

Characterizing College Systems for Addressing Student Alcohol Use: Latent Class Analysis of U.S. Four-Year Colleges

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ABSTRACT. Objective: The purpose of this study was to assess the status and integration of college systems to address student alcohol use. **Method:** We conducted a survey of college leaders (campus administrators, healthcare directors, and enforcement directors) among 569 4-year colleges in the United States. We measured strategies across five key system components: policy, enforcement, education, screening, and intervention/treatment. We used latent class analyses to identify classes of colleges based on their alcohol systems. **Results:** We identified three classes of colleges. Thirty-four percent of colleges were in a class that was characterized as having the most strategies relative to the other colleges, including high probabilities for having one of the three policy strategies, both enforcement strategies, two of the three screening

strategies, and both intervention strategies. Class 2 colleges were similar to Class 1 colleges but had very low probabilities of having the intervention strategies. Thirty percent of the colleges were in Class 3; these colleges had a low probability of having any of the strategies except two of the three policy strategies. **Conclusions:** Many of the colleges had implemented strategies to address student alcohol use across multiple system components, although no class of colleges had implemented all of the identified strategies in each of the five components. Many colleges failed to use complementary strategies, such as having screening but no treatment or intervention services. More research is needed to assess whether class membership is associated with rates of student alcohol use and related problems. (*J. Stud. Alcohol Drugs*, 74, 777–786, 2013)

HEAVY ALCOHOL USE AMONG COLLEGE students is associated with problems such as fatal traffic crashes, assaults, unintentional injuries, academic problems, and alcohol problems later in life (Benton et al., 2006; Harford et al., 2006; Hingson et al., 2009). Students who have diagnosable alcohol use disorders have the highest individual risk of experiencing those problems (Knight et al., 2002; Wechsler and Nelson, 2006). However, heavy drinkers who do not meet these criteria also are at high risk for problems. More than two in five college students reported heavy drinking in the past 2 weeks, and these rates have stayed fairly stable over the past 2 decades (Gruza et al., 2009; Johnston et al., 2011; Nelson et al., 2009). New system-based approaches to reducing problems may be needed to help students who are at risk for experiencing problems associated with their alcohol use.

A variety of approaches to reduce alcohol use and related problems have been identified, including those targeting the individual and the broader environment. Theoretical models

such as the Social Ecological Model (Stokols, 1992) and the integrated theoretical model of drinking behavior developed by Wagenaar and Perry (1994) suggest that interventions targeting individual risk factors should be combined with strategies that create environments that discourage heavy alcohol use in order to achieve sustained reductions in heavy drinking behavior (Flay and Petraitis, 1994). The individual-level efforts need to be supported by creating socio-environmental conditions that discourage heavy drinking among those who drink and experience problems but do not need intervention or treatment services, and also so that alcohol problems among heavier drinkers do not resurface after individually based treatment or prevention programs are completed. Few studies have examined how college campuses combine individually based treatment and intervention programs with environmental strategies to target heavy drinking.

A significant amount of research has been conducted to assess the prevalence and effects of single programs and policies on college campuses related to alcohol treatment, intervention, and prevention, and some have been effective in reducing drinking and related problems (Carey et al., 2007; Faden et al., 2009; Larimer and Crounce, 2007; Larimer et al., 2004–2005; Schaus et al., 2009; Sugarman and Carey, 2007; Wechsler and Nelson, 2008; Wechsler et al., 2004). For example, several programs that target individual students show strong evidence of effectiveness, including norms clarification, cognitive-behavioral skills training, and motivational

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interviewing; these programs aim to change students' views about the effects of alcohol and to provide personalized feedback to students about their alcohol use (Carey et al., 2007, 2009; Larimer and Cronce, 2007; Sugarman and Carey, 2007; Wood et al., 2007). However, only 50% of colleges report implementing these types of programs (Nelson et al., 2010). Researchers also have identified specific alcohol policies that may reduce alcohol use and related problems among students, including policies that increase the price of alcohol and restrict the availability of alcohol (Toomey and Wagenaar, 2002; Toomey et al., 2007). Despite recommendations to do so, representatives of the majority of 4-year campuses report that they have not worked with local community leaders to implement these strategies (Nelson et al., 2010).

