressing college student drinking.[5,18]

The "A Matter of Degree" (AMOD) program, developed and funded by the Robert Wood Johnson Foundation (RWJF) with programmatic support from the American Medical Association, is a coalition-based approach that brings campuses and communities together to change environments that promote heavy alcohol consumption. The community coalition model holds promise for addressing a wide range of social problems.[38] Previous efforts at community-based prevention have demonstrated effectiveness in reducing consumption and alcohol-related harms,[32,39–41] and may be particularly appropriate in addressing college drinking.[42,43]

This paper reports the results from the AMOD program evaluation. Two important research questions about the program are addressed: (1) Can AMOD program sites implement environmentally based interventions to address student alcohol use? (2) Are environmentally based preventive interventions associated with reductions in student drinking, drinking-related harms, and reports of secondhand effects of alcohol? We hypothesized that AMOD sites would experience reductions in alcohol consumption and harms over the program period, and that these positive changes would be greater than those observed in a set of comparison sites from the national CAS.[1,6,44,45] In addition, we hypothesized that, within the AMOD program, sites with greater environmental prevention emphasis would realize the greatest changes.

Methods
Definition of Intervention Sites

Ten AMOD college sites were identified from the first national CAS sample.[5] The national CAS sample was divided into tertiles reflecting low (<36%), moderate (36% to 50%), and high (>50%) binge prevalence levels.[6] Colleges that fell within the high binge group and expressed commitment to implementing environmental changes were invited to submit a proposal to RWJF for consideration as an intervention site in fall 1996. Sites were selected on the basis of high binge drinking rates in the 1993 survey and willingness by the college presidents to give high priority to the intervention program. All of the colleges participating agreed to form a college-community coalition and to undertake environmental strategies in responding to heavy drinking by students.

Of the 11 schools asked to apply for grants under the AMOD program, ten did so, and all were accepted into the program. Six sites made up the first cohort of the AMOD program, and four additional sites were selected in 1997. Sites were funded for a year at the outset of the program to begin forming coalitions of stakeholders from the campus and the community and to start the planning process for their activities. Intervention activities began 1 to 2 years following the initial award of the grants.

Definition of Comparison Sites

The remainder of the high binge colleges that participated in subsequent CAS surveys in 1997, 1999, and 2001 ($n = 32$) served as comparison sites to track secular change on the same outcome measures.[46]

Measuring Program Implementation and Environmental Programming

The evaluation was guided by a program logic model that forecast change at three levels of outcome.[43] Program intervention efforts were expected to alter alcohol-related access and availability, price, promotions, and advertising to produce changes in alcohol-related policies and practices (level 1), alcohol availability and norms (level 2), and high-risk drinking and related harms (level 3). The AMOD logic model (Harvard School of Public Health, "A Matter of Degree" Program Evaluation, available at *www.hsph.harvard-.edu/amod/logicmod.html*) reflects a systems view of behavior, in which drinking-related norms and behaviors result from interactions over time and space between individuals and their environments.[47,48] While the logic model proposes a sequential ordering of outcomes as the primary direction of effect, reciprocal effects among outcomes may occur (e.g., shifts in norms about the acceptability of alcohol abuse may precede policy or program development).

The AMOD is a demonstration program.[49] Demonstration programs often require the development of specialized implementation measures to prospectively track implemented interventions to characterize the natural process of community change.[49–53] The AMOD evaluation team included a team of trained local (field) evaluators, who served as participant observers of coalition activities and were staffed from the AMOD site communities (i.e., they lived and worked at the sites). These team members observed coalition activities, interviewed key members of the program staff, and reviewed local documents and communications to comprehensively and prospectively track coalition activities and interventions. Field staff submitted standardized descriptions of implemented interventions from 1997 to 2001 to the national evaluation office using a formal protocol and theory-based intervention categorization system rooted in the public health model of agent/host/environment.[26,54] This model, when applied to alcohol abuse prevention, defines features of the beverage alcohol (price, composition, labeling, packaging), characteristics of the individual drinker (knowledge, attitudes, intentions, skills), and the environmental context within which both the alcohol and the individual drinker exist (advertising/promotion, availability, physical context, sociocultural context, legal sanctions, key influencers, and institutions).

Subsequently, a primary reader at the national office reviewed field reports and confirmed the coding of each discrete intervention, after which a team of secondary readers reviewed the reports against the original submitted descrip-

tions, and raised questions about coding, interpretation, and labeling. Final codification of program elements was achieved by the consensus of multiple readers.[49]

Once all data were coded and summarized, a debriefing with site staff was conducted to ensure reliability, transparency, and feedback of process data. The extent of program implementation was determined by tallying the number of discrete interventions that were implemented at each site within program areas. Sites were ranked according to the number of implemented environmental interventions and then divided into two groups: high and low environmental programming. The site rankings were developed prior to conducting the outcome analyses in conjunction with regular feedback of information to the sites.

Study Measures

The survey. The AMOD program evaluation used the CAS survey, a 20-page mailed questionnaire that asks questions about students' alcohol use and associated problems, and background characteristics. The CAS was first administered in 1993 using a standard set of questions adapted from other large-scale surveys.[55,56]

Procedure. An administrator at each school provided a list of randomly selected, full-time undergraduate students enrolled during each survey year. Comparison schools sampled 225 students, and AMOD program schools sampled 750 students during the years enrolled in the program. Program participant schools were surveyed annually between February and April, while comparison schools were surveyed in 1997, 1999, and 2001 only. A subcontractor conducted the questionnaire administration and delivered final data sets for analysis. Further details on the CAS survey procedures and sampling plan are provided elsewhere.[1,6,44,45]

Outcome measurement. Multiple outcome measures were employed in three categories: alcohol consumption, alcohol-related harms, and secondhand effects of alcohol consumption by others.[1,6,44,45] The following seven measures of consumption were used.

1. any alcohol use in the past year,
2. binge drinking, defined as five or more (for men) or four or more (for women) drinks per drinking occasion at least once in the past 2 weeks,
3. frequent binge drinking, defined as binging on three or more occasions in the past 2 weeks, and
4. uptake of binge drinking in college (defined as binging among students who did not typically binge drink in their last year of high school).

For students who had at least one drink in the past month

5. consumption on ten or more occasions in the past 30 days,
6. experiencing intoxication three or more times in the past month, and
7. usually consuming at or above a binge level when drinking in the past month.

Eleven items were used to measure students' experiences of educational, interpersonal, health, or safety problems attributable to their own drinking since the beginning of the school year, and these questions were analyzed only for students who drank alcohol in the past year. Problems ranged

from a hangover or missing a class, to more serious problems such as getting in trouble with the police or receiving medical treatment for an alcohol overdose. The number of students reporting five or more of these alcohol-related problems (excluding hangover and including driving after drinking) was examined. All students were asked whether they experienced negative consequences due to other students' drinking since the beginning of the school year (secondhand effects); these ranged from interruptions of sleep and study to verbal or physical assaults and destruction of personal property. The number of students experiencing more than three of these secondhand effects was examined.

Measuring intermediate effect. One important component of the approach adopted by the AMOD program is restricting access to alcohol. We analyzed whether this was occurring by using the survey question: How easy is it for you to obtain alcohol? Response categories were "very difficult," "difficult," "easy," and "very easy." This variable was dichotomized into "difficult" and "easy."

Data Analysis

Measuring change over time. We used a quasi-experimental design[46] and two sets of comparisons. Outcome measures were assessed for change over time for all ten AMOD colleges compared to 32 referent colleges. The AMOD sites were then disaggregated into two groups: those with high program implementation ($n=5$), and those with a low program implementation ($n=5$). The ten sites were then analyzed over time simultaneously in comparison to the referent colleges.

The prevalence rate point estimate at each college was estimated by aggregating individual responses after removing the missing data for that outcome. Missing data comprised <5% for all outcome variables by year and <1.5% for the majority of outcomes. The marginal multivariate logistic model[57] was used to examine change in outcome prevalence rates at the college level over time and to compare change over time between intervention and referent colleges.

Two separate statistical tests were employed to analyze these data. The first was a test for trend using all data available for the 1997–2001 period. The test for trend compared the slope over time for intervention colleges and referent colleges; the associated p values from these analyses are presented. In addition, for ease of interpretation, the change from the baseline year (1997) to the end point (2001) only was analyzed. The change results for the baseline and end-point years are expressed as odds ratios with corresponding confidence intervals in subsequent text and tables.

School response rate was included as a covariate in all models to adjust for potential response bias. The percentage of students who engaged in binge drinking in high school was included as a covariate in the modeling of the alcohol consumption outcomes model to adjust for changes in the composition of each college population over time. The AMOD program cohort was included in models (where appropriate) to adjust for the staggered nature of entry into the program. All analyses were conducted using SAS version 8.2 (SAS Institute, Cary NC, 1994) on the Unix platform.

Weighting and standardization. Comparisons were performed over time using a direct standardization procedure to protect against falsely attributing change on outcome mea-

Table 1. Demographic characteristics of AMOD program and comparison sites at baseline

Demographic characteristic	AMOD program (n = 10)	Comparison sites (n = 32)	p value[a]
Public university	9	22	0.2451
Commuter school	0	0	
Region			
Northeast	2	11	0.4103
South	4	7	0.4658
Northcentral	3	13	0.7152
West	1	1	0.4239
Enrollment ≥10,000 students	8	18	0.2696
Admissions competitiveness (Baron's rating)			
Noncompetitive	0	7	0.1683
Competitive	4	14	1.0000
Very	4	8	0.4331
Most	2	3	0.5773
Location			
Suburban/urban	7	13	0.1520
Small town/rural	3	19	
NCAA Division 1 athletics	10	20	**0.0400***
Binge drinking rate	59.0% (8.1)[b]	51.4% (9.4)[b]	**0.0237[c]***
Greek students	21.1% (12.7)[b]	15.4% (9.6)[b]	0.2729[c]

[a]Fischer's exact test, except where noted.
[b]Mean prevalence (standard deviation).
[c]Wilcoxon–Mann–Whitney test p value.
*Significant at 0.05 level (bolded).
AMOD, A Matter of Degree; NCAA, National Collegiate Athletic Association.

sures to changes in demographic characteristics. The standardization procedure used eight strata (i.e., gender by two age groups—<22 vs other—and two ethnic groups—white vs other) of each school's underlying demographic characteristic at baseline as a reference. No school in the AMOD program intentionally altered their admissions practices to address problem drinking. With the assumption that college demographic characteristics remained constant, the potential selection bias in the prevalence rate of each outcome measure was reduced for all survey years and can reliably interpret changes over time. All analyses used weighted data only.

Findings
Site Characteristics

The AMOD program and comparison sites reflect a diversity of demographic characteristics (Table 1). Program and comparison sites did not differ except with regard to National Collegiate Athletic Association Division 1 athletics programs. The AMOD sites also differed from comparison colleges in their binge drinking rate and response rate to the survey, although the absolute difference was small. There was no change in the rate of binge drinking while the students were in high school in the comparison colleges during the study period (adjusted odds ratio [AOR]=0.91, 95% confidence interval [CI]=0.82–1.0, test for trend p =0.1690), while the low environment sites declined significantly (AOR=0.82, 95% CI=0.68–0.99, test for trend p =0.0351). High school binge drinking rates over time at the high environment sites did not differ significantly

from the comparison sites (AOR=0.89, 95% CI=0.73–1.07, test for trend p =0.2266).