To be effective at reaching the entire continuum of students who may experience alcohol-related problems, colleges must do more than implement single policies or programs (DeJong and Langford, 2002; Dowdall and Wechsler, 2002; Hingson and Howland, 2002; Wood et al., 2009). Components of a comprehensive college alcohol system are likely to include alcohol screening, intervention, treatment, education, prevention policies, and enforcement. Recent recommendations call for understanding the effects of more comprehensive and integrated approaches to address college student drinking. The National Research Council (NRC) and Insti-

tute of Medicine (IOM) report, *Reducing Underage Drinking: A Collective Responsibility*, recommended that colleges adopt “. . . comprehensive prevention approaches, including evidence-based screening, brief intervention strategies, consistent policy enforcement, and environmental changes. . .” (Recommendation #10-3, p. 207; NRC and IOM, 2004). This report describes an optimal system within college settings where students are both helped and held accountable. This recommendation parallels a priority area in the strategic plan of the National Institute on Alcohol Abuse and Alcoholism Division of Epidemiology and Prevention Research, “Expanding Comprehensive Community Interventions to Reduce Alcohol-related Injuries and Other Problems.” The Division of Epidemiology and Prevention Research indicated that, to prevent alcohol-related problems, multiple complementary components are needed that target college students who are at highest risk as well as the college student population as a whole (DeJong and Langford, 2002; Dowdall and Wechsler, 2002; Hingson and Howland, 2002; Wood et al., 2009). Recent research suggests that making multiple changes to the campus and community alcohol environment is associated with reductions in alcohol use and related problems among college students (Nelson et al., 2005; Saltz et al., 2009; Weitzman and Nelson, 2004; Wood et al., 2009; Weitzman et al., 2004). However, none of these studies have assessed