Program Implementation

High and low environment status was based on the distribution of efforts across the entire program. High (n=5) and low (n=5) environment sites within the AMOD program differed substantially in the extent of program implementation, independent of program cohort (i.e., AMOD cohorts were equally distributed in the high and low environment groups), and the demarcation between high and low environmental change sites was also independent of program cohort. High environment sites had substantially more implemented interventions (188 vs 67) and interventions that addressed the environment (158 vs 46) than low environment sites, while the difference between these groups of sites was less pronounced with regard to interventions targeting the individual (30 vs 21). A summary of interventions by category from this theoretical model for the high and low environment sites and examples within each category is provided in Table 2.

Intermediate Effects on Ease of Obtaining Alcohol

Categorization of sites into high and low environmental change groups was validated against student reports about ease of obtaining alcohol, a measure of intermediate program effect, over the intervention period. Students at high environment AMOD colleges reported

Table 2. Environmental interventions implemented in high and low implementation sites in the "A Matter of Degree" program by category

| Type of intervention | Interventions implemented | | Examples of interventions |
	High environment sites	Low environment sites	
Availability	26	5	Keg registration
			Mandatory responsible beverage service training
			Curbs on selling alcohol without a license
			Overservice enforcement
Legal sanction	21	4	Restrictive policy for Greek students
			Campus–community police collaboration on wild party enforcement
			Increasing penalties and sanctioning policies
Physical context	8	2	Substance-free residence halls
			Enforcement of bar capacity
			Outreach and education to student landlords
Advertising and promotion	7	4	Ban on alcohol ads in student newspapers
			Ban on alcohol-related items in the student bookstore
			Ban on alcohol advertising in the athletic department
Key influencers	16	8	Parental notification policy
			Staffed and trained peer intervention teams
			Increased outreach to faculty
Sociocultural context	79	23	Alcohol-free programming
			Letter-writing campaign
			Faculty senate resolution

higher rates of difficulty obtaining alcohol over time (7.8 in 1997 and 10.4 in 2001, AOR=1.58, 95% CI=1.16–2.16 for 2001 compared with 1997, test for trend $p =0.0016$), while the low environment sites did not differ (10.4 in 1997 and 10.8 in 2001, AOR=1.29, 95% CI=0.96–1.74 for 2001 compared with 1997, test for trend $p =0.0787$) from the change in the comparison colleges (10.8 in 1997 and 10.4 in 2001, AOR=0.94, 95% CI=0.81–1.10 for 2001 compared with 1997, test for trend $p =0.3729$).

Behavioral Effects

Alcohol consumption. No pattern of significant change was observed over time when the ten AMOD schools were compared to the 32 referent colleges for any of the alcohol consumption outcome measures; for any alcohol use in the past year (AOR=0.96, 95% CI=0.75–1.23, test for trend $p=0.2235$); binge drinking (AOR=0.99, 95% CI=0.84–1.15, test for trend $p =0.6179$); frequent binge drinking (AOR=0.87, 95% CI=0.74–1.02, test for trend $p =0.0608$); taking up binge drinking in college (AOR=0.99, 95% CI=0.81–1.20, test for trend $p =0.9999$); drinking on ten or more occasions in the past 30 days (AOR=0.87, 95% CI=0.72–1.05, test for trend $p =0.2136$); drunkenness on more than three occasions in the past 30 days (AOR=0.85, 95% CI=0.72–1.01, test for trend $p =0.085$); and usually binged when drinking (AOR=1.07, 95% CI=0.90–1.28, test for trend $p =0.6448$).

When the group of sites with greatest implementation of environmental programming was examined, significant declines in six of the seven consumption outcome measures were observed over the 1997–2001 period (Table 3). The change was in contrast to either flat or increasing secular change in these measures observed over the same period at the 32 referent schools. The pattern of decreasing relative risk over time persisted when each school was systematically removed from the high intervention cohort and the models were re-estimated. This sensitivity analysis suggests that no single school drove the observed declines. No significant decrease was observed in the five low environment AMOD colleges for any alcohol consumption measure compared with the referent colleges (Table 4).

Alcohol-related harms. Considering all ten AMOD program sites in aggregate, significant declines were observed in only two of 11 alcohol-related harms over the evaluation period. There were declines in the percentage of students reporting that they missed a class due to their alcohol use (AOR=0.77, 95% CI=0.65–0.90, test for trend $p <0.0001$). Additionally, driving after consuming five or more drinks was significantly different (AOR=0.64, 95% CI=0.49–0.84, test for trend $p =0.0440$) relative to an increase over time among the comparison sites (AOR=1.28, 95% CI=1.10–1.48, test for trend $p =0.0005$). Each of the other harms related to drinking did not change significantly.

Table 3. Alcohol consumption over time at high and low environment AMOD and comparison sites