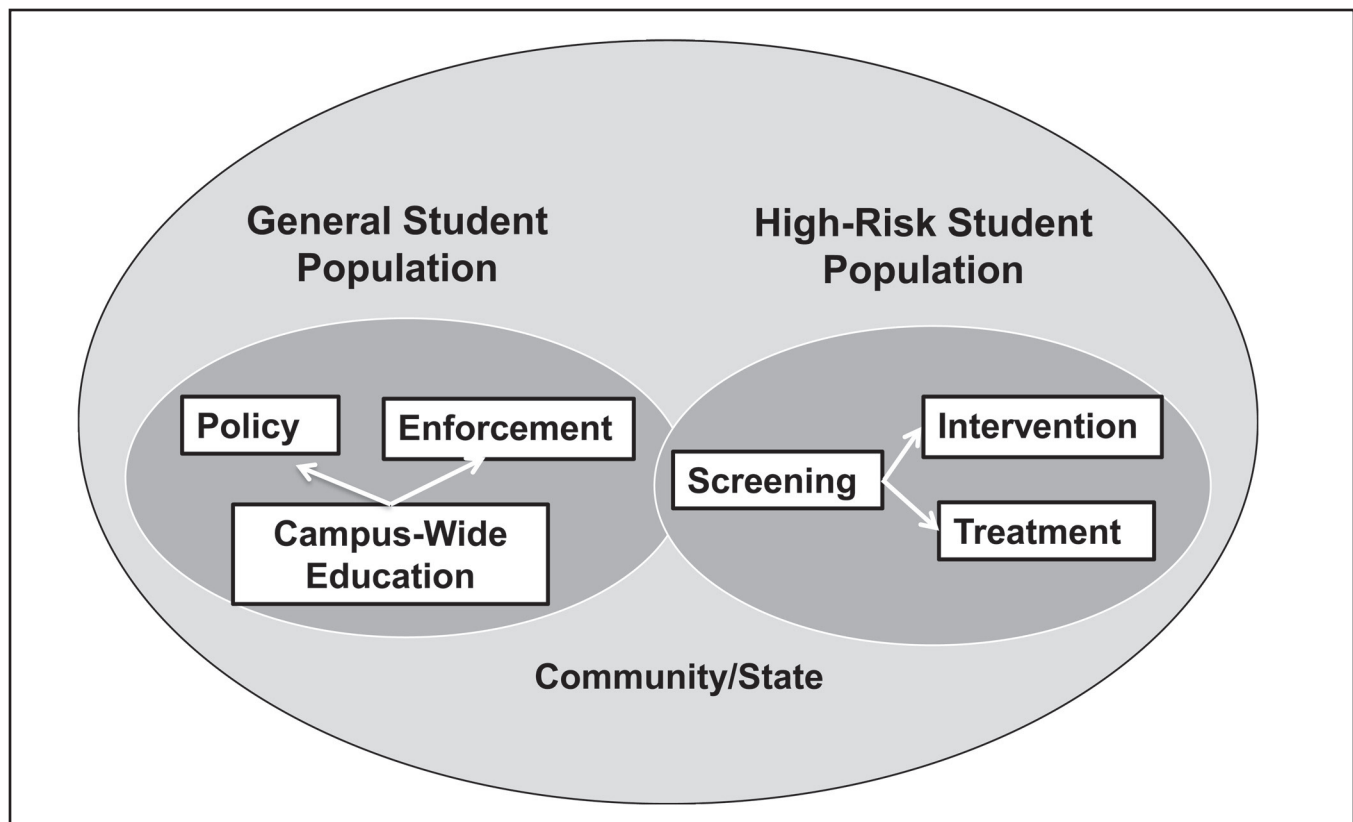


FIGURE 1. Model of campus alcohol system

whether colleges across the United States are using complementary, comprehensive strategies.

A basic model of a comprehensive alcohol system on college campuses can be constructed based on both research and theory (Figure 1), although the ideal combination of programs, policies, and other systems changes has not yet been identified. The model includes two targeted population groups, the general student population and the high-risk student population. Strategies aimed at the general student population include policies that decrease the focus on alcohol across campus and reduce the availability of alcohol, as well as enforcement and educational strategies to complement the policy strategies. Strategies aimed at students at highest risk include alcohol screening, ideally through population-based methods that reach all students to identify as many students at risk as possible, including via surveys, during routine health and mental health visits, and after alcohol-related incidents. Also, for all students who are identified through screening to be at risk for alcohol-related problems, access to evidence-based intervention and treatment programs is needed (Winters et al., 2011).

A systems approach suggests that the strategies within each population group should complement each other and should be implemented in an integrated way to be maximally effective. For example, policies are less effective if they are not enforced, and conversely, enforcement without adequate policies also is unlikely to result in the desired changes in rates of student drinking and related problems. Similarly, screening students without offering appropriate intervention or treatment services is unlikely to lower the risk of those students who meet the diagnostic criteria for alcohol use disorders.

No published studies have assessed specific combinations of alcohol strategies being used within colleges across the United States. A first step toward a comprehensive, integrated approach to reducing alcohol-related problems on college campuses is to assess and characterize the current status of alcohol systems at U.S. colleges. Based on a national survey of 4-year colleges, we conducted a developmental study to address the following research questions: (a) Can classes or patterns of college alcohol systems be identified? (b) Are colleges combining strategies in a way that maximizes effectiveness? (c) What proportion of colleges has the most comprehensive alcohol systems? and (d) Are college characteristics (i.e., public vs. private status, enrollment size) associated with patterns of alcohol systems? Results from this study may help move the practice and research field toward identification of approaches that help to reduce rates of alcohol use and related problems on campuses.

Method

We surveyed up to three campus leaders from 4-year colleges across the United States to assess whether colleges

are implementing strategies within five key alcohol system components: policy, enforcement, education, screening, and intervention/treatment. This study was approved by the Institutional Review Board at the University of Minnesota.

Colleges. We identified 2,482 accredited 4-year colleges from a list provided by the American Council on Education. From this list, we excluded colleges that (a) were not residential colleges offering several majors (i.e., we excluded free-standing graduate schools, virtual colleges or online colleges, associations of schools, and specialty schools that offered one type of program/major) and (b) were not included in either the *Barron's Profiles of American Colleges 2007* or the College Board's *2008 College Handbook*. Leaders from four local colleges assisted us with the development of our survey instruments or participated in pre-testing of these instruments. Those colleges also were excluded from the list, resulting in a final list of 1,572 colleges. For sampling purposes, these colleges were stratified by size (i.e., full-time undergraduate enrollment < 2,500 students vs. \geq 2,500 students) and public versus private status. To determine the enrollment cutoff for large versus small colleges, we first considered a median split (cutoff = 1,764 students), but this would have grouped colleges that were still quite small (~2,000 students) with large colleges. Hence, we adjusted the cutoff slightly to 2,500, which resulted in 62% of colleges (982) in the "small" group and 38% of colleges (591) in the "large" group. We used a weighting procedure that sampled colleges in proportion to student enrollment in each of four strata, resulting in inclusion of a greater number of large versus small colleges in our sample (given that a larger proportion of students attend large colleges). The final selection included 100 small private, 100 small public, 101 large private, and 268 large public colleges. Our final sample was 569 4-year colleges.