		Prevalence by year (%)					Change 1997 to 2001 % (CI)	Test for trend *p* value[a]
Consumption	Site	1997	1998	1999	2000	2001		
Any alcohol use	AMOD high environment	90.1	89.7	89.9	88.1	89.1	0.91 (0.69–1.21)	0.2235
	Low AMOD	88.5	88.3	86.9	87.5	86.6	0.77 (0.59–1.02)	0.0837
	Comparison	86.3	—	86.8	—	87.4	1.29 (1.12–1.49)	**0.0012***
Binge drinking	AMOD high environment	61.2	65.5	61.7	58.2	59.4	0.81 (0.68–0.97)	**0.0006***
	Low AMOD	59.0	57.4	56.7	53.9	54.8	0.93 (0.78–1.12)	0.2223
	Comparison	53.3	—	56.2	—	54.3	1.19 (1.08–1.32)	**0.0005***
Frequent binge drinking	AMOD high environment	34.6	41.8	35.1	32.6	34.4	0.75 (0.62–0.90)	**<0.0001***
	Low AMOD	30.7	32.1	32.5	30.7	31.3	0.90 (0.74–1.08)	0.1093
	Comparison	28.1	—	31.6	—	31.1	1.34 (1.20–1.49)	**<0.0001***
Take up binge drinking in college	AMOD high environment	45.7	51.8	44.9	42.0	42.7	0.76 (0.61–0.96)	**0.0016***
	Low AMOD	45.5	41.2	39.8	40.9	40.4	0.84 (0.68–1.05)	0.1992
	Comparison	40.6	—	42.4	—	40.9	1.00 (0.89–1.13)	0.9786
Drinks on ten or more occasions in last 30 days[b]	AMOD high environment	31.4	33.6	26.4	29.3	29.6	0.69 (0.56–0.86)	**0.0002***
	Low AMOD	28.5	27.7	27.7	29.6	29.2	0.96 (0.77–1.19)	0.6269
	Comparison	25.0	—	27.2	—	27.1	1.20 (1.06–1.37)	**0.0200****
Drunk on three or more occasions in last 30 days[b]	AMOD high environment	41.0	50.7	37.1	38.3	37.8	0.68 (0.55–0.83)	**<0.0001***
	Low AMOD	37.9	39.9	38.4	38.5	38.5	0.97 (0.79–1.19)	0.4090
	Comparison	34.1	—	37.1	—	35.1	1.17 (1.04–1.31)	**0.0129***
Usually binges when drinking	AMOD high environment	55.8	54.2	53.3	52.4	49.5	0.79 (0.64–0.97)	**0.0040***
	Low AMOD	45.6	48.2	49.2	47.0	46.8	1.12 (0.92–1.37)	0.2818
	Comparison	49.9	—	54.1	—	47.1	1.11 (0.98–1.25)	0.0677

Note: Adjusted for site survey response rate and percent of students who binge drank in high school.
[a]Among high school nonbingers only.
[b]Among those who drank in the past year only.
*Significant at 0.01 level (bolded).
**Significant at 0.05 level (bolded).
AMOD, A Matter of Degree; CI, confidence interval.

When the sites were examined according to their degree of program implementation, a significant decline was observed in nine of 11 alcohol-related harm outcomes over the evaluation period at the five high environment sites (Table 4). Over time, significantly fewer students reported that they had a hangover, missed a class, fell behind in their school work, forgot where they were or what they did, got into an argument, vandalized someone else's property, or were hurt or injured because of their drinking. In contrast, three harms declined significantly at the five low environment sites: had a hangover, missed a class, and fell behind in schoolwork. One harm—engaging in unplanned sex because of drinking—declined in the comparison schools relative to its baseline level and four increased: had a hangover, missed a class, got in trouble with the police, and drove after consuming five or more drinks.

There was no change in the percentage of drinkers who reported more than five problems related to their drinking among the ten sites in aggregate, the five low environment sites, or the 32 comparison sites. This measure declined among students at the five high environment sites (Table 4).

Alcohol-related secondhand effects. No significant changes in the report of alcohol-related secondhand effects were found at the AMOD program sites when

they were examined in aggregate. When the AMOD sites were disaggregated according to program implementation, a different pattern emerged. Among students at the five high environment AMOD sites, significant declines were observed in five out of nine alcohol-related secondhand effects (Table 5). Declines were also observed for assault, baby-sitting a drunken student, finding vomit, study or sleep interrupted, and experiencing an unwanted sexual advance. No declines in any secondhand effects were observed at the five low environment AMOD sites. Reports of three or more secondhand effects declined at the five high environment AMOD sites, while the absolute decline in aggregate secondhand effects at the five low environment AMOD sites did not differ from stable or downward shifts at the 32 comparison schools.

Discussion

Using longitudinal analyses to test for time trends, no consistent pattern of declines was found in alcohol consumption, alcohol-related harms, or secondhand effects of alcohol use in the ten sites that participated in the AMOD program. However, when these ten sites were disaggregated into two groups according to their implementation of environmentally based interven-

Table 4. Alcohol-related harms over time at high and low environment AMOD and comparison sites[a]

Harm	Site	Prevalence by year					Change 1997 to 2001 % (CI)[b]	Test for trend p value[b]
		1997	1998	1999	2000	2001		
Hangover	AMOD high environment	71.6	78.6	74.6	70.4	72.6	0.77 (0.62–0.95)	**0.0001***
	Low AMOD	74.1	73.3	70.7	68.4	69.3	0.72 (0.58–0.84)	**0.0003***
	Comparison	67.4	—	68.5	—	69.1	1.13 (1.01–1.26)	**0.0268****
Miss a class	AMOD high environment	46.6	51.4	43.1	34.2	39.5	0.60 (0.50–0.73)	**<.0001***
	Low AMOD	44.1	41.3	39.2	35.4	35.1	0.69 (0.57–0.89)	**<.0001***
	Comparison	35.6	—	35.1	—	36.2	1.09 (0.98–1.22)	0.1532
Fall behind in school	AMOD high environment	32.4	35.7	31.0	26.0	27.6	0.77 (0.62–0.94)	**0.0002***
	Low AMOD	33.5	34.0	29.5	26.1	25.3	0.75 (0.61–0.92)	**0.0001***
	Comparison	25.8	—	25.2	—	24.6	0.95 (0.84–1.07)	0.4929
Do something regretted	AMOD high environment	47.8	50.8	46.1	40.9	44.2	0.83 (0.69–1.00)	**0.0012***
	Low AMOD	40.9	43.6	44.4	40.5	39.7	0.94 (0.78–1.14)	0.4667
	Comparison	42.6	—	42.1	—	39.6	0.96 (0.87–1.07)	0.3017
Forgot where they were	AMOD high environment	39.2	45.5	37.3	35.5	34.2	0.77 (0.63–0.93)	**0.0001***
	Low AMOD	33.9	38.7	36.4	32.1	34.7	1.05 (0.87–1.28)	0.3341
	Comparison	33.0	—	34.1	—	30.4	0.94 (0.85–1.05)	0.3293
Got into an argument	AMOD high environment	31.3	32.6	28.7	24.4	26.2	0.77 (0.62–0.94)	**0.0003***
	Low AMOD	28.1	29.2	28.3	26.1	26.3	0.93 (0.75–1.14)	0.2868
	Comparison	27.9	—	27.2	—	27.6	0.96 (0.85–1.08)	0.3791
Unplanned sex	AMOD high environment	29.5	30.0	27.0	23.9	26.1	0.86 (0.69–1.06)	**0.0228****
	Low AMOD	24.3	28.3	26.5	23.7	23.8	1.01 (0.82–1.25)	0.6948
	Comparison	27.0	—	26.4	—	23.7	0.87 (0.77–0.98)	**0.0244****
Unprotected sex	AMOD high environment	12.1	12.4	10.8	12.1	11.3	0.93 (0.70–1.25)	0.8529
	Low AMOD	11.8	9.6	11.3	9.5	10.3	0.88 (0.66–1.18)	0.5459
	Comparison	12.7	—	11.6	—	11.9	0.92 (0.79–1.08)	0.3309
Vandalism	AMOD high environment	17.1	19.0	14.3	12.6	13.6	0.72 (0.56–0.94)	**0.0006***
	Low AMOD	13.8	15.8	15.2	12.7	12.5	0.93 (0.70–1.22)	0.1744
	Comparison	14.6	—	14.0	—	13.9	0.92 (0.79–1.06)	0.2856
Got in trouble with police	AMOD high environment	9.4	11.7	8.6	7.2	8.9	0.75 (0.54–1.05)	**0.0072***
	Low AMOD	7.2	7.0	6.8	5.3	7.8	0.92 (0.65–1.31)	0.2232
	Comparison	6.9	—	7.5	—	7.3	1.14 (0.94–1.38)	0.1934
Got hurt or injured	AMOD high environment	18.8	22.1	19.1	13.7	17.2	0.76 (0.59–0.96)	**0.0003***
	Low AMOD	14.3	17.5	16.8	15.4	18.2	1.11 (0.87–1.42)	0.8692
	Comparison	15.9	—	15.5	—	16.2	1.01 (0.88–1.16)	0.8792
Medical treatment for overdose	AMOD high environment	0.7	0.7	0.6	0.5	0.7	1.01 (0.34–2.97)	0.9145
	Low AMOD	0.4	0.5	0.3	0.4	0.7	1.32 (0.43–4.06)	0.6580
	Comparison	0.8	—	0.6	—	0.7	0.91 (0.50–1.65)	0.7539
Drove after five or more drinks	AMOD high environment	19.0	14.1	18.4	18.5	15.9	0.92 (0.69–1.21)	0.9594
	Low AMOD	16.6	10.4	15.6	15.7	12.6	0.73 (0.54–1.00)	0.6071
	Comparison	15.3	—	18.8	—	16.6	1.30 (1.12–1.51)	**0.0004***
Five or more alcohol-related problems	AMOD high environment	31.6	34.8	28.4	23.7	26.0	0.70 (0.56–0.86)	**<0.0001***
	Low AMOD	25.0	28.0	27.6	23.4	24.7	0.88 (0.71–1.09)	0.0584
	Comparison	25.2	—	23.9	—	24.7	1.00 (0.89–1.13)	0.9586

[a]Among those who drank in the past year only.
[b]Adjusted for site survey response rate.
*Significant at 0.01 level (bolded).
**Significant at 0.05 level (bolded).
AMOD, A Matter of Degree; CI, confidence interval.

tions, statistically significant decreases were found in reports on multiple measures of consumption, harms, and secondhand effect among students at sites that employed more environmental prevention programming compared to the same data from students at the low implementation sites and comparison schools. These findings correspond with the AMOD program logic model and with reports about the types of interventions conducted at participant sites. Within the AMOD program, sites that implemented greater depth and breadth of environmental programming reported consistent declines in consumption and harms.

These findings suggest that receipt of program funds and public awareness of the effort through the media and public announcements were not sufficient to produce change. Contrary to concerns that restricting access and availability through local supply-side efforts would increase drinking/driving patterns, reports of binge drinking and driving among students who drive did not increase at the high environmental change sites.

The findings about program efficacy indicate promise for coalition-based environmental prevention strategies. They are especially so given that the AMOD program was only partially completed at the time of this

Table 5. Secondhand effects of alcohol over time at high and low environment AMOD and comparison sites