Participants. We attempted to survey three different campus leaders at each college who would have specific knowledge about different parts of an alcohol system: the campus administrator most knowledgeable about alcohol policies and programs on campus (e.g., vice president of student affairs, dean of students), the director of campus healthcare, and the director of campus enforcement (or security if a law enforcement department was not present). We chose these three types of campus leaders based on discussions with various college officials and the experience of the research staff with prior surveys. Previous national-level studies assessing college programs, policies, and practices have primarily relied solely on the college president or one other top administrator to provide information for the campus. Research staff members reviewed college websites and, if needed, telephoned college departments to identify contact information for potential participants for each college.

Online/telephone survey. Separate survey instruments were developed for each type of campus leader. To develop the survey instruments, we first reviewed the research lit-

erature to identify recommendations for each of the specified system components (policy, enforcement, education, screening, intervention/treatment). We then reviewed survey instruments used as part of the Harvard School of Public Health College Alcohol Study (Wechsler et al., 2004) to select items that measured various strategies within each component and to identify areas where new items needed to be developed. Relevant items from these surveys were included as candidates, and new items were developed when needed. We identified relevant leaders from local colleges to review drafts of the survey instruments to help us determine the most appropriate respondent for our questions and to pre-test the instrument. We revised items as needed, based on feedback. The administrator survey included items pertaining to alcohol policies and educational services; the enforcement/security survey included items about campus alcohol-enforcement practices; and the healthcare director survey included items assessing alcohol screening, intervention, and treatment practices and programs.

Campus leaders were first contacted by email to invite them to participate in an online survey (the email included a link to the online survey). The initial email was followed by up to 5 reminder emails and up to 10 attempted follow-up telephone contacts. During the telephone contacts, research staff members reminded potential participants to complete the survey, and they also provided an opportunity for participants to complete the survey over the telephone. Twenty-nine respondents (distributed fairly equally across the three types of leaders) chose to complete the survey over the telephone. The survey was administered by the Health Survey Research Center at the University of Minnesota's School of Public Health and was housed on a university server using secure sockets layer protocol and maintained according to industry standards for Internet security (<http://www.casro.org>) as well as institutional review board standards.

Our response rates were as follows: (a) administrators = 61.7% (351/569); (b) enforcement/security directors = 60.9% (343/563); and (c) healthcare directors = 61.6% (333/541); 92.3% of the campuses had at least one of the three types of leaders complete a survey. Note that sample sizes varied across the three surveys because six colleges did not have campus security/enforcement personnel and 28 colleges did not have campus healthcare services. Administrators and law enforcement directors from large colleges were more likely than those from small colleges to participate in our survey (administrators: 68.2% vs. 50.5%, $p < .0001$; enforcement directors: 67.0% vs. 49.5%, $p < .0001$). Enforcement directors from public colleges also were more likely to participate in our survey than law enforcement directors from private colleges (66.1% vs. 51.7%, $p = .0008$). For healthcare administrators, we found no differences in their likelihood of participation based on size or type of college.

Measures

All analytical measures were dichotomous (yes/no)—“yes” indicated that the respondent endorsed that item. For survey items that had a “don’t know” response option, the “don’t know” responses were collapsed with “no” responses; these collapsed variables were used in all models. We first attempted to complete the analyses with the “don’t know” and the “no” responses as two separate categories, but the models did not converge because of the complexity of the resulting contingency table. When we collapsed the two response options, the model converged. Also, by collapsing the “don’t know” responses with the “no” responses rather than coding the “don’t know” responses as missing, we were able to retain more respondents in our sample. “Not applicable” responses and all missing responses were coded as missing for all models. We surveyed campus leaders who oversee different parts of campus alcohol systems; if they were unaware of one of the assessed policies or practices on their campus (i.e., they responded “don’t know”), it is unlikely that the specified policy or practice played a prominent role on their campuses. Not all survey items had a “don’t know” option, and, when it was an option, most of the respondents did not choose it (0%–23% across items; $Mdn = 11%$). Missing items were negligible (0%–4% across items). For measures in which we combined several individual survey items, if a respondent reported “yes” for any of the individual survey items, the combined variable was assigned a “yes.”

From the survey of administrators, we created 10 measures pertaining to alcohol policies. The specific variables are shown in Table 1 (“Policy component”). One general policy measure was whether alcohol is prohibited on campus overall. Regardless of the response to this question, respondents were asked additional policy questions regarding alcohol prohibition at specific events and locations, but the response option “not applicable” was provided for these items. Three measures pertained to whether alcohol use is prohibited at various types of campus events (sporting events, residence hall and fraternity/sorority events, arts/entertainment events), and one measure pertained to whether alcohol sales are prohibited at sporting events.