Secondhand effect	Site	Prevalence by year					Change 1997 to 2001 % (CI)[a]	Test for trend p value[a]
		1997	1998	1999	2000	2001		
Insulted	AMOD high environment	40.4	42.5	41.6	35.8	35.7	0.85 (0.71–1.02)	**0.0078***
	Low AMOD	37.7	39.1	37.8	37.5	34.2	1.06 (0.89–1.28)	0.4122
	Comparison	37.6	—	37.9	—	34.4	0.90 (0.82–0.99)	**0.0380****
Got in an argument	AMOD high environment	35.8	37.5	35.0	28.7	31.8	0.84 (0.69–1.01)	**0.0021***
	Low AMOD	30.9	30.0	32.9	29.1	29.7	1.00 (0.82–1.20)	0.7914
	Comparison	32.4	—	33.4	—	30.8	0.93 (0.84–1.03)	0.2489
Assaulted	AMOD high environment	19.6	20.8	18.3	14.2	17.0	0.75 (0.60–0.95)	**0.0002***
	Low AMOD	15.2	15.9	15.9	13.7	15.3	1.11 (0.87–1.41)	0.9722
	Comparison	16.8	—	17.3	—	15.4	0.91 (0.80–1.04)	0.2057
Property vandalized	AMOD high environment	21.4	26.3	21.9	19.3	21.0	0.79 (0.64–0.98)	**0.0019***
	Low AMOD	25.4	23.0	21.6	19.9	22.2	0.98 (0.79–1.20)	0.2839
	Comparison	20.5	—	19.3	—	20.9	1.04 (0.92–1.16)	0.6150
Had to babysit a student	AMOD high environment	63.4	65.9	65.0	57.2	60.3	0.71 (0.59–0.85)	**<0.0001***
	Low AMOD	57.9	61.0	60.6	55.6	59.9	0.99 (0.83–1.19)	0.1667
	Comparison	60.6	—	62.3	—	60.6	1.06 (0.96–1.17)	0.2952
Found vomit	AMOD high environment	49.4	51.8	46.6	38.5	41.4	0.71 (0.59–0.85)	**<0.0001***
	Low AMOD	43.0	46.6	42.9	36.8	39.4	1.12 (0.94–1.33)	0.3831
	Comparison	46.7	—	43.4	—	38.5	0.68 (0.62–0.75)	**<0.0001***
Study or sleep disrupted	AMOD high environment	64.7	71.0	62.9	56.4	57.6	0.67 (0.55–0.80)	**<0.0001***
	Other AMOD	59.5	63.8	59.5	55.4	58.3	1.09 (0.91–1.31)	0.7856
	Comparison	60.4	—	59.2	—	55.1	0.84 (0.76–0.92)	**0.0003***
Unwanted sexual advance	AMOD high environment	31.6	35.8	31.3	26.5	27.8	0.74 (0.61–0.90)	**<0.0001***
	Low AMOD	27.0	29.0	29.3	26.4	27.6	0.98 (0.81–1.19)	0.4453
	Comparison	27.8	—	30.3	—	26.9	0.99 (0.89–1.10)	0.9118
Date rape	AMOD high environment	2.8	2.5	2.1	1.5	2.6	0.76 (0.42–1.38)	0.1508
	Low AMOD	1.6	1.6	1.8	1.2	1.6	0.90 (0.45–1.82)	0.4859
	Comparison	1.5	—	1.6	—	1.6	1.16 (0.79–1.69)	0.4367
Three or more secondhand effects	AMOD high environment	60.8	67.7	61.3	51.4	54.5	0.67 (0.56–0.81)	**<0.0001***
	Low AMOD	56.0	58.0	56.0	51.0	52.1	1.01 (0.84–1.20)	0.3166
	Comparison	56.9	—	57.1	—	52.6	0.86 (0.78–0.94)	**0.0013***

[a]Adjusted for site survey response rate.
*Significant at 0.01 level (bolded).
**Significant at 0.05 level.
AMOD, A Matter of Difference; CI, confidence interval.

first quasi-experimental outcome analysis. While it is premature to declare the program a "success," given that the program is still operating, findings are an important indication of the potential this model holds. Continued assessment to ascertain final program efficacy in a dynamic secular context and with further program development is essential.

In reviewing the findings, it is important to consider the challenges of the research. As with all studies that incorporate self-report measures, these findings were subject to response bias. However, self-report surveys are common in studies examining alcohol use and generally considered to be valid and reliable.[58,60] In addition, response rates were slightly lower among the AMOD sites, but were included as a covariate in each analytic model. We also used weighted data to better represent the underlying demographic distribution of each college. Greater pressure may exist at intervention sites leading to under-reporting of risky or illicit behaviors. However, if that is the case, it would be expected that the response bias would operate equally at all

intervention sites, yet we found that high environment sites showed a pattern of declines in the outcome measures while the low environment program sites did not. The study also had smaller sample sizes and fewer time points for observing the comparison schools, although the samples were randomly drawn, anonymous, and confidential. The smaller sample sizes may decrease the measurement precision and make it more difficult to detect true change over time.

The quasi-experimental time-series design employed in this study was subject to several limitations.[46] Sites were not randomly assigned to the AMOD program, but were selected on the basis of high binge-drinking rates, an interest in dealing with this problem, and commitment to an intervention model. Comparison colleges were identified from the original pool of colleges surveyed in the 1993 CAS with similar binge-drinking rates to address potential threats to validity of history and maturation. Given the higher starting point on many of the outcome measures for the high environmental sites, it is possible that the results reflect a

regression to the mean. However, the sites were not selected into the high and low environment groups on the basis of their pre-test score.

Further, a longitudinal data analytic strategy was used to test these data, and the multiple observations over time help to improve reliability and protect against an alternative explanation of regression to the mean.[46] It is also possible that the sites with the highest drinking rates at the outset of the program may have been more highly motivated to act to change their environment. However, sites were only provided data about their own drinking rates, and were not informed where their sites ranked within the program or relative to comparison colleges.

We were constrained by our limited ability to report on prevention efforts at comparison sites. Our previous research on two national samples of colleges found that environmental approaches that address the supply of alcohol available to college students at U.S. colleges are rare but increasing.[7] However, the effect of having more of these types of interventions in the comparison group would be to bias the findings to a null result.

These findings show that an environmental prevention program can be implemented within college communities and can lead to reductions in alcohol consumption and related harms, with benefits accruing to drinkers as well as those around them. Changing conditions that shape drinking-related choices, opportunities, and consequences for drinkers and those that supply them with alcohol appear to be key ingredients to an effective public health prevention program.

The ability to demonstrate promising findings for the AMOD program is the first step in understanding more about the dynamics of prevention. It will be important to update this research in successive years to check on sustainability and continuation of program effects. Similarly, it will be important to follow this study with detailed analyses of program data to identify the most effective elements of environmental prevention programming and their underlying social and behavioral mechanisms. Studying these areas in depth will help to identify model programs as well as to make recommendations for their adaptation and replication in other settings.

What This Study Adds . . .

Data-based evaluations of prevention program efficacy for reducing heavy and harmful drinking among college students have been lacking, despite considerable recent attention to this problem and investments in addressing it.

Using a rigorous, prospective, quasi-experimental methodology, the authors have shown that environmental strategies may provide a realistic and effective response for colleges and surrounding communities and that, when most fully implemented, these approaches can moderate alcohol consumption and harms.

References

1. Wechsler H, Lee JE, Kuo M, Seibring M, Nelson TF, Lee H. Trends in alcohol use, related problems and experience of prevention efforts among US college students 1993–2001: results from the 2001 Harvard School of Public Health College Alcohol Study. J Am Coll Health 2002;50:203–17.
2. O'Malley PM, Johnston LD. Epidemiology of alcohol and other drug use among American college students. J Stud Alcohol 2002;S14:23–39.
3. Wechsler H, Wuethrich B. Dying to drink: confronting binge drinking on college campuses. Emmaus PA: Rodale Books, 2002.
4. Perkins HW. Surveying the damage: a review of research on consequences of alcohol misuse in college populations. J Stud Alcohol 2002;S14:91–100.
5. National Institute on Alcohol Abuse and Alcoholism Task Force on College Drinking. A call to action: changing the culture of drinking at U.S. colleges, 2002 Available at: www.collegedrinkingprevention.gov/Reports/TaskForce/TaskForce_TOC.aspx. Accessed March 26, 2003.
6. Wechsler H, Davenport A, Dowdall G, Moeykens B, Castillo S. Health and behavioral consequences of binge drinking in college: a national survey of students at 140 campuses. JAMA 1994;272:1672–7.
7. Wechsler H, Kelley K, Weitzman ER, San Giovanni J, Seibring M. What colleges are doing about student binge drinking: a survey of college administrators. J Am Coll Health 2000;48:219–26.
8. Wechsler H, Weitzman ER. Community solutions to community problems–preventing adolescent alcohol problems. Am J Public Health 1996;86:923–5.
9. Aguirre-Molina M, Gorman DM. Community-based approaches for the prevention of alcohol, tobacco, and other drug use. Annu Rev Public Health 1996;17:337–58.
10. Moskowitz JM. The primary prevention of alcohol problems: a critical review of the research literature. J Stud Alcohol 1989;50:54–88.
11. Wechsler H, Nelson TF, Lee JE, Seibring M, Lewis C, Keeling RP. Perception and reality: a national evaluation of social norms marketing interventions to reduce college students' heavy alcohol use. J Stud Alcohol 2003;64:484–94.
12. Larimer ME, Cronce JM. Identification, prevention and treatment: a review of individual-focused strategies to reduce problematic alcohol consumption by college students. J Stud Alcohol 2002;(suppl 14):148–63.
13. Hawkins JD, Catalano RF, Miller JY. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: implications for substance abuse prevention. Psychol Bull 1992;112:64–105.
14. Newcomb MD. Understanding the multidimensional nature of drug use and abuse: the role of consumption, risk factors, and protective factors. In: Glantz M, Pickens R, eds. Vulnerability to drug abuse. Washington DC: American Psychological Association, 1992;255–97.
15. Wagenaar AC, Perry CL. Community strategies for the reduction of youth drinking: theory and application. J Res Adolesc 1994;4:319–45.

16. Weitzman ER, Nelson TF, Wechsler H. Taking up binge drinking in college: the influence of personal, social and environmental factors. J Adolesc Health 2003;32:26–35.

17. Wechsler H, Kuo M, Lee H, Dowdall G. Environmental correlates of underage alcohol use and related problems of college students. Am J Prev Med 2000;19:24–9.

18. Bonnie RJ, O'Connell ME, Reducing underage drinking. Washington DC: National Academies Press, 2003.

19. DeJong W, Langford LM. A typology for campus-based alcohol prevention: moving toward environmental management strategies. J Stud Alcohol 2002;S14:140–7.

20. Toomey TL, Wagenaar AC. Environmental policies to reduce college drinking: Options and research findings. J Stud Alcohol 2002;(suppl 14):193–205.

21. Wagenaar AC, Toomey TL. Effects of minimum drinking age laws: review and analyses of the literature from 1960 to 2000. J Stud Alcohol 2002;(suppl 14):206–25.

22. Koopman JS, Lynch JW. Individual causal models and population system models in epidemiology. Am J Public Health 1999;89:1170–4.

23. Rose G. The strategy of preventive medicine. Oxford: Oxford University Press, 1992.

24. McMichael A. Prisoners of the proximate: loosening the constraints on epidemiology in an age of change. Am J Epidemiol 1999;149:887–97.

25. Dowdall G, Wechsler H. Studying college alcohol use: widening the lens, sharpening the focus. J Stud Alcohol 2002;(suppl 14):14–22.

26. Giesbrecht N, Krempulec L, West P. Community-based prevention research to reduce alcohol-related problems. Alcohol Health Res World 1993;17:84–8.

27. Wallack L, Corbett K. Alcohol, tobacco and marijuana use among youth: an overview of epidemiological, program and policy trends. Health Educ Q 1987;14:223–49.

28. Holder HD, Saltz RF, Grube JW, et al. Summing up: lessons from a comprehensive community prevention trial. Addiction 1997;92(suppl): S293–301.