We also created an index from seven items pertaining to types of written alcohol policies for events (dichotomized to four or more written policies vs. fewer than four, based on the frequency distribution). Additionally, we measured whether there is a pub on campus and whether the college offers alcohol-free residence halls. We created two measures pertaining to whether the college prohibits advertisements for alcoholic beverages and for bars/clubs in campus newspapers, on radio stations, and/or on bulletin boards/kiosks. In addition, we created two measures pertaining to alcohol education services—whether alcohol education is required for all students and whether at least four different types of education methods are used. Currently, there is no research

TABLE 1. Component strategies for total sample and chosen latent class analysis models for each component

Component strategies	Total sample	Class prevalences and item-level probabilities			
		Class 1	Class 2	Class 3	Class 4
Policy component		<i>37%</i>	<i>19%</i>	<i>30%</i>	<i>14%</i>
Alcohol use prohibited on campus ^a	30%	.57	.32	.07	.09
No pub on campus for students	77%	.97	.75	.58	.69
Alcohol-free residence halls offered ^a	78%	.85	.82	.75	.60
Alcohol sales prohibited at sporting events	72%	.90	.80	.67	.25
Alcohol use prohibited at sporting events	85%	1.0	1.0	.83	.30
Alcohol use prohibited at housing events	76%	1.0	.94	.61	.23
Alcohol use prohibited at entertainment events	60%	.97	.79	.30	.00
Advertising prohibited for alcoholic beverages ^{a,b}	68%	.98	.15	.92	.10
Advertising prohibited for bars ^{a,b}	53%	.82	.01	.76	.05
Written policies for campus events	55%	.47	.60	.66	.44
Enforcement component		<i>56%</i>	<i>9%</i>	<i>26%</i>	<i>9%</i>
Enforcement conducted at:					
Arts/entertainment events	67%	.96	1.0	.11	.04
Sporting events	69%	.98	.95	.20	.07
Events in residence halls and fraternity/sorority houses	54%	.79	.62	.09	.23
Enforcement strategies used:					
Drinking-driving patrols ^a	79%	.90	.06	.98	.27
Party patrols	79%	.87	.33	.92	.44
Compliance checks	83%	.97	.03	.96	.39
Other retail enforcement	82%	.94	.25	1.0	.13
Proactively enforce policies ^a	62%	.81	.78	.32	.15
No barriers to enforcement	46%	.53	.54	.36	.29
Work closely with local agency	55%	.64	.32	.45	.52
Screening component		<i>72%</i>	<i>12%</i>	<i>8%</i>	<i>8%</i>
Situations where screening occurs:					
Routine health visits ^a	73%	.80	.81	.14	.56
After alcohol incident: housing	86%	.94	1.0	.73	.01
After alcohol incident: legal system	92%	.99	1.0	.86	.20
After alcohol incident: healthcare	93%	1.0	.95	.48	.66
Methods to identify students with problems					
Self-referral	74%	.86	.23	.79	.30
Case by case	85%	1.0	.35	.94	.18
Student surveys ^a	48%	.53	.35	.52	.16
Persons trained in screening:					
Health care personnel	94%	.99	1.0	.55	.83
Residence hall staff ^a	74%	.84	.77	.47	.09
Legal professionals	80%	.90	.71	.58	.23
Intervention/treatment component		<i>19%</i>	<i>7%</i>	<i>28%</i>	<i>47%</i>
≥1 recommended intervention strategies used ^a	48%	.95	.23	.97	.06
Intervention services free to students	42%	.73	.20	.70	.16
≥1 intervention staff (FTEs)	33%	.84	.10	.60	.00
≤1 barriers to offering intervention	56%	.62	.54	.70	.46
Treatment offered ^a	27%	1.0	.99	.01	.02
≥3 recommended treatment features used	19%	.71	.83	.00	.00
≤1 barriers to offering treatment	32%	.34	.47	.35	.28
Treatment/intervention adequate	19%	.27	.38	.27	.09
Recovery services offered	67%	.95	.60	.74	.54
≥2 referral actions	52%	.50	.53	.50	.53

Notes: FTEs = full-time equivalents. Class prevalences are in *italics*. ^aItem was included in final latent class analysis model; ^bthese two items were combined for final latent class analysis model.

indicating which combination of written policies or educational approaches is most effective. For this developmental study, we dichotomized these measures based on the frequency distribution of the measures.