29. Wagenaar AC, Murray DM, Wolfson M, Forster JL, Finnegan JR. Communities mobilizing for change on alcohol: design of a randomized community trial. J Community Psychol 1994:79–101.

30. Wittman FD. Local control to prevent problems of alcohol availability: experience in California communities. In: Plant M, Single E, Stockwell T, eds. Alcohol: minimizing the harm. What works? New York: Free Association Press, 1997.

31. Kuh GD. The influence of college environments on student drinking. In: Gonzalez G, Clement V, eds. Research and intervention: preventing substance abuse in higher education. Washington DC: Office of Educational Research and Improvement, 1994:45–71.

32. Holder HD, Gruenewald PJ, Ponicki WR, et al. Effect of community-based interventions on high-risk drinking and alcohol-related injuries. JAMA 2000;284:2341–7.

33. Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Prevention, Division of State and Community Systems Development. Preventing problems related to alcohol availability: environmental approaches, 1999. Available at: www.health.org/govpubs/PHD822/aar.htm. Accessed July18, 2001.

34. Gorman DM, Speer PW, Gruenewald PJ, Labouvie EW. Spatial dynamics of alcohol availability, neighborhood structure and violent crime. J Stud Alcohol 2001;62:628–36.

35. Saffer H. Alcohol advertising and youth. J Stud Alcohol 2002;(suppl 14):173–81.

36. Treno AJ, Gruenewald PJ, Johnson FW. Alcohol availability and injury: the role of local outlet densities. Alcohol Clin Exp Res 2001;25:1467–71.

37. Weitzman ER, Folkman A, Folkman KL, Wechsler H. The relationship of alcohol outlet density to heavy and frequent drinking and drinking-related problems among college students at eight universities. Health Place 2003;9:1–6.

38. Wandersman A, Florin P. Community interventions and effective prevention. Am Psychol 2003;58:441–8.

39. Hingson R, McGovern T, Howland J, Heeren T, Winter M, Zakocs R. Reducing alcohol-impaired driving in Massachusetts: the Saving Lives Program. Am J Public Health 1996;86:791–7.

40. Perry CL, Williams CL, Veblen-Mortenson S, et al. Project Northland: outcomes of a communitywide alcohol use prevention program during early adolescence. Am J Public Health 1996;86:956–65.

41. Wagenaar AC, Murray DM, Gehan JP, et al. Communities mobilizing for change on alcohol: outcomes from a randomized community trial. J Stud Alcohol 2000;61:85–94.

42. Hingson RW, Howland J. Comprehensive community interventions to promote health: implications for college-age drinking problems. J Stud Alcohol 2002;S14:226–40.

43. Weitzman ER, Nelson TF, Wechsler H. Assessing success in a coalition-based environmental prevention programme targeting alcohol abuse and harms: process measures from the Harvard School of Public Health "A Matter of Degree" programme evaluation. Nordisk Alkohol Narkotikatidskrift 2003;20:141–9 (English-language supplement).

44. Wechsler H, Dowdall GW, Maenner G, Gledhill-Hoyt J, Lee H. Changes in binge drinking and related problems among American college students between 1993 and 1997. J Am Coll Health 1998;47:57–68.

45. Wechsler H, Lee JE, Kuo M, Lee H. College binge drinking in the 1990s: a continuing problem results of the Harvard School of Public Health 1999 College Alcohol Study. J Am Coll Health 2000;48:199–210.

46. Cook TD, Campbell DT. Quasi-experimentation: design and analysis issues for field settings. Chicago: Rand McNally College Publishing, 1979.

47. Bronfenbrenner U. The ecology of human development: experiments by nature and design. Cambridge MA: Harvard University Press, 1979.

48. Sallis JF, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, eds. Health behavior and health education: theory, research, and practice. San Francisco: Jossey-Bass, 1996:403–24.

49. Yin RK. Case study research design and methods. Newbury Park CA: Sage Publications, 1989.

50. Corbett K, Thompson B, White N, Taylor M. Process evaluation in the Community Intervention Trial for Smoking Cessation (COMMIT). Int Q Community Health Educ 1991;11:291–309.

51. McGraw S, McKinley SM, McClements L, Lasater TM, Assaf A. Methods in program evaluation: the process evaluation systems of the Pawtucket Heart Health Program. Eval Rev 1989;13:459–83.

52. Gambone MA. Challenges of measurement in community change initiatives. In: Fulbright-Anderson K, Kubisch AC, Connell JP, eds. Theory, measurement, and analysis. Vol. 2, New approaches to evaluating community initiatives. Washington DC: Aspen Institute, 1998:149–64.

53. Rossi PH, Freeman HE. Evaluation: a systematic approach. Newbury Park CA: Sage Publications, 1989.

54. Torjman SR. Prevention in the drug field. Toronto: Addiction Research Foundation of Ontario, 1986.

55. Johnston LD, O'Malley PM, Bachman JG. Drug use among american high school seniors, college students, and young adults, 1975–1990, vol. II. Washington DC: U.S. Department of Health and Human Services, 1991.

56. Wechsler H, McFadden M. Drinking among college students in New England. J Stud Alcohol 1979;40:969–96.

57. Heagarty PJ, Zeger SL. Marginalized multilevel models and likelihood inference. Stat Sci 2000;15:1–26.

58. Cooper AM, Sobell MB, Sobell LC, Maisto SA. Validity of alcoholics' self-reports: duration data. Int J Addict 1981;16:401–6.

59. Frier MC, Bell RM, Ellickson PL. Do teens tell the truth? The validity of self-report tobacco use by adolescents. Santa Monica CA: RAND, 1991.

60. Midanik L. Validity of self report alcohol use: a literature review and assessment. Br J Addict 1988;83:1019–30.