Based on survey responses from the enforcement directors, we created 10 measures pertaining to campus enforcement (Table 1: "Enforcement component"). Three assessed whether prohibitions on alcohol are proactively and regu-

larly enforced at three types of campus events. Four measures pertained to types of enforcement actions conducted by campus and/or local police: drinking-driving patrols, party patrols, compliance checks to prevent sales to underage patrons, and other types of enforcement at alcohol retail establishments. In addition, we measured whether alcohol policies in general are proactively and regularly enforced, whether there are any reported barriers to enforcing

alcohol policies, and whether the department works closely with local law enforcement.

From the survey of healthcare directors, we created 10 measures pertaining to campus screening services, including 4 pertaining to different types of situations in which students may be systematically assessed for a possible alcohol problem, 3 pertaining to types of methods used to identify students with alcohol problems, and 3 pertaining to different groups of staff members formally trained in identifying students with alcohol problems (Table 1: "Screening component"). We also measured 10 aspects of alcohol intervention/treatment services—(a) the use of recommended brief intervention strategies (e.g., brief motivational interviewing, norms clarification) for high-risk, nondependent students, (b) whether intervention services are free, (c) the number of intervention staff personnel, (d) barriers to offering intervention, (e) whether intervention/treatment services are adequate, (f) the number of referral actions, (g) whether treatment (specified as "not brief intervention") is offered, (h) the use of recommended treatment features, (i) barriers to offering treatment, and (j) whether recovery services are offered (Table 1: "Intervention/treatment component"). Measures were dichotomized based on frequency distributions when applicable.

Analyses. We used latent class models to characterize college alcohol systems. Because these models can accom-

modate only a limited number of measures or variables, we needed to reduce the total variables used to describe a comprehensive college alcohol system. We used a two-stage approach to select the most salient variables. First, we conducted four separate latent class analyses (LCAs) for the policy, enforcement, screening, and intervention/treatment components. Each LCA model included the 10 dichotomous measures from each component (Table 1: "Component strategies"). We conducted each analysis using two-class, three-class, four-class, five-class, and six-class solutions and selected the best-fitting model for each component based on standard criteria including model fit (using the Akaike Information Criteria [AIC] and the Bayesian Information Criteria [BIC]). Model fit alone is sometimes not a sufficient criterion for selecting the best model, particularly when information criteria are not consistent. We also used interpretability, theoretical soundness, prevalence in each class, and homogeneity of and separation between classes (Collins and Lanza, 2009). Item-response probabilities were used for class interpretation, with high or low probabilities (> ~70% or < ~30%, respectively) indicating homogeneity and facilitating interpretation for most strategies. If a strategy was very common or uncommon, we also considered the item-response probability relative to the prevalence of that strategy for the overall sample. We chose the four-class model for each of the components (Table 2). From each chosen model, we selected

TABLE 2. Fit criteria for models for first- and second-stage latent class analyses

State/component	No. of classes	AIC ^a	BIC ^a	Size of smallest class	Model chosen
First stage					
Policy	3	557	681	19%	
	4	494	660	15%	x
	5	463	671	6%	
	6	461	711	5%	
Enforcement	2	732	812	34%	
	3	525	648	12%	
	4	470	635	9%	x
	5	457	665	4%	
Screening	6	445	695	4%	
	2	436	516	14%	
	3	406	528	9%	
	4	385	549	8%	x
Intervention/treatment	5	370	576	7%	
	6	367	614	3%	
	2	695	775	49%	
	3	568	690	25%	
	4	540	704	7%	x
	5	512	719	7%	
6	496	743	7%		
Second stage					
Overall	2	905	1,020	44%	
	3	906	1,081	34%	x
	4	911	1,146	15%	
	5	917	1,211	17%	
	6	926	1,280	8%	

Notes: AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria. "Shaded" = lowest indicator for series of models.

TABLE 3. College alcohol systems: Three-class model

Component strategies	Item-response probabilities		
	Class 1 (34% of colleges)	Class 2 (35% of colleges)	Class 3 (30% of colleges)
Policy component			
Alcohol prohibited on campus	.19	.25	.51
Alcohol-free residence halls offered	.76	.73	.86
Advertising for alcohol prohibited	.69	.61	.83
Enforcement component			
Conduct drink-driving patrols	.92	.81	.57
Proactively enforce policies	.71	.59	.56
Education component			
Education required for all students	.23	.21	.09
≥4 education methods used	.69	.60	.32
Screening component			
Screen at routine health visits	.79	.76	.60
Student surveys used to identify students	.59	.61	.19
Residence hall staff trained	.90	.83	.44
Intervention/treatment component			
≥1 recommended intervention strategies used	.93	.00	.01
≥1 intervention staff (FTEs)	.96	.39	.02
Treatment offered	.50	.21	.06

Notes: FTEs = full-time equivalents.

the measures that most clearly differentiated class membership. For example, for the first-stage LCA for intervention/treatment, the item-level probabilities for whether treatment was offered on a campus were 1.0 and .99 for Classes 1 and 2, respectively, and .01 and .02 for Classes 3 and 4. Similarly, offering one or more of the recommended intervention strategies had item-level probabilities of .95 and .97 for Classes 1 and 3 respectively, and .23 and .06 for Classes 2 and 4, respectively (Table 1: see item-level probabilities).

In addition to using results from these LCAs, measures were selected based on having a strong theoretical link to a quality college alcohol system. We selected three measures from the policy component, two from the enforcement component, two from the screening component, and three from the intervention/treatment component (as indicated with a footnote in Table 1). We used these selected measures and the two measures pertaining to the alcohol education component in a final LCA model to create an overall assessment of college alcohol systems, using the same procedures described in the first set of LCA models.

Last, using class assignments from the final LCA model, we assessed whether class membership was associated with college characteristics—undergraduate student enrollment (small: <2,500; large: ≥2,500) and type of college (public vs. private)—using logistic regression. All analyses were done using SAS 9.1 (SAS Institute, Inc., Cary, NC). Proc LCA was used for LCAs, and Proc Logistic was used for logistic regression.

Results

We chose the three-class model for the overall assessment (Tables 2 and 3). Although the two-class model had the lowest AIC and BIC, the three-class model had considerably better separation between classes, greater homogeneity within classes, and overall better interpretability; in addition, the AIC was only slightly higher than the two-class model.

Thirty-four percent of colleges were in Class 1, which was characterized as having the most system strategies relative to the other colleges in our sample. Colleges in this class were characterized by high probabilities of having (a) one of the policy strategies (offering alcohol-free housing), (b) both of the measured strategies in the alcohol enforcement component (conducting drink-driving enforcement and proactively enforcing policies), (c) two of the three screening strategies (screening at routine health visits and having residence hall staff trained), and (d) both intervention strategies (using at least one recommended strategy and having at least one full-time staff member). Colleges in this class had low/moderate probabilities for the other two policy strategies (prohibiting alcohol use and advertising on campus), for the two education strategies, for conducting student surveys, and for offering treatment. Thirty-five percent of colleges were in Class 2. These colleges had probabilities similar to those in Class 1 except they had low probabilities for both intervention strategies and slightly lower probabilities for both enforcement strategies. Class 3 was a slightly smaller class

(30%) and was characterized by having high probabilities for two of the three policy strategies (offering alcohol-free housing and prohibiting alcohol advertising) but low/moderate probabilities for all other system strategies.

Compared with Classes 2 and 3, large colleges were more likely than small colleges to be in Class 1 ($p < .0001$), but there were no differences across classes among private versus public colleges.

Discussion

We used LCA to identify three classes of colleges across five system components that colleges use to address student alcohol use. At least based on the strategies measured in this study, results of this study suggest that there is no group of colleges in our sample that can be characterized as having an overall, comprehensive alcohol system to address student alcohol use.

About a third (34%) of the colleges was in the class that had the most strategies, compared with other classes, across the five components (Class 1). Unlike the colleges in the other two classes, the colleges in Class 1 were likely to use both enforcement strategies and both intervention strategies. Although these colleges were more likely to offer treatment services than colleges in the other two classes, only about half of the colleges in Class 1 were likely to offer treatment.

Approximately another third of the colleges (35%) were in Class 2, which, overall, reported having fewer of the measured strategies than those in Class 1 but more strategies than those in Class 3. The most striking difference between Class 2 and Class 1 was that the colleges in Class 2 had considerably lower probabilities of using at least one of the recommended intervention strategies and of having at least one full-time intervention staff member.

The remaining third or so of colleges were in Class 3. These colleges had a lower probability than colleges in the other two classes of endorsing the three screening strategies, particularly for conducting student surveys, and had very low probabilities of using any of the measured intervention/treatment strategies. These campuses, however, had a higher probability than colleges in the other two classes of having alcohol-free residence halls and prohibiting advertising for alcohol.

As shown in Figure 1, the systems components are intended to function in ways that complement each other. For example, screening, intervention, and treatment programs are synergistic. Having good screening practices for identifying students in need of intervention or treatment may not be as useful if there are no intervention or treatment services offered. We found that the colleges in Class 1 had screening and intervention services but did not offer treatment services. The colleges in Class 2 reported having screening strategies, but these colleges had a low probability of reporting using one or more of the recommended intervention

strategies, having at least one full-time intervention staff member, or offering treatment services. There also is synergy between alcohol policies and enforcement. Policies need consistent, proactive enforcement to be maximally effective (Harris et al., 2010). None of the classes we identified was characterized by having all of the measured alcohol policies and proactive enforcement of those policies. Our results may provide the impetus and tools for colleges to assess what strategies they are using in each of the five components and to determine how they can improve functioning across synergistic components as parts of a larger, integrated system for addressing student alcohol use.

Large colleges were more likely than small colleges to be in Class 1 (compared with Classes 2 and 3), and the colleges in Class 1 were likely to use more of the measured strategies than other colleges. Large campuses may be more likely to have the resources and personnel to implement campus alcohol services and practices than smaller colleges. Small colleges may need more guidance on how to use their limited resources as strategically and as effectively as possible.

All colleges could increase the number of strategies used to address student alcohol use. Although it is possible that some of the colleges had few problems with alcohol use among their students and, therefore, did not need policies or programs addressing student alcohol use, heavy drinking among students is a significant public health challenge that affects most colleges in some way. In previous national studies, only 3% of campuses reported that alcohol use among their students was not considered a problem (Wechsler et al., 2004).

Previous research has demonstrated that college student drinking behavior and the health and social problems associated with drinking vary widely across different types of colleges and that these population-level patterns are stable over time (Nelson et al., 2009; Wechsler et al., 1994, 2002). Alcohol environments also vary across colleges, with permissive alcohol environments associated with higher levels of student drinking and the initiation of heavy episodic drinking during college (Nelson and Wechsler, 2003; Wechsler and Nelson, 2008; Weitzman et al., 2003). What is not known is whether the degree of comprehensiveness of college alcohol systems is directly associated with student drinking and related problems. We identified three classes of college alcohol systems as a first step toward characterizing the types of services, policies, and practice available on campuses, but more research is needed to assess whether these classes of alcohol systems are associated with alcohol use and related problems across colleges.

One limitation of this study is that it relies on self-reported data, which could result in overreporting or underreporting of actual college practices. However, there are no alternative sources of information on the full range of programs, policies, and practices that we assessed. Given the limited implementation of the policies, programs, and prac-

tices reported by these campus leaders, it seems unlikely that our participants were overreporting campus activities and services. Although it is possible that some of our participants were not knowledgeable across the full range of alcohol policies and practices on campus and may have underreported certain activity, we attempted to limit this type of bias by collecting specific types of information from each campus leader that corresponded to his or her expertise. Some of our campus leaders indicated that they did not know whether a specific strategy was being used on their campuses. We collapsed these “don’t know” responses with “no” responses, which may have introduced bias into study results. Future studies of campus alcohol systems may benefit by including surveys of a broader group of campus leaders.

Another potential limitation is that we combined some measures in each component to fit the requirements of the LCA models. In the process, we may have omitted important information; however, we examined the information within each component in our initial phase of this work in an attempt to reduce this possibility. Additionally, we may not have included measures of all of the critical strategies for each of the system components. Given that this was a developmental study, we also assessed a limited number of college characteristics that could affect a college alcohol system. Furthermore, this study focused solely on campus programs, policies, and practices. Other research indicates that student alcohol use is influenced by programs, policies, and practices in the broader community and state (Nelson et al., 2005; Wechsler and Nelson, 2008). Future research is needed to characterize these broader systems that may reinforce or mitigate effects of college alcohol systems.

Despite these limitations, this study takes an important step in moving beyond a focus on individual college alcohol programs, policies, and practices toward a more comprehensive systems approach to address alcohol use and related problems among college students. Although many of the colleges included in this study had implemented programs, policies, and practices to address student alcohol use across multiple components, no class of colleges had implemented all of our identified strategies in each of the five components we assessed. Further research is needed to assess whether the classes of college alcohol systems we identified in this study are associated with student alcohol use and related problems, to identify methods to increase the prevalence of the use of recommended strategies, and to determine whether implementation of a comprehensive alcohol system will substantially reduce future alcohol use and related problems.

